Christchurch Bay & Harbour FCERM Strategy

Short List Options Report

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

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DRAFT

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Quality information

Prepared by	Checked by	Verified by	Approved by
Ben Taylor Principal Consultant	Lyn Lind Graduate Consultant	Jonathan Short Associate	Ben Taylor Principal Consultant

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Prepared for:

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

Prepared by:

AECOM Limited
Midpoint, Alencon Link
Basingstoke
Hampshire RG21 7PP
United Kingdom

T: +44(0)1256 310200
aecom.com

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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).

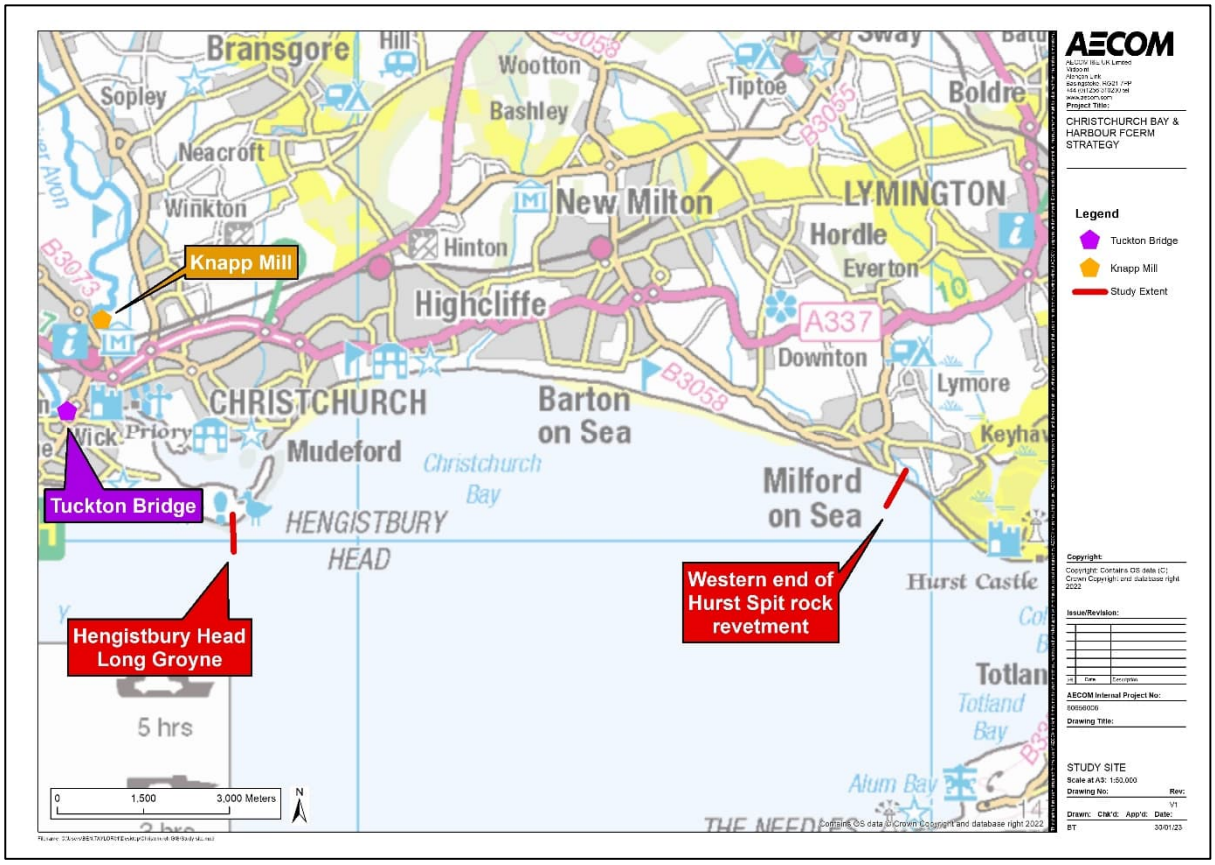

Figure 1-1: Map of Strategy area

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 Long List to Short List option appraisal that has been undertaken in the development of The Strategy. This part of the appraisal forms the fourth stage of The Strategy development process, immediately following on from the development of the Long List. Details of the previous phases of option appraisal are presented in the Strategy Option Development Unit Report (AECOM, 2022) and Long List Report (AECOM, 2022). More details of the option development and appraisal process are provided in Section 2) of this report.

This report has the following key sections:

1) Introduction
2) Overview of option development and appraisal process
3) Long List to Short List Option Appraisal – Strategy Management Zone 1
4) Long List to Short List Option Appraisal – Strategy Management Zone 2
5) Long List to Short List Option Appraisal – Strategy Management Zone 3
6) Long List to Short List Option Appraisal – Strategy Management Zone 4
7) Long List to Short List Option Appraisal – Strategy Management Zone 5
8) Long List to Short List Option Appraisal – Strategy Management Zone 6
9) Frontage-wide Short List Options
10) Summary and next steps.

1.3 Stakeholder Engagement

To date three rounds of stakeholder engagement have been carried out as part of the development of The Strategy. Each engagement round 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.

Each stage of the stakeholder engagement rounds has provided valuable information to the project team that has informed and fed into both the initial identification of the Long List options and also the appraisal of these options as outlined in this report. A summary of the feedback provided by stakeholders for Strategy Management Zone (SMZ) is presented in the Long List Report (AECOM, 2022).

A further three rounds of stakeholder engagement are planned for the remainder of the Strategy. The first of these (round 4) will present the draft Short List options to the public and key stakeholders, summarising the results of the long to short list appraisal outlined in this report.

2. Option Development and Appraisal

2.1 Overview of the approach

Option appraisal for The Strategy is being undertaken across a spatial framework comprised of six Strategy Management Zones (SMZs) and 18 smaller Option Development Units (ODUs). A map showing the SMZ locations is shown in Figure 2-1. The Strategy Option Development Unit Report (AECOM, 2022) provides further details of the development of the spatial framework for the appraisal.

The appraisal process is being undertaken in stages. These stages are shown in Figure 2-2 overleaf. Stages 1-4 of the appraisal have been completed and this report summarises stage 4. Stage 4 has involved:

- Further development of the Strategic options in each SMZ
- Undertaking a multicriteria appraisal of the Long List of Local Measures in each ODU

The outcome of stage 4 of the appraisal is a draft Short List of options, as presented in this report. The Short List of options comprises a list of high level Strategic options for each SMZ, as well as the supporting appropriate Local Measures identified for implementing these Strategic options in each ODU.

The identification of Local Measures in each ODU on the short list informs the appraisal process supporting development of The Strategy, particularly with respect to the costing, economic and environmental appraisal. However, it should be noted that measures discounted from the short list at this stage are by no means excluded from further consideration during subsequent design and appraisal work. When developing business cases for future schemes along the frontage, the design of the scheme should not be constrained by the appraisal undertaken at this strategic level as further information and more detailed data will be available to inform scheme development and design.

The next stage of the process is stage 5, where the draft Short List of options will be presented to the public and key stakeholders for review and feedback. Following this, updates to the Short List of options may be made to reflect key feedback. Further work will then be undertaken to develop the Short List of options in more detail (stage 6) to inform the selection of the Leading option(s) (stage 7). More details on the next steps for the appraisal are presented in the summary section of this report.

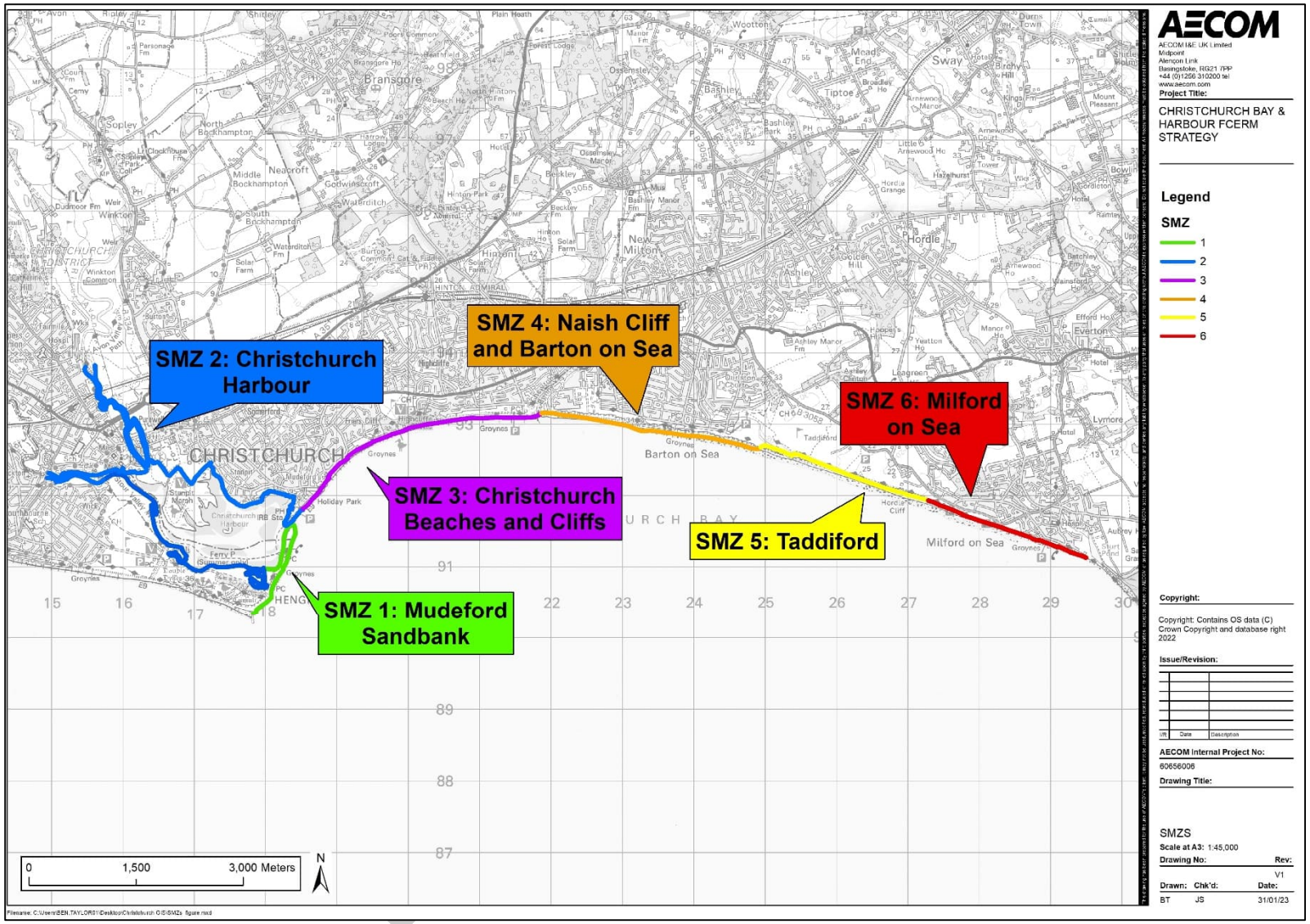

Figure 2-1: Location of the SMZs

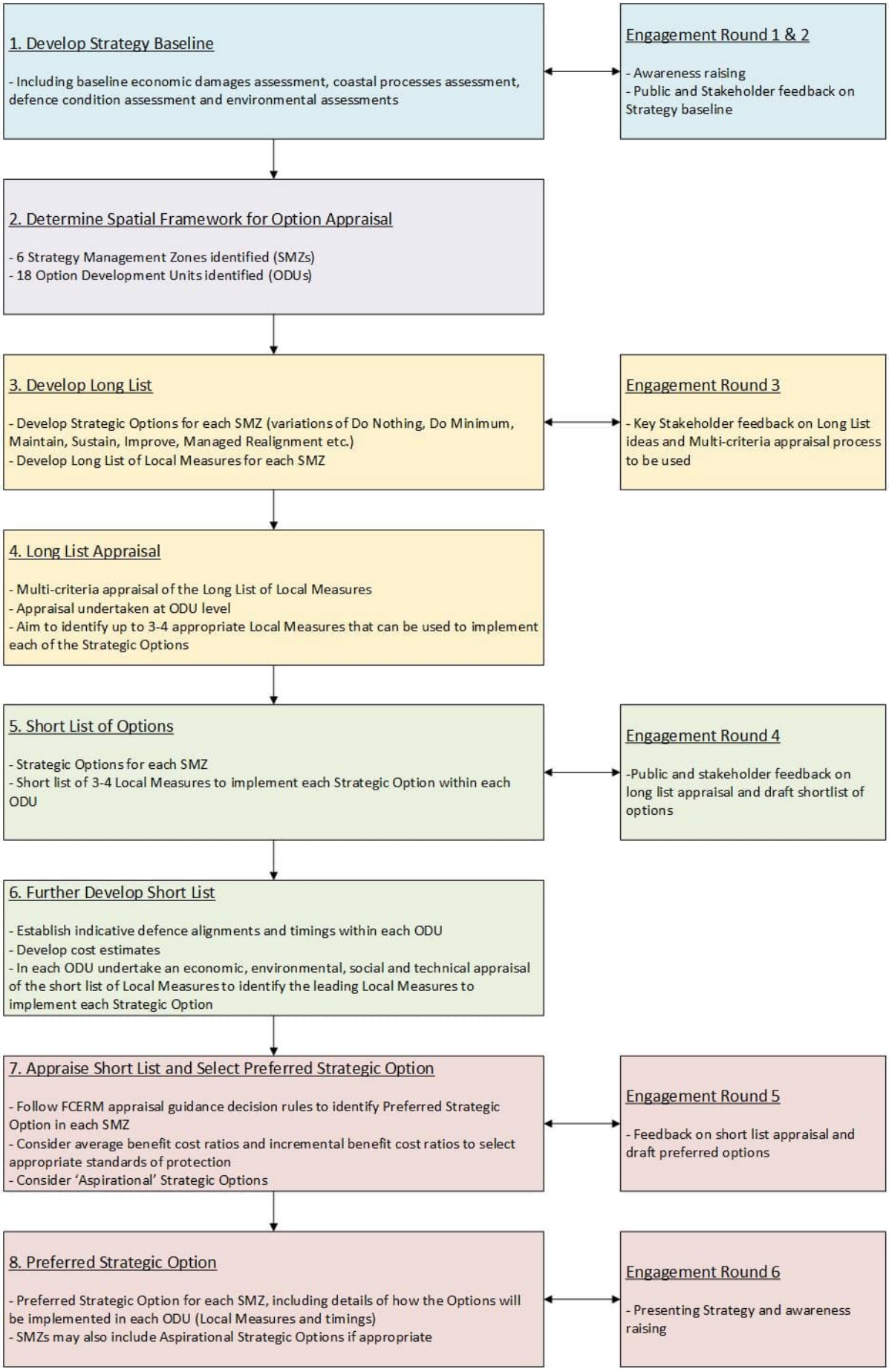

Figure 2-2: Flowchart showing the Strategy Option development and appraisal process

2.2 Multi-criteria appraisal

This section outlines the multi-criteria appraisal approach that has been used to appraise the Long List of Local Measures to select those to comprise draft Short List options.

Appraisal categories

The multi-criteria appraisal has been undertaken by scoring each Long List Local Measure in each ODU against the following nine categories:

- Flood / erosion risk management
- Indicative cost
- Design life
- Natural Environment (including impacts on coastal processes)
- Landscape and built environment
- Carbon impact
- Technical complexity
- Maintenance / operational requirements
- Broader outcomes (including scope for environmental enhancements).

Scoring criteria

Scoring rules were developed for the multi-criteria appraisal to ensure a consistent and objective approach. Table 2-1 presents the scoring criteria for each category.

A score between 0-2 was assigned to each of the nine categories and the total score across all of the categories has been calculated. No weighting has been applied to the categories when calculating the total score.

A summary of the scoring in each ODU is provided in Appendix A. For ease of interpretation and ‘at a glance’ understanding of the scoring, a score of 0 is denoted by a red cross symbol, a score of 1 is denoted by an orange dash symbol, and a score of 2 is denoted by a green tick symbol.

In each location, for each Strategic option the measures with the highest overall scores have been taken through to the short list. Typically between 3-4 measures with the highest overall scores in each location have been taken forward to the short list. However, in some areas where the risks are complex a larger number of measures has been taken forward to provide additional flexibility during the next stage of the appraisal process.

Table 2-1: Scoring criteria for multi-criteria appraisal of Long List Measures

Category	Scoring criteria		
	Poor score (score of 0) ✗	Medium score (score of 1) ▬	Good score (score of 2) ✓
Flood / erosion risk management	Measure does not improve the flood and / or erosion risk.	Measure improves or alleviates the flood and / or erosion risk but relies on additional measures as part of a combined defence.	Measure improves or effectively manages the flood and / or erosion risk and does not rely on any other measures.
Indicative cost	Cost is likely to be high relative to other measures.	Cost is likely to be moderate relative to other measures.	Cost is likely to be low relative to other measures.
Design life	Measure has a short design life (e.g. < 10 years).	Measure has an average design life (e.g. 10-30 years).	Measure has a long design life (e.g. > 30 years).
Natural Environment	Measure is likely to lead to significant negative impacts to habitats, ecology and statutory designations.	Measure is likely to lead to minor negative impacts to habitats, ecology and statutory designations that could be mitigated.	Measure is unlikely to lead to any negative impacts to habitats, ecology and statutory designations
Landscape and built environment	Measure is likely to lead to significant negative impacts to landscape and/or the built environment.	Measure is likely to lead to minor negative impacts to landscape and/or the built environment that could be mitigated.	Measure is unlikely to lead to any negative impacts to landscape and/or the built environment.
Carbon impact	Measure is likely to have a large negative carbon impact.	Measure is likely to have an average negative carbon impact.	Measure is likely to have a minor negative carbon impact or a positive impact.
Technical complexity	Measure is likely to have highly complex technical design, modelling or constructability requirements.	Measure is likely to have challenging technical design, modelling or constructability requirements.	Measure is likely to have standard technical design, modelling or constructability requirements.
Maintenance / operation requirements	Measure would require extensive ongoing maintenance and / or operation.	Measure would require typical ongoing maintenance and / or operation.	Measure would require little ongoing maintenance and / or operation.
Broader outcomes	Measure has limited potential to deliver broader outcomes and wider benefits.	Measure has average potential to deliver broader outcomes and wider benefits.	Measure has high potential to deliver broader outcomes and wider benefits.

The scoring has been informed by the following data and baseline understanding:

1. Supporting data and assessments – a review of a wide variety of relevant data and completion of baseline studies.
2. Visual site inspection - a site walkover was completed at project inception and photographs recorded.
3. Project team appreciation of the coastline, coastal processes and engineering knowledge.
4. Key stakeholder and public engagement – feedback from stakeholder engagement rounds 2 and 3.

A sensitivity test has been undertaken to determine the impact on the multicriteria appraisal and draft short list of measures in each ODU / Strategic option if the cost category is not included in the appraisal. Details of this are included in Appendix B.

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.

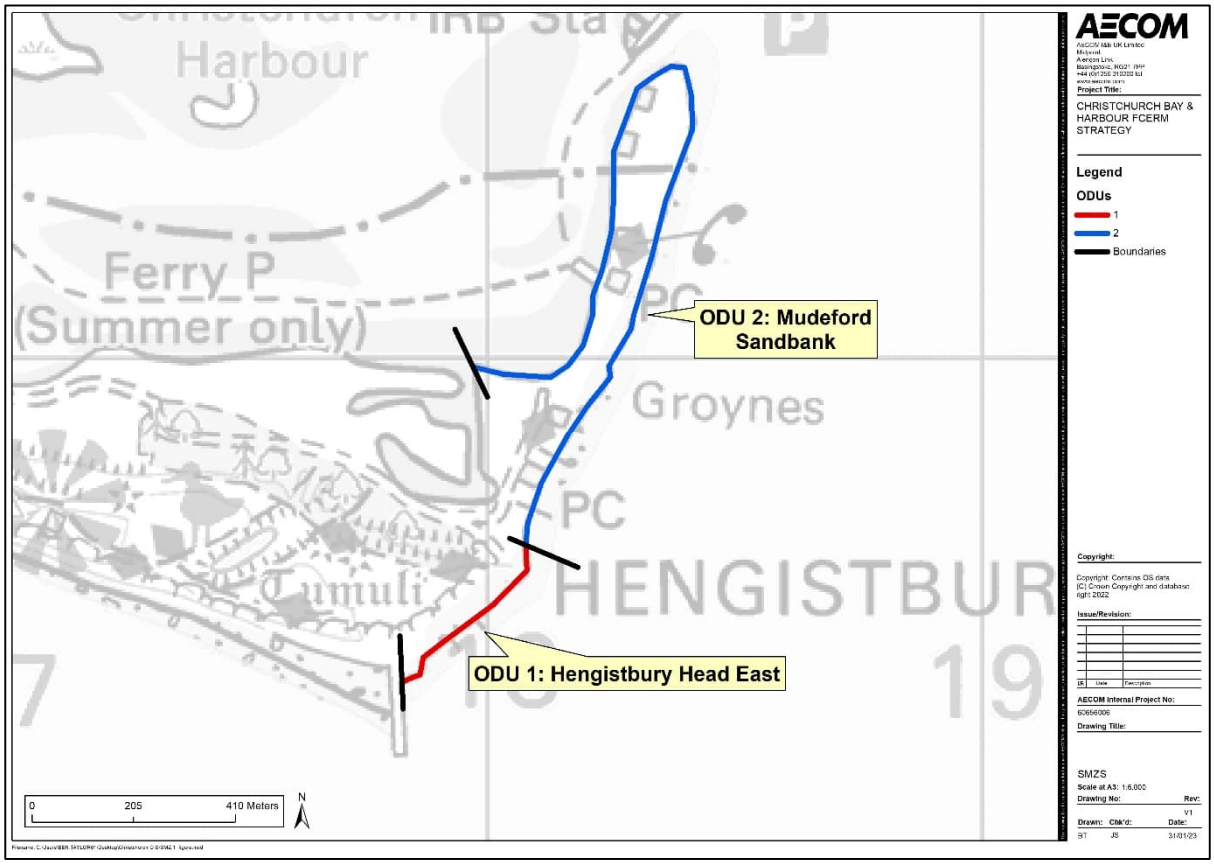

Figure 3-1: Location of ODUs within SMZ 1

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. There are 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 is due to be refurbished shortly and provides an anchor point for the coastline at Hengistbury Head, retaining beach material from Poole Bay. Strategic decisions for the Strategy are dependent on the ongoing function of the long groyne in stabilising Hengistbury Head.

3.2 Strategic Options

A variety of Strategic options have been developed, focussing on the management of the Sandbank over time. These include options looking to hold the Sandbank in its current position, as well as options to realign the Sandbank and encourage and manage gradual roll back into the harbour (in line with the SMP policy). The Strategic options for SMZ 1 are described in more detail below:

Do Nothing (baseline for appraisal)

The Do Nothing scenario is a hypothetical 'walk away' scenario whereby further maintenance of existing defences or beach management activities are not undertaken. In this location the Do Nothing scenario is not likely to be 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 H&S measures to make safe an FCERM asset.

Do Minimum

The Do Minimum Strategic 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 small amount (i.e. several years maximum). 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 as defences fail as part of this option. For example, clearance of failed defences, removal of buried infrastructure as it gets exposed and or removing access to unsafe areas.

Maintain

The Maintain Strategic option would involve undertaking proactive maintenance to the existing defences on a larger scale than the Do Minimum option. This 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.

The management of beach levels will be important to deliver the option. The Sandbank is predominantly fed from material from Poole Bay via longshore drift, but in the past beach recycling has been undertaken as required (most recently in 2017). It is unclear if the material feed onto the Sandbank will continue with sea level rise and therefore beach management in the form of beach recycling may be undertaken as part of this option to redistribute material as required. A secondary benefit of beach recycling is that it can be used to prevent growth of the Sandbank into the 'Run' which could cause navigational issues. If a programme of beach recycling is required this could be delivered as part of a wider capital beach management programme.

This option is likely to extend the service life of the existing defences by a longer duration than the Do Minimum option. Repeat interventions could be undertaken to ensure that the defences remain in place and perform as intended over the course of the next century.

The Maintain option does not include any raising of the existing defences. Therefore, due to sea level rise, the standard of protection (SoP) provided by the defences would reduce over time.

With respect to the Sandbank, this option would be focussed on maintaining existing defences and therefore holding the Sandbank in its existing position. With sea level rise it is likely to become increasingly challenging to hold the Sandbank in position by maintaining the existing defences and undertaking beach recycling. Therefore the long term viability of this option is uncertain. Based on existing sea level rise projections, if the crest level of the Sandbank remains unchanged, it is likely that the Sandbank would be inundated during large extreme events in the future (note that some areas of the Sandbank are already impacted during larges storms – for example at groyne S3).

The Shoreline Management Plan (SMP) policy for ODU 1 is for Managed Realignment, and for ODU 2 is for Managed Realignment from SMP epoch 2. As such, this Strategic option does not align with the SMP policies for the area as the intent with this option would be to aim to hold the Sandbank in its current position.

Sustain

The Sustain Strategic option would involve upgrading the existing defences and / or constructing new defences to reduce flood and erosion risk to the area and provide an SoP that keeps pace with sea level rise over time. This may involve beach management (nourishment and recycling) to raise existing beach levels. Increasing the material grain size of the beach over time may also be considered as this would generate a steeper beach gradient which could help manage the response of the Sandbank to sea level rise.

This option represents a managed adaptive approach to managing the coastal flood and erosion risk, with defences or beaches constructed and / or raised incrementally over time as required to sustain the desired SoP.

With respect to the Sandbank, this option would aim to hold the Sandbank in its existing position over time with the introduction of upgraded / new defences / beach nourishment. As per the Maintain option, this option does not align with the SMP policies as the intent of the option would be to aim to hold the Sandbank in its current position.

Improve

The Improve Strategic option would involve upgrading the existing defences and / or constructing new defences to reduce flood and erosion risk to the area by providing a high SoP through to the end of the appraisal period.

This may involve beach management (nourishment and recycling) to raise existing beach levels and as per the Sustain option, opportunities to increase the beach material grain size could also be explored. This option represents a precautionary approach to managing the coastal flood and erosion risk, with the defences constructed and / or raised in one main intervention based on providing a 2122 SoP. For the majority of the appraisal period, the SoP would be much higher than the target SoP at the end of the appraisal period, gradually falling over time due to sea level rise to reach the target SoP in 100 years' time.

With respect to the Sandbank, this option would aim to hold the Sandbank in its existing position over time with the introduction of upgraded / new defences / beach nourishment. As per the Maintain and Improve options, this option does not align with the SMP policies as the intent of the option would be to aim to hold the Sandbank in its current position.

Managed Realignment

The Managed Realignment Strategic option would involve realigning the existing coastline inland by actively managing the rate of erosion. For ODU 1 this would involve allowing the clifftop and beach to recede over time in a controlled manner. In ODU 2, the intent would be to maintain the integrity of the Sandbank whilst it is allowed to roll back in response to increased pressure from sea level rise. To ensure the success of this Strategic option, it will be important to manage the rates of cliff recession in ODU 1 and the rollback of the Sandbank in ODU 2 to avoid a disconnect in the coastline. A disconnect could occur if the rate of Sandbank rollback exceeded the erosion rate of the cliffs and vice versa, leading to an increasing risk of breaching of the sandbank and interrupted natural sediment supply from around Hengistbury Head.

The Managed Realignment Strategic option would allow continued use of this area for amenity and recreation, supported by defence maintenance / upgrades / beach management To ensure the continued safe navigation of the Run (main navigation channel into Christchurch harbour), it may be necessary to maintain the position of the Sandbank Head (north east end of the Sandbank) through defences and beach recycling from this location. As the Sandbank rolls back it may be necessary to place new beach material on the harbour side of the Sandbank through recharge, to provide sufficient space to move any properties / beach huts over time in a proactive manner. Consideration of how to manage the buried services beneath the Sandbank and the Run would be required as part of this option.

With this Strategic option the intent would be to keep the level of the Sandbank similar to the current situation as it rolls back. Defences on the Sandbank would not be raised and the crest level of the Sandbank itself would not be increased through recharge. The SoP provided to properties / beach huts on the Sandbank would therefore not be improved and over time with sea level rise the flood risk to properties on the Sandbank would be expected to increase.

By realigning the coastline in ODU 1 and ODU 2, this Strategic option broadly aligns with the SMP policies for this this location.

Managed Realignment with Sustain / Improve

The Managed Realignment with Sustain / Improve Strategic option would follow the same approach as the Managed Realignment option, except that it would also include upgrading defences on the Sandbank to provide a higher SoP to properties / beach huts compared to the existing situation. This could be achieved by constructing higher defences or placing more recharge material on the Sandbank to raise the crest level. The appropriate SoP for this option will be investigated as part of the economic assessment to be undertaken as part of the detailed short list appraisal during stage 6 of the appraisal.

Maintain then Managed Realignment (with or without Sustain / Improve)

This Strategic option would involve initially maintaining the defences in ODUs 1 and 2 (as per the Maintain Strategic option above), before transitioning into the Managed Realignment approach (as per the Managed

Realignment options above). The main benefit of this option is that it provides a period of time over which to adjust and transition into the Managed Realignment approach rather than implementing this from the outset. The time period over which defences would be maintained will be considered in more detail as part of the economic assessment to be undertaken as part of the detailed short list appraisal during stage 6 of the appraisal.

Adaptation / Resilience

The Adaptation / Resilience Strategic option is based on adapting to the risks caused by coastal flooding and erosion through planning policies and property and community level resilience measures. This option would not involve the construction of any new linear defences or beach management activities and therefore the cliff line in ODU 1 and the Sandbank in ODU 2 would be left to evolve naturally (similar to the Do Nothing option).

Planning policies such as assigning areas as Coastal Change Management Areas (CCMAs) could be implemented via the BCP Local Plan. For the permanent properties on the Sandbank, property level resilience measures such as flood doors, non-return valves, self-closing airbricks, water proofing and measures such as moving electricity sockets and valuable items to higher locations could be implemented. It is unlikely that property level resilience measures will be suitable for the beach huts on the Sandbank, but options for moving the beach huts or raising them on platforms could be considered as part of this option.

3.3 Short List of Local Measures

Table 3-1 summarises the results of the multicriteria appraisal and presents the short list of Local Measures for each unit that could be used to implement the broader Strategic options. For each Strategic option in each ODU, the preferred solution recommended by the Strategy will likely involve a combination of the short list measures but may not include all the different measures (i.e. some may be excluded from the preferred solution). Further appraisal work in the next stage of the Strategy development will consider how the measures can be combined at the local scale to achieve the intent of each Strategic option.

The commentary following Table 3-1 provides a high level summary of the short list measures. Details of the multicriteria appraisal scoring and justification for discounting the long list measures that did not make it onto the short list can be found in the multicriteria appraisal shown in Appendix A.

Table 3-1: Summary of short list of Local Measures for SMZ 1

Strategic option (s)	Strategic option intent	ODU(s)	Short List of Local Measures
Do Nothing	No active intervention.	1-2	-
Do Minimum	Small scale / ad-hoc defence maintenance.	1-2	Patch and Repair.
Maintain	Larger scale / proactive defence maintenance.	1-2	Capital refurbishment of existing assets, Beach recycling.
Sustain / Improve (holding coastline in position)	Upgrade defences to minimise amount of cliff erosion.	1 – Hengistbury Head East	Beach management (nourishment and recycling), Rock groynes, Rock revetment, Cliff slope drainage, Sand dune armouring, Sand dune enhancements
	Aim to hold Sandbank in existing position whilst upgrading defences.	2 – Mudeford Sandbank	Beach management (nourishment and recycling), Rock groynes, Rock revetment, Saltmarsh restoration (harbour side), Crest raising, Sand dune armouring, Sand dune enhancements.
Managed Realignment (Various approaches with respect to timings, crest level etc)	Allow cliff to erode over time, in a controlled manner.	1 – Hengistbury Head East	Beach recycling, Rock groynes (refurb existing), Rock revetment, Cliff slope drainage.
	Allow Sandbank to roll back over time, in a managed / controlled manner. When paired with Sustain / Improve, upgrade defences and SoP as the Sandbank moves position.	2 – Mudeford Sandbank	Beach management (nourishment and recycling), Rock groynes (refurb existing), Rock revetment / rock armour, Sand dune enhancements.
Adaptation / Resilience	Adapt to risks through planning policy and resilience measures.	1-2	Community level resilience measures.

3.3.1 ODU 1 – Hengistbury Head East

ODU 1 is 400m long and is located immediately to the east of Hengistbury Head long groyne. Hengistbury Head provides a stabilising influence on the shape of the wider bay by acting as an 'anchor point', with works planned for an upgrade of the long groyne in the immediate future which will ensure it remains so for the next century. The erosion rate of the coastline in this unit is likely to have an impact on the position and integrity of Mudeford Sandbank.

There is currently rock armour and gabions providing protection to the toe of the cliffs, although these defences are in a poor condition with an estimated residual life < 10 years. There are no FCERM Do Nothing Damages in this unit and therefore when considered in isolation there is likely to be a very poor economic case and limited justification for funding.

The SMP policy for this unit is for Managed Realignment of the cliff line. The various Managed Realignment Strategic options align with this policy, however, implementation of the Sustain / Improve options would represent a deviation from the SMP recommendations as the aim would be to hold the cliff line and coastline in place by minimising cliff erosion. 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.

Sustain / Improve Strategic Options

For the Sustain / Improve Strategic options the short list of measures includes beach nourishment, rock groynes, a rock revetment, cliff slope stabilisation / drainage measures and sand dune armouring / enhancements. Further details on each short list measure for these Strategic options are provided below:

- Beach management: this measure would involve the addition of beach material to this location, helping to provide a wider / higher beach affording greater protection to the toe of the cliff. This measure would likely have minimal landscape impact and may also support further development of sand dunes in this location. It would likely be necessary to supplement this measure with beach control structures such as groynes to help retain beach material placed in this location and beach recycling to move material as required.
- Rock groynes: groynes would help retain beach material in this location, in turn helping to provide a wider / higher beach affording greater protection to the toe of the cliff. There are currently rock groynes in this unit and it is likely that the rock could be reused as part of this measure if required, reducing cost compared to an entirely new set of structures. Rock groynes are likely to have a longer design life than timber groynes.
- Rock revetment: constructing a rock revetment at the cliff toe would reduce the reliance on the beach to provide protection and would provide a robust long term defence. Relative to other linear defences such as a seawall or concrete revetment, a rock revetment is likely to be lower cost.
- Cliff slope drainage: in order to minimise the cliff top erosion it is likely that any toe defences in this location would need to be combined with cliff slope stabilisation and drainage measures, such as perforated piping
- Sand dune armouring / enhancements: could be used to sustain / increase the size of the sand dunes on the Sandbank which provide a natural defence against flood risk. Measures to strengthen the sand dunes could involve local reinforcement and geotextiles. Measures to enhance the sand dunes could involve planting and fencing and would rely on natural processes and a regular supply of wind-blown sand to be successful.

Managed Realignment Strategic Option

For the Managed Realignment Strategic option in ODU 1, the short list of measures includes beach recycling, rock groynes, gabions and cliff slope stability / drainage. The intent of this Strategic option is to control the rate of cliff erosion and each of these measures could be used in isolation or in combination to achieve this objective. Further details on each short list measure for these Strategic options are provided below:

- Beach recycling: this measure would involve moving material from another part of the frontage to this location, helping to sustain beach levels and provide protection to the toe of the cliff. This measure differs to the beach nourishment measure with smaller quantities of material likely being placed as part of the beach recycling measure. It can be used to help control the rate of cliff erosion – i.e. topping up beach levels when erosion needs to be slowed and leaving the beach level to fall to encourage further erosion (recognising the delay / lag in the system).

- Rock groynes: groynes would help retain beach material in this location, in turn helping to sustain beach levels and provide protection to the toe of the cliff. These measures would supplement the beach recycling and provide greater confidence in beach material being retained in this location as intended. There are currently rock groynes in this unit and it is likely that the rock could be reused as part of this measure if required, reducing cost compared to an entirely new set of structures. Rock groynes are likely to have a longer design life than timber groynes.
- Rock revetment: constructing a rock revetment or placing rock armour in targeted areas could be used to help control erosion of the cliff toe and the overall rate of cliff top erosion as part of the Managed Realignment approach. Rock is preferable to other structures such as gabions because it can be moved and replaced in response to a changing cliff position over time.
- Cliff slope drainage: could be installed in combination with toe defences to help control the rate of erosion of the cliff. Likely a scaled back measure relative to the approach taken with the Sustain / Improve Strategic options.

3.3.2 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 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. A significant constraint in this location is that any works to improve coastal defences will likely have very limited FCERM-GiA available and are likely to be heavily reliant on third party contributions. In addition, FCERM-GiA will not be available for protecting beach huts.

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. In the Strategy, the Managed Realignment based Strategic options align with the SMP policy and would facilitate the rollback of the Sandbank over time in response to sea level rise. However, the Strategic options which aim to hold the Sandbank in its current position, such as the Maintain and Sustain / Improve options, would deviate from the SMP recommendations.

<u>Sustain / Improve Strategic Options (holding Sandbank in position)</u>

For the Sustain / Improve Strategic options that aim to hold the Sandbank in place, the short list of measures includes beach nourishment, rock groynes, a rock revetment, crest raising of existing defences, sand dune armouring and enhancements, and saltmarsh restoration (on the harbour side of the Sandbank). Further details on each short list measure for these Strategic options are provided below:

- Beach management: this measure would involve the addition of beach material to the Sandbank through beach nourishment, increasing the volume and crest level of the Sandbank aiming to make it more resistant to flooding. With this approach it is likely that the existing beach huts would need to be raised / moved to a higher position as material is added to the Sandbank. It is likely that beach nourishment would need to be supported with beach control structures such as groynes to help retain beach material placed in this location and hold the Sandbank in position. Beach recycling could be needed to reposition material to its desired location over time. This could involve moving material from the north end of the Sandbank to prevent impacts to navigation in the Run.
- Rock groynes: would help retain beach material in this location and supplement the beach nourishment measure. There are currently rock groynes in this unit and it is likely that the rock could be reused as part of new rock groynes if required, reducing cost compared to an entirely new set of structures.
- Rock revetment: could be constructed to provide a robust defence and help retain the position of the Sandbank over time. If a linear rock revetment is constructed along the length of the Sandbank and used in isolation without the addition of beach material (e.g. without beach nourishment), there is a risk that the characteristic sandy environment of the Sandbank would be lost over time as sea levels rise. Therefore, in order to preserve the recreation and amenity benefit of the Sandbank, it is likely that the rock revetment would be needed in addition to beach nourishment to strengthen certain parts of the Sandbank (e.g. the northern end and narrow points).

- Crest raising: would involve raising the height of the existing defences along the Sandbank, such as the concrete walls and rock structures. If supplemented with beach nourishment it is likely that the visual impact associated with raising the defences could be minimised.
- Sand dune armouring / enhancements: could be used to sustain / increase the size of the sand dunes on the Sandbank which provide a natural defence against flood risk. Measures to strengthen the sand dunes could involve local reinforcement and geotextiles. Measures to enhance the sand dunes could involve planting and fencing and would rely on natural processes and a regular supply of wind-blown sand to be successful.
- Saltmarsh restoration: if the Sandbank is to be held in its current position there is an opportunity to restore saltmarsh habitat on the harbour side of the Sandbank. This could be implemented through placement of sediment, fencing and planting.

Managed Realignment Options (allowing rollback of Sandbank in controlled manner)

For the Managed Realignment based options that aim to control the rollback of the Sandbank over time, the short list of measures includes beach recycling, beach nourishment, rock groynes, rock revetment / rock armour, gabions and sand dune enhancements.

It is noticeable that many of these measures are similar to those on the short list for the Sustain / Improve Strategic options. This is the case as these measures are considered to be most appropriate for this environment and can be implemented in different ways, depending on the intention of the Strategic option. For example, for the Sustain / Improve options that look to hold the Sandbank in place over time, the beach nourishment measure would be used to build-up the volume of the Sandbank and increase the crest height to adjust to sea level rise. However, for the Managed Realignment based options that aim to facilitate the rollback of the Sandbank, the beach nourishment measure could be used to add material to the harbour side of the Sandbank, creating space to move beach huts and other properties as the Sandbank rolls back over time.

As the Sandbank changes position with this option, consideration of how to proactively manage the buried services beneath the Sandbank and the Run would be required as part of this option.

Further details on each short list measure for the Managed Realignment Strategic options are provided below:

- Beach management: this measure would involve moving existing material (recycling) or placing additional beach material (nourishment) on the harbour side of the Sandbank to sustain the width of the Sandbank over time as the coastal side of the Sandbank erodes. Moving or placing new material on the harbour side of the Sandbank would help control the rollback process in a gradual manner. It would also enable beach huts and other assets to be moved proactively. Otherwise there is a risk that the rollback process would occur sporadically in response to specific storm events, leading to more property loss on the coastal side of the Sandbank over time. There may also be scope to use beach nourishment to raise the crest level of the Sandbank as it rolls back over time, providing a higher SoP against flood risk to the properties on the Sandbank. As with the sustain / improve options, beach recycling could also be used to prevent navigation impacts in the Run.
- Rock groynes: would help retain beach material allowing the rollback process to be better controlled. The advantage of rock is that it can be reused and moved into a new position over time as the Sandbank shifts position, reducing cost compared to an entirely new set of structures for each Sandbank position (e.g. relative to timber groynes which would have greater dismantling / rebuild costs).
- Rock revetment / armour: a rock revetment / rock armour could be placed at key parts of the Sandbank to help control the rate of rollback over time, for example at the narrow points and at the northern end of the Sandbank. Similar to the rock groynes, the rock used for a revetment / armour can be reused and moved to a new position as the Sandbank rolls back. This would reduce cost compared to an entirely new set of structures for each Sandbank position (e.g. relative to concrete or timber structures).
- Sand dune enhancements: could be used to sustain / increase the size of the sand dunes on the Sandbank as it rolls back over time. Measures to enhance the sand dunes could involve planting and fencing and would rely on natural processes and a regular supply of wind-blown sand to be successful.

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.

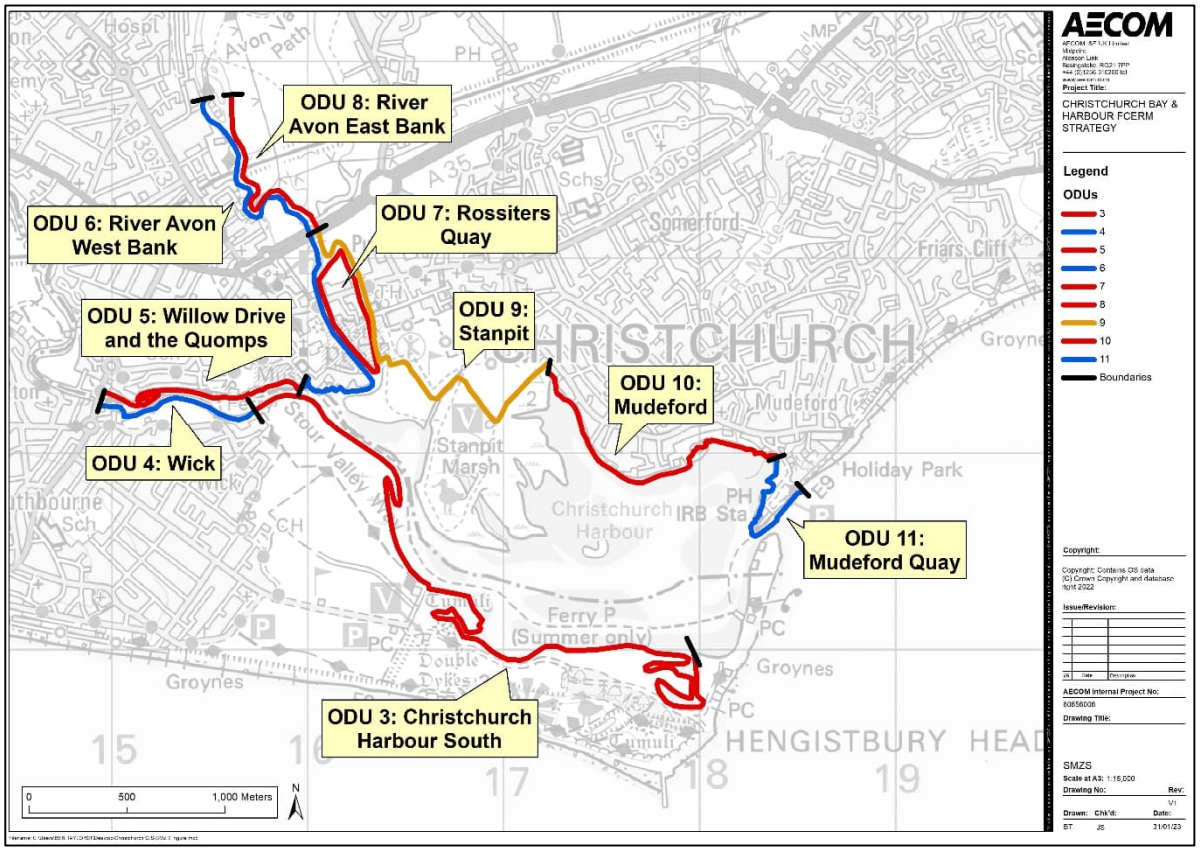

Figure 4-1: Location of ODUs within SMZ 2

SMZ 2 is a sheltered harbour environment and generally the main risk of 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 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.

4.2 Strategic Options

The Strategic options developed for SMZ 2 primarily focus on the management of the tidal flood risk within the Harbour. The Strategic options are outlined below:

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 the majority of locations in SMZ 2 the Do Nothing scenario is not likely to be a viable way forward, but it is important to include in the short list for these areas as it forms the baseline for the appraisal, against which all other options are compared. However in some areas the Do Nothing scenario may well be the favoured approach. For example, in ODU 3 the SMP policy is for No Active Intervention and the Strategy appraisal could come to similar conclusions. The Do Nothing option may include H&S measures to make safe an FCERM asset.

Do Minimum

The Do Minimum Strategic 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.

This option is likely to extend the service life of the existing defences but only by a small amount (i.e. several years maximum). 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.

Maintain

The Maintain Strategic option would involve undertaking proactive maintenance to the existing defences on a larger scale than the Do Minimum option. This 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 length of time than the Do Minimum option. Repeat interventions could be undertaken to ensure that the defences remain in place and perform as intended over the course of the next century.

The Maintain option does not include any raising of the existing defences. Therefore, due to sea level rise, the standard of protection (SoP) provided by the defences would reduce over time.

Sustain

The Sustain Strategic option would involve upgrading the existing defences and / or constructing new defences to reduce flood and erosion risk to the area and provide an SoP that keeps pace with sea level rise over time. This option represents a managed adaptive approach to managing the coastal flood and erosion risk, with defences constructed and / or raised incrementally over time as required to sustain the desired SoP.

During the design of future schemes consideration should be given to interaction of raised defences with other sources of risk such as surface water. For example, improvements to existing pumping stations or additional pumping may be required to mitigate any surface water risks in the future.

Improve

The Improve Strategic option would involve upgrading the existing defences and / or constructing new defences to reduce flood and erosion risk to the area by providing a high SoP through to the end of the appraisal period. This option represents a precautionary approach to managing the coastal flood and erosion risk, with the defences constructed and / or raised in one main intervention based on providing a 2122 SoP. For the majority of the appraisal period, the SoP would be much higher than the target SoP at the end of the appraisal period, gradually falling over time due to sea level rise to reach the target SoP in 100 years' time.

Similar to the Sustain Strategic option, during the design of future schemes consideration should be given to interaction of raised defences with other sources of risk such as surface water. For example, improvements to existing pumping stations or additional pumping may be required to mitigate any surface water risks in the future.

Maintain then Sustain / Improve

This Strategic option would involve initially maintaining the defences (as per the Maintain Strategic option), before transitioning into either the Sustain or Improve approach. This is a key option to consider as in many areas the present day risk from flooding may not currently be enough to economically justify upgrading the defences at this point in time. However in the future when the risk is expected to increase due to sea level rise the economic case for upgrading the defences will improve. Considering this change in risk profile over time, this option would ensure that defence upgrades are recommended when the need arises. The time periods in which the transition from Maintain to Sustain / Improve occurs in each ODU will be investigated further during the detailed short list appraisal during stage 6.

Improve (tidal barrier)

This option would involve constructing a tidal barrier across the entrance to Christchurch Harbour (the Run). The barrier would be closed during periods of increased tidal flood risk (i.e. tidal surges) to reduce the risk of tidal flooding within the harbour area. The River Stour and River Avon discharge into Christchurch Harbour and therefore this option would also need to include traditional defences around the harbour to reduce the risk of flooding from these fluvial watercourses. A barrier across Christchurch Harbour entrance is likely to have significant environmental and navigational impacts, as well as being a very high cost solution. However this option has a place on the shortlist so that more detailed investigation (e.g. cost estimates) can be undertaken to robustly assess the viability of this option. Given the large upfront investment required to implement this option, a precautionary approach to managing the flood risk (i.e. an Improve approach rather than a Sustain approach) results.

Adaptation / Resilience

The Adaptation / Resilience Strategic option is based on adapting to the risks caused by coastal flooding around Christchurch Harbour through planning policies and property and community level resilience measures. This option would not involve the construction of any new linear defences.

Planning policies such as assigning areas as Coastal Change Management Areas (CCMAs) could be implemented to limit any further development in the area. At the property level, property level resilience (PLR) measures such as flood doors, non-return valves, self-closing airbricks, water proofing and measures such as moving electricity sockets and valuable items to higher locations could be implemented. At the community level, implementation of flood support groups, flood warning and emergency systems could be implemented to reduce the impacts of flooding.

4.3 Short List of Local Measures

Table 4-1 summarises the results of the multicriteria appraisal and presents the short list of Local Measures for each unit that could be used to implement the broader Strategic options. For each Strategic option in each ODU, the preferred solution recommended by the Strategy will likely involve a combination of the short list measures but may not include all the different measures (i.e. some may be excluded from the preferred solution). Further appraisal work in the next stage of the Strategy development will consider how the measures can be combined at the local scale to achieve the intent of each Strategic option.

The commentary following Table 4-1 provides a high level summary of the short list measures. Details of the multicriteria appraisal scoring and justification for discounting the long list measures that did not make it onto the short list can be found in the multicriteria appraisal shown in Appendix A.

There are a number of historic landfill / potentially contaminated land sites throughout SMZ 2. The costs associated with remediation of these sites will be considered as part of the appraisal. Whilst remediation is not strictly a coastal defence measure, it would provide an environmental enhancement and a potential alternative to protecting these sites with coastal defences in the future.

Table 4-1: Summary of short list of Local Measures for SMZ 2

Strategic option(s)	Strategic option intent	ODU(s)	Short List of Local Measures
Do Nothing	No active intervention.	3-11	Small scale works to make safe failing defences (health and safety)
Do Minimum	Small scale / ad-hoc defence maintenance.	3-11	Patch and Repair.
Maintain	Larger scale / proactive defence maintenance.	3-11	Capital refurbishment.
Sustain / Improve*	Upgrade defences to sustain or improve SoP against flooding.	3 – Christchurch Harbour South	Setback floodwall, Setback embankment, Slope armour and reinforcement (as local erosion defence), Saltmarsh restoration.
		4 - Wick	Seawall / quay wall with parapet, Setback floodwall, Sheet pile wall, Setback embankment, Deployable permanent defences (mainly for access points – i.e. flood gates), Slope armour and reinforcement (as local erosion defence).
		5 – Willow Drive and the Quomps	Crest raising (existing setback defences), Seawall / quay wall with parapet, Setback floodwall, Sheet pile wall, Setback embankment, Deployable permanent defences (e.g. flood gates at access points or flip-up barriers in gardens).
		6 – River Avon West Bank	Crest raising (existing defences), Seawall / quay wall with parapet, Setback floodwall, Sheet pile wall, Setback embankment, Deployable permanent defences (i.e. flood gates at access points), Land raising (Sailing club / Boatyard area).
		7 – Rossiters Quay	Crest raising (existing defences), Seawall / quay wall with parapet, Setback floodwall, Sheet pile wall, Setback embankment, Deployable permanent defences (i.e. flood gates at access points), Land raising.
		8 – River Avon East Bank	Setback floodwall, Setback embankment, Deployable permanent defences (i.e. flood gates at access points).
		9 - Stanpit	Seawall / quay wall with parapet, Rock revetment, Setback floodwall, Sheet pile wall, Setback embankment, Slope armour and reinforcement, Deployable permanent defences (i.e. flood gates at access points), Land raising, Saltmarsh restoration.
		10 - Mudeford	Crest raising (of existing defences), Seawall / quay wall with parapet, Setback floodwall, Sheet pile wall, Deployable permanent defences (i.e. flood gates at access points), Saltmarsh restoration.
		11 – Mudeford Quay	Crest raising (of existing defences), Seawall / quay wall with parapet, Setback floodwall, Sheet pile wall, Setback embankment, Deployable permanent defences (i.e. flood gates at access points), Land raising, Saltmarsh restoration.

Strategic option(s)	Strategic option intent	ODU(s)	Short List of Local Measures
Improve (tidal barrier)	Tidal barrier at entrance to Christchurch Harbour. Linear defences around the harbour to mitigate fluvial risk.	3-11	Tidal barrier at entrance to harbour, Linear defences within harbour as described above for Sustain / Improve options.
Adaptation / Resilience	Adapt to risks through planning policy and resilience measures.	3-11	Community level resilience measures, Property level resilience measures.

**includes Sustain / Improve measures for delayed upgrades as part of the 'Maintain then Sustain / Improve' Strategic option*

4.3.1 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 no formal coastal defences present. ODU 3 is part of / adjacent to many important environmental designations and there are two historic landfill locations in this unit. 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 the erosion risk is expected to be low. Over the next 100 years the total PV damages for this unit are estimated to be approximately £0.9million under the baseline scenario.

The SMP policy for ODU 3 is therefore 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.

Sustain / Improve Strategic Options

The intent of the Sustain / Improve options in this unit would be to reduce flood risk to the small number of properties at risk. This option may also involve localised erosion protection to areas of historic landfill as required.

For the Sustain and Improve Strategic options the short list measures include setback floodwall, setback embankment, slope armour and reinforcement (as a local erosion defence) and saltmarsh restoration. Further details on each short list measure is provided below:

- Setback floodwall / embankment: likely constructed around properties and key assets at risk with the alignments to be considered further during the next stage of the appraisal. There is sufficient space in this unit for setback structures and with construction on land this approach would not lead to any encroachment into the intertidal foreshore. Due to space availability there is potential to incorporate landscaping features into this approach to deliver broader outcomes.
- Slope armour and reinforcement (as local erosion defence): included in the short list for the defence of historic landfill sites in this unit. Existing shoreline is characterised by a natural verge and slope armour / reinforcement is likely to align with this well. Different structures could be implemented, including products like armour lock or similar.
- Saltmarsh restoration: there is existing saltmarsh habitat located along the frontage in parts of this unit. Saltmarsh restoration techniques such as fencing, planting and local sediment deposition could be implemented to encourage saltmarsh growth in existing areas or to create new areas of saltmarsh. Unlikely to provide significant flood risk reduction benefits but would provide environmental improvements to the area.

4.3.2 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 around the north east of Wick and a steel sheet pile wall in the west of the unit. The large residential area of Wick is located within this ODU and there are also historic landfill sites located to the north of the residential properties in this unit. The unit is adjacent to many important environmental designations.

Whilst the present day tidal flood risk is minimal, over time the risk increases with approximately 40 properties at risk from a 200 year event in 50 years' time and over 120 properties at risk in 100 years' time. 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 £4.3million.

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 and the Maintain then Sustain / Improve Strategic option.

Sustain / Improve Strategic Options

The intent of the Sustain / Improve options in this unit would be to reduce flood risk to the developed area of Wick.

For the Sustain and Improve Strategic options the short list measures include a seawall / quay wall (frontline structure), a sheet pile wall (frontline structure), a setback floodwall, setback embankment. Deployable permanent defences (such as flood gates at key access points) and slope armour and reinforcement (as a local erosion defence). Further details on each short list measure are provided below:

- Seawall / quay wall / sheet pile wall: constructed as a frontline structure along the south bank of the River Stour. This would replace the existing quay wall where it is already in place and provide a new structure where the bank is currently undefended. This would provide a defence against flood risk from the north of this unit from the River Stour channel. This approach would likely lead to some encroachment into the river channel but this could be limited through design. Being a frontline structure this approach would provide protection to Tuckton Gardens Park as well as the residential areas to the south. A frontline structure would also help facilitate broader outcomes such as continued mooring, access to pontoons and also access to the river channel. However flood gates / access points may be required in certain locations to provide this access.
- Setback floodwall / embankment: in the north part of this unit there are many possible alignments available, for example along Wick Lane or through Tuckton Gardens Park. In the east part of the unit a setback floodwall or embankment would provide protection from flooding coming from the east (Wick Meads direction) and potentially outflanking the defence to the north. A setback approach is likely favourable from a natural environment perspective as it would not lead to any encroachment into the river channel.
- Deployable permanent defences: in this location access to the River from the bank is important given the use of the river channel for mooring. It is likely that flood gates would need to be incorporated into any frontline or setback defences in this location and therefore this measure is included in the short list.
- Slope armour and reinforcement (as local erosion defence): included in the short list for the defence of historic landfill sites in this unit. Existing shoreline is characterised by a natural verge and slope armour / reinforcement is likely to align with this well. Different structures could be implemented, including products like armour lock or similar.

4.3.3 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 Quomps. 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. In the east part of the ODU the land use is the Quomps recreational area and also a historic landfill that may require defending. The unit is adjacent to many important environmental designations which provide a significant constraint, especially for front line defence options. 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 likely to be 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; between 35-40 properties are expected to be at risk from a present day 1 in 200 year event, increasing to over 560 properties at risk in 100 years' time. 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.

Sustain / Improve Strategic Options

For the Sustain and Improve Strategic options the short list measures include a seawall / quay wall (frontline structure), a sheet pile wall (frontline structure), a setback floodwall, a setback embankment, crest raising of the existing setback defences (if technically viable) and deployable permanent defences (such as flood gates at key access points). Further details on each short list measure are provided below:

- Seawall / quay wall / sheet pile wall: constructed as a frontline structure along the north bank of the River Stour. This would replace the existing quay wall where it is already in place and provide a higher crest level to upgrade the SoP against tidal flood risk. This approach may lead to some encroachment into the river

channel but this could potentially be limited through design. Being a frontline structure this approach would provide protection all areas to the north of the alignment, including the recreational area / historic landfill beneath the Quomps. There are likely to be complexities with a frontline structure, particularly in the western part of this unit where the river bank lies adjacent to private gardens / properties and space may be more restricted. Successfully delivering a frontline structure here will likely require extensive collaboration and engagement with the private property owners as well as ECI advice on constructability. A frontline structure would also help facilitate broader outcomes such as continued mooring, access to pontoons and also access to the river channel. However flood gates / access points may be required in certain locations to provide this access.

- Setback floodwall / setback embankment / setback defence raising: alignments will be investigated in more detail during the next stage of appraisal. The main benefits of setback defences are that they are likely to be lower cost than frontline solutions and also reduce the impact on the natural environment (no defence footprint encroachment into river channel). It may be possible to raise the crest level of the existing setback floodwall along the north side of the Quomps to keep the same alignment as there is currently. A setback floodwall is likely to lead to visual and landscape impacts and opportunities to minimise this impact would need to be considered as part of the design of a scheme in this location (e.g. glass topped walls).
- Deployable permanent defences: in this location access to the River from the bank is important given the use of the river channel for mooring. It is likely that flood gates would need to be incorporated into any frontline or setback defences in this location and therefore this measure is included in the short list. In addition, there is potential to incorporate deployable flip-up barriers in some locations (subject to additional funding being secured as these are typically more costly measures).

4.3.4 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 Quomps) to Knapp Mill. The ODU includes the Millstream. There are a large number of different defence sections in this ODU, including a concrete seawall, masonry walls, a sheet pile wall, gabions and natural verge. There is a large 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.

The tidal flood risk within this unit is most prominent at the south end and central area of the unit. Over the next 100 years the total PV damages for this ODU are estimated to be over £6.6 million. Between 35-40 properties are expected to be at risk from a present day 1 in 200 year event in this ODU, increasing to over 120 properties in 100 years' time.

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.

Sustain / Improve Strategic Options

The intent of the Sustain / Improve options in this unit would be to reduce flood risk along the west bank of the River Avon.

For the Sustain and Improve Strategic options the short list measures include a seawall / quay wall (frontline structure), a sheet pile wall (frontline structure), crest raising of existing defences, a setback floodwall, setback embankment, deployable permanent defences (i.e. flood gates at access points) and land raising (of the sailing club land / boatyard). Further details on each short list measure is provided below:

- Seawall / quay wall / sheet pile wall: constructed as a frontline structure along the west bank of the River Avon, either the main river channel and/or the Millstream pending further investigation of alignments during the next stage of appraisal. The defence would replace the existing quay wall / defences where it is already in place and provide a higher crest level to upgrade the SoP against tidal flood risk. This approach would likely lead to some encroachment into the river channel but this could be limited through design. There are likely to be constructability challenges associated with a frontline alignment. Given the importance of mooring and river access along this frontage the frontline structure will likely require a large amount of flood gates / access points.

- Crest raising of existing defences: where there is sufficient space available with a suitable existing structure there may be scope to raise the crest level of existing defences. The main benefit of this approach is that it should limit forward encroachment of the defences and may also reduce the cost compared to replacing existing defences. The viability of this approach will depend on numerous factors including existing defence type and condition.
- Setback floodwall / embankment: constructed further back from the river bank where there is sufficient space available. Likely that these measures may be more viable in the north part of the unit in the vicinity of Christchurch Bypass. Advantages of setback defences are typically lower cost than frontline structures, as well as reduced impact on the natural environment due to no encroachment into the river channel.
- Deployable permanent defences: in this location access to the river from the bank is important given the use of the river channel for mooring. It is likely that flood gates would need to be incorporated into any frontline or setback defences in this location and therefore this measure is included in the short list.
- Land raising: this measure is on the short list as it may be a viable approach in areas such as Christchurch Sailing Club or Elkins Boatyard. These areas are water compatible areas but with sea level rise the incidence of flooding will increase and in order to not impact accessibility to the river channel raising the land level may be a suitable approach (rather than a linear defence with access points).

4.3.5 ODU 7 – Rossiters Quay

ODU 7 covers the Rossiters Quay island in the middle of the River Avon. Defences in ODU 7 consist of natural verges, embankment and masonry walls. There are also a large number of flood gates. In this ODU many properties are located close to the water's edge and therefore there is generally a lack of space to construct new defences. Given the numerous private landowners in this location, for a flood risk mitigation scheme to be successful, there will need to be collaboration between the numerous land owners and the flood risk authorities.

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.

The unit is at risk from flooding and over the next 100 years the total PV damages for this ODU are estimated to be over £5.5 million. Only 2 properties are expected to be at risk from a present day 1 in 200 year event in this ODU, increasing to over 50 properties in 100 years' time.

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.

Sustain / Improve Strategic Options

The intent of the Sustain / Improve options in this unit would be to reduce the flood risk on the Rossiters Quay island.

For the Sustain and Improve Strategic options the short list measures include a seawall / quay wall (frontline structure), a sheet pile wall (frontline structure), crest raising of existing defences, a setback floodwall, setback embankment, deployable permanent defences (i.e. flood gates at access points) and land raising (of boatyard / water compatible areas). Further details on each short list measure is provided below:

- Seawall / quay wall / sheet pile wall: constructed as a frontline structure around the Rossiters Quay island. Further work will be undertaken on potential alignments during the next stage of appraisal. The defence would replace the existing quay wall / defences where it is already in place and provide a higher crest level to upgrade the SoP against tidal flood risk. This approach would likely lead to some encroachment into the river channel but this could be limited through design. There are likely to be constructability challenges associated with a frontline alignment. Given the importance of mooring and river access along this frontage the frontline structure will likely require a large amount of flood gates / access points.
- Crest raising of existing defences: where there is sufficient space available with a suitable existing structure there may be scope to raise the crest level of existing defences. The main benefit of this approach is that it should limit forward encroachment of the defences and may also reduce the cost compared to replacing existing defences. The viability of this approach will depend on numerous factors including existing defence type and condition.

- Setback floodwall / embankment: constructed further back from the river bank where there is sufficient space available, potentially in the north part of the island where more space is available. Advantages of setback defences are typically lower cost than frontline structures, as well as reduced impact on the natural environment due to no encroachment into the river channel.
- Deployable permanent defences: in this location access to the river from the bank is important given the use of the river channel for mooring. It is likely that flood gates would need to be incorporated into any frontline or setback defences in this location and therefore this measure is included in the short list.
- Land raising: this measure is on the short list as it may be a viable approach in water compatible / boatyard areas, particularly in the southern part of the island. Given reliance on access to the river channel, raising the land level rather than a linear defences with fewer access points may be preferable.

4.3.6 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. 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 are at risk from tidal flooding beyond the area of open space to the east although not until the future with 8 properties expected to be at risk from a 1 in 200 year tidal event in 100 years' time. 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 lots of space to construct new defences if required and also potential opportunities to explore habitat restoration / environmental enhancements. However, building a robust economic and funding case is likely to be challenging given the low number of properties at risk relative to the long defence length (and associated cost) required. Over the next 100 years the total PV damages for this ODU are estimated to be just under £0.4million.

Sustain / Improve Strategic Options

The intent of the Sustain / Improve options in this unit would be to reduce the flood risk to the properties at risk on the east bank of the River Avon in this unit.

For the Sustain and Improve Strategic options the short list of measures includes a setback floodwall, a setback embankment and deployable permanent defences (i.e. flood gates at access points). Further details on each short list measure is provided below:

- Setback floodwall / embankment: there is sufficient space available to construct setback defences in this unit. It is likely that these would be located to the east of the natural flood plain area, adjacent to the B2247 but further work will be undertaken during the next stage of the appraisal to investigate potential alignments in more detail. It would be important to ensure that a defence in this location does not constrain the river channel / natural flood plain and increase fluvial flood risk / detriment flooding. Advantages of setback defences are typically lower cost than frontline structures, as well as reduced impact on the natural environment due to no encroachment into the river channel.
- Deployable permanent defences: in this location flood gates may be incorporated into any new defences to preserve access.

4.3.7 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. Defences comprise a natural verge, earth embankment, masonry wall and sheet pile wall, as well as a large number of flood gates.

The management of historic landfill in this ODU is a key driver for options in the area. Erosion of the landfill sites in the short term has potential to lead to environmental impacts. Other factors to consider include the continued importance of access to the river and potential future development. It may be difficult to build a robust economic / funding case due to long lengths of defence required. There are also properties at risk from flooding in this unit, however, the risk does not increase substantially until later on in the appraisal period. In 100 years' time it is expected that over 850 properties would be at risk from a 1 in 200 year tidal flood event. Over the next 100 years the total PV damages for this ODU are estimated to be over £38 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.

Sustain / Improve Strategic Options

The intent of the Sustain / Improve options in this unit would be to reduce the flood risk to the properties at risk on the east bank of the River Avon. Different alignments for defences around Stanpit will be investigated. A frontline alignment would defend the Stanpit recreation area and historic landfill from erosion sites whereas a setback alignment may not defend these areas.

For the Sustain and Improve Strategic options the short list measures include a seawall (frontline), rock revetment (frontline), sheet pile wall (frontline), slope armour and reinforcement (frontline), setback floodwall, setback embankment and saltmarsh restoration. Further details on each short list measure is provided below:

- Seawall / sheet pile wall: constructed as a frontline structure in this unit. A vertical structure (seawall / sheet pile wall) would be most appropriate for the east bank of the River Avon where space is limited and defence footprint into the river channel needs to be restricted. A new seawall / sheet pile wall around the Stanpit area is less feasible and more appropriate solutions are available.
- Rock revetment / slope armour and reinforcement: constructed around Stanpit to work with the existing sloped embankment in this location and provide erosion defence to the Stanpit recreation site. A sloped structure is less feasible on the east bank of the River Avon as it would advance into the river channel, restricting navigation and access for mooring. If intended to provide a flood risk function, the rock revetment structure would need to incorporate an impermeable layer. The slope armour is likely not feasible if intended as a flood defence.
- Setback floodwall / embankment: further work will be undertaken during the next stage of the appraisal to consider setback alignments to defend against the flood risk in this unit. It is possible that setback alignments are viable and may be lower cost solutions than a frontline structure in some locations in this unit (e.g. immediately to the south of Christchurch Bypass, and to the north of Stanpit).
- Deployable permanent defences: in this location flood gates may be incorporated into the any new defences to preserve access.
- Land raising: a potential measure in the north part of the unit where the main land use is commercial / businesses rather than residential. Land raising could be incorporated into any redevelopment and would reduce reliance on deployable defences such as flood gates.
- Saltmarsh restoration: the intertidal area immediately to the south of Stanpit recreation area currently has a large expanse of saltmarsh habitat that provides environmental and flood risk benefits. In the future with sea level rise, the saltmarsh habitat may be reduced in area. However saltmarsh restoration measures could be implemented to reduce the impacts of sea level rise on the saltmarsh in this location. Measures could include the local deposition of sediment, planting and fencing.

4.3.8 ODU 10 – Mudeford

ODU 10 spans the north side of Christchurch Harbour between Stanpit Marsh 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. For a flood risk mitigation scheme to be successful, there will need to be collaboration between the numerous land owners and the flood risk authorities.

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 £11million.

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.

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.

Sustain / Improve Strategic Options

The intent of the Sustain / Improve Strategic options in this unit would be to reduce the flood risk to the properties in this unit at Mudeford. The short list of measures for these options includes crest raising of the existing defences, a seawall / quay wall (frontline structure), sheet pile wall (frontline structure), a setback floodwall, deployable permanent defences (i.e. flood gates at access points or flip-up barriers in gardens), and saltmarsh restoration. Further details on each short list measure are provided below:

- Seawall / quay wall / sheet pile wall: constructed as a frontline structure along the alignment of the existing defences. The defence would replace the existing quay wall / defences where and provide a higher crest level to upgrade the SoP against tidal flood risk. This approach would likely lead to some encroachment into the harbour but this could be limited through design. There are likely to be constructability challenges associated with a frontline alignment and construction access. Given the importance of mooring and river access along this frontage the frontline structure will likely require a large amount of flood gates / access points.
- Crest raising of existing defences: where there is sufficient space available with a suitable existing structure there may be scope to raise the crest level of existing defences. The main benefit of this approach is that it should limit forward encroachment of the defences and may also reduce the cost compared to replacing existing defences. The viability of this approach will depend on numerous factors including existing defence type and condition.
- Setback floodwall: constructed inland from the existing defence alignment. Alignments will be considered in more detail during the next stage of the appraisal. Opportunities for setback alignments include along Fisherman's Bank pathway. Advantages of setback defences are typically lower cost than frontline structures, as well as reduced impact on the natural environment due to no encroachment into the harbour.
- Deployable permanent defences: mooring and waterside access is a key factor in this location and therefore flood gates / access points would need to be incorporated into any new defences in this location. In addition, there is potential to incorporate deployable flip-up barriers in some locations, such as private gardens (subject to additional funding being secured as these are typically more costly measures).
- Saltmarsh restoration: the intertidal area immediately to the south of the Mudeford frontage may be suitable for restoring / creating saltmarsh habitat using measures such as the local deposition of sediment, planting and fencing. It is recognised however that this area is used for mooring and therefore any saltmarsh restoration would need to account for this activity.

4.3.9 ODU 11 – Mudeford Quay

ODU 11 envelopes Mudeford Quay between Chichester Way in the harbour and Mudeford Quay car park entrance on the open coast. There are few commercial and residential properties in this unit and therefore building a robust economic and funding case for new / improved defences in this location (beyond the existing localised defences) may be challenging. Over the next 100 years the total PV damages for this ODU are estimated to be just over £1million. There is currently a small flood defence scheme at the south end of the Quay which provides defences to a small number of properties in this location and any new defences will have to consider the interaction with this scheme.

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.

As mentioned in section 4.3.8, the area of open space in the north part of this unit (to the north of the main quay area) 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 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).

As part of the option appraisal, setback defence alignments in the area to the north of the quay will be considered in more detail, leaving the opportunity open to explore changes in shoreline position here in the future pending the outcome of contaminated land assessments.

Sustain / Improve Strategic Options

The intent of the Sustain / Improve Strategic options in this unit would be to reduce the flood risk to properties and other assets (such as roads and infrastructure) in this unit. Pending the outcome of contaminated land assessments that are recommended as part of the SMP refresh, it may also be the objective to prevent erosion to the area of open space to the north of the Quay. This area is currently used for recreation and amenity uses providing additional justification for protecting this part of the coastline from erosion.

The short list of measures for the Sustain / Improve Strategic options includes crest raising of the existing defences, a seawall / quay wall (frontline structure), sheet pile wall (frontline structure), a setback floodwall, a setback embankment, deployable permanent defences (i.e. flood gates at access points or flip-up barriers in gardens), land raising and saltmarsh restoration. Further details on each short list measure is provided below:

- Seawall / quay wall / sheet pile wall: constructed as a frontline structure along the alignment of the existing defences. The defence would replace the existing quay wall / defences where present and provide a higher crest level to upgrade the SoP against tidal flood risk. This approach would likely lead to some encroachment into the harbour but this could be limited through design. There are likely to be constructability challenges associated with a frontline alignment but generally there is more open space available in this unit for construction compared to elsewhere along the frontage. Given the importance of mooring and river access along this frontage the frontline structure will likely require a large amount of flood gates / access points.
- Setback floodwall / setback embankment: constructed inland from the existing defence alignment. Alignments will be considered in more detail during the next stage of the appraisal. Opportunities for setback alignments include along the road south of the boat storage and along Chichester Way Road. These alignments would not protect the areas seaward from erosion and maintenance of frontline defences would need to be continued / or discontinued depending on the approach taken to hold or realign the shoreline in this unit. Advantages of setback defences are typically lower cost than frontline structures, as well as reduced impact on the natural environment due to no encroachment into the harbour.
- Deployable permanent defences: waterside access is a key factor in this location and therefore flood gates / access points would need to be incorporated into any new defences in this location. Some of the properties at the south end of Mudeford Quay also currently use flood gates in their defences and subject to the findings during the next stage of appraisal these may need to be replaced in time when they reach the end of their service life.
- Land raising: this measure is included in the shortlist as it may be a feasible solution in areas of open space that are at risk from flooding from multiple directions, such as Mudeford Quay car park. Land raising would need to account for the retaining capacity of the existing quay wall and improvements to existing structures may be needed to support this measure.
- Saltmarsh restoration: the intertidal area to the west of the ODU 11 frontage may be suitable for restoring / creating saltmarsh habitat using measures such as the local deposition of sediment, planting and fencing. It is recognised however that most of ODU 11 is used for boat launching and therefore any saltmarsh restoration would need to account for this activity.

4.3.10 Tidal Flood Barrier

Construction of a tidal flood barrier across the entrance to Christchurch Harbour would provide tidal flood risk benefits to each of the ODUs within the harbour and SMZ 2 (ODUs 3-11). Further work appraising a tidal flood barrier approach will be undertaken during the next stage of the appraisal process. It is likely to be a very costly option given the complexities associated with building such a structure and is also likely to have detrimental impacts on the natural environment (including to international environmental designations) and navigation in and

out of the harbour. The tidal flood barrier would also need to be accompanied by defences within the harbour due to the fluvial flood risk from the River Stour and Avon.

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.

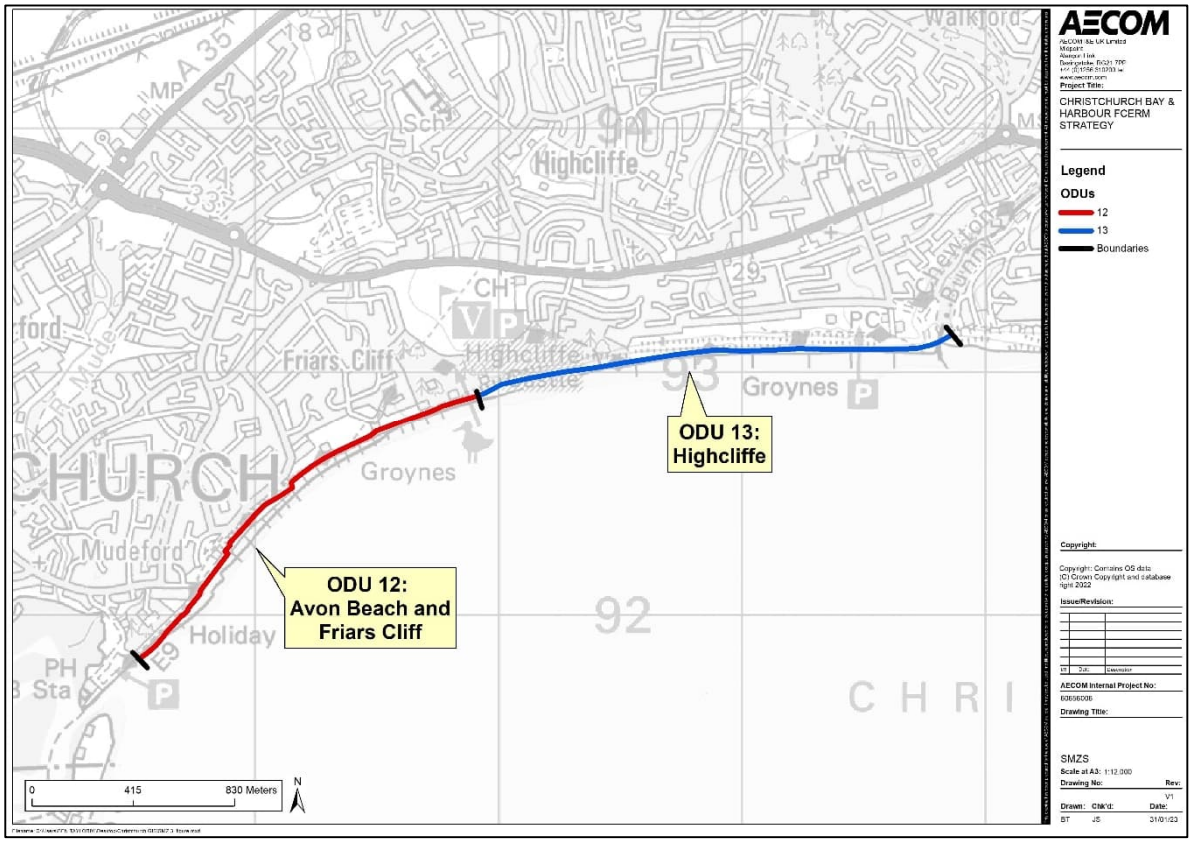

Figure 5-1: Location of ODUs within SMZ 3

SMZ 3 is an open coast environment, comprising ODUs 12 and 13. 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 the Walkford Brook stream 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 Strategic Options

A variety of Strategic options have been developed for SMZ 3, primarily focussed on managing the coastline and cliff position to control erosion risk, but also with the option to include local flood defences as required.

The Maintain and Improve Strategic options align with the SMP policy recommendations. The Improve Strategic option would involve upgrading the existing defences and would provide more long term confidence in minimising the amount of cliff top recession compared to the Maintain option. For the Maintain option, with anticipated sea level rise it is uncertain how effective beach recycling / defence refurbishment may be in the long term in minimising cliff top recession and defence upgrades may be required (Improve option) to ensure the cliff remains stable.

The interaction between ODU 13 and ODU 14 to the east is an important point to consider for the appraisal. A Managed Realignment option has therefore been included for ODU 13. The intent of a Managed Realignment approach in ODU 13 would be to let the shoreline retreat in a controlled manner but intervene in the future to limit future property loss. As part of this option, opportunities for creating a more gradual transition into ODU 14 will be explored, potentially through the realignment of the defences at the eastern end of Highcliffe. This may prevent a disconnect in the shoreline position from developing in the future and could also create a more continuous sediment supply between Highcliffe and the frontage to the east. In addition, a Managed Realignment option in ODU 13 could be a more economically viable solution than the Improve option, but this will need to be determined during the next stage of the appraisal.

The Strategic options for SMZ 3 are outlined below:

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. The Do Nothing scenario is not likely to be 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. With the Do Nothing scenario, defences would fail when they reach the end of their service life, and with projected sea level rise, the cliff line in SMZ 3 would be expected to erode. The Do Nothing option may include H&S measures to make safe an FCERM asset.

Do Minimum

The Do Minimum Strategic 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 small amount (i.e. several years maximum). 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.

Maintain

The Maintain Strategic option would involve undertaking proactive maintenance to the existing defences on a larger scale than the Do Minimum option. This 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. Beach management in the form of beach recycling would also likely be undertaken as part of this option.

This option is likely to extend the service life of the existing defences by a longer length of time than the Do Minimum option. Repeat interventions could be undertaken to ensure that the defences remain in place and perform as intended over the course of the next century.

The Maintain option does not include any raising or lengthening of the existing defences. Therefore, due to sea level rise, the standard of protection (SoP) provided by the defences would reduce over time. Without raising and upgrading the beach and defences there is a possibility that cliff erosion may occur in the future. However it is difficult to establish the probability of this happening as the natural evolution of the beach in this location in response to sea level rise will influence this outcome and the evolution of the cliffs with this Strategic option.

Improve (erosion risk)

The Improve Strategic option would involve upgrading the existing defences and / or constructing new defences to reduce the erosion risk to the cliffs through to the end of the appraisal period. The intent of this Strategic option would be to minimise the amount of coastal erosion / cliff top recession. Given the nature of complex cliff erosion this Strategic option would be achieved by a combination of defences at the toe of the cliff and cliff slope stabilisation measures. This would help mitigate both coastal erosion of the toe and cliff slope instability caused by groundwater / precipitation factors. The Improve Strategic option would fully align with the SMP policy recommendations for this part of the Strategy frontage and would likely be based around sustaining the wide amenity beach as the primary defence for the cliff toe. Depending on the leading option at Naish cliffs to the east, there may be a continued risk of outflanking of the defences at Highcliffe with the Improve option and this would need to be managed effectively.

There is also scope with this Strategic option to put in place localised flood defences in the west part of ODU 12 where there is a risk of flooding. This area is low lying and whilst the primary driver of flood risk is from the west (from within Christchurch Harbour) there are localised areas on the open coast where wave overtopping may be an issue.

Maintain then Improve

This Strategic option would involve initially maintaining the defences in ODU 12 and ODU 13 (as per the Maintain Strategic option), before transitioning into the Improve approach (as per the Improve Strategic option above). The main benefit of this approach is that it provides a period of time over which to evaluate how the beach and cliff line is responding to sea level rise before committing to upgrading the defences. It may provide a more economically viable way of implementing a Hold the Line policy in the area as costly defence upgrades are delayed until the future, closer to the point in time when most benefits would be realised. It is noted with this approach that the existing timber groynes in ODU 12 would likely need replacing soon.

Managed Realignment (ODU 13 only)

The Managed Realignment Strategic option would involve controlling the rate of cliff erosion to transition the coastline into a new position that is more sustainable with rising sea levels. The Managed Realignment option would not be implemented in ODU 12 because compared to ODU 13 the topography is lower and there is less space between the shoreline and properties to implement this approach.

As part of this option, opportunities for creating a more gradual transition for the coastline between ODU 13 and ODU 14 will be explored. This could involve realigning the defences at the eastern end of Highcliffe, reducing the length of the groynes at Highcliffe to allow more beach material to pass to the east, or even the construction of offshore structures to create a wider beach and sediment transport pathway.

Any changes to the defences at Highcliffe will need to be carefully considered as they could reduce the effectiveness of the existing defence system, The aspiration of any changes would be to create a dual benefit of reducing the outflanking risk at Highcliffe but also benefiting the coastline to the east at Naish Cliff and Barton on Sea.

The Managed Realignment option would likely involve an intervention with new defences in the future to hold the coastline / cliff line in its new position alongside a new slope stabilisation / drainage system to replace the existing system (that is established and working well in this location). The costs of the Managed Realignment approach(s) will be estimated during the next stage. There is potential for the approach to have a lower cost than the Improve option, but this may depend on how costly it would be to reinstall a new cliff stability system (to replace the

existing one at Highcliffe). The economic feasibility and affordability of this option will be a key consideration within the overall context of improving coastal processes and create a more gradual transition between the two areas.

Maintain then Managed Realignment (with or without Sustain / Improve) (ODU 13 only)

This Strategic option would involve initially maintaining the defences in ODUs 12 and 13 (as per the Maintain Strategic option above), before transitioning into the Managed Realignment approach (as per the Managed Realignment options above). The main benefit of this option is that it provides a period of time over which to adjust and transition into the Managed Realignment approach rather than implementing this from the outset. The time period over which defences would be maintained will be considered in more detail as part of the economic assessment to be undertaken as part of the detailed short list appraisal during stage 6 of the appraisal.

Adaptation / Resilience

The Adaptation / Resilience Strategic option is based on adapting to the risks caused by coastal flooding and erosion through planning policies and property and community level resilience measures. This option would not involve the construction of any new linear defences or beach management activities and therefore the cliff line would be left to evolve naturally (similar to the Do Nothing option).

Planning policies such as assigning areas as Coastal Change Management Areas (CCMAs) could be implemented to limit any further development in the area. Given the main risk in this SMZ is from coastal erosion, property level resilience measures will not be effective and over time this would lead to the loss of properties from erosion.

5.3 Short List of Local Measures

Table 5-1 summarises the results of the multicriteria appraisal and presents the short list of Local Measures for each unit that could be used to implement the broader Strategic options. For each Strategic option in each ODU, the preferred solution recommended by the Strategy will likely involve a combination of the short list measures but may not include all the different measures (i.e. some may be excluded from the preferred solution). Further appraisal work in the next stage of the development of The Strategy will consider how the measures can be combined at the local scale to achieve the intent of each Strategic option.

The commentary following Table 5-1 provides a high level summary of the short list measures. Details of the multicriteria appraisal scoring and justification for discounting the long list measures that did not make it onto the short list can be found in the multicriteria appraisal shown in Appendix A.

Table 5-1: Summary of short list of Local Measures for SMZ 3

Strategic option(s)	Strategic option intent	ODU(s)	Short List of Local Measures
Do Nothing	No active intervention.	12-13	Small scale works to make safe failing defences (health and safety)
Do Minimum	Small scale / ad-hoc defence maintenance.	12-13	Patch and Repair.
Maintain	Larger scale / proactive defence maintenance.	12-13	Capital refurbishment, Beach recycling.
Improve (Various approaches with respect to timings)	Hold the coastline in existing position. Mitigate localised flood risk from wave overtopping in west part of unit.	12 – Avon Beach and Friars Cliff	Beach nourishment, Timber groynes, Rock groynes, Seawall, Rock revetment, Cliff slope stabilisation and drainage, Land raising, Setback floodwall (local flood risk measure), Deployable permanent defences (local flood risk measure), Crest raising (local flood risk measure).
	Minimise cliff erosion.	13 – Highcliffe	Beach nourishment, Rock groynes, Rock revetment, Cliff slope stabilisation and drainage.
Managed Realignment (Various approaches with respect to timings)	Control rate of cliff erosion, transitioning the coastline into a more sustainable long term position.	13 - Highcliffe	Beach recycling, Rock revetment, Rock groynes, Offshore breakwater / reef, Cliff slope stabilisation and drainage.
Adaptation / Resilience	Adapt to risks through planning policy and resilience measures.	12-13	Community level resilience measures.

5.3.1 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 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 £8.7million. Over the next 20 years 9 properties are expected to be at risk from erosion under the Do Nothing scenario, increasing to 140 properties 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.

Improve Strategic Option

The intent of the Improve Strategic option in this unit would be to hold the existing defence line in place. The beach is important for providing protection to the toe of the existing defences here, as well as providing an amenity and recreational benefit. The aspiration for the Improve option would therefore be to maintain the beach in this location. There is also scope to include localised flood defences as part of this Strategic option to mitigate wave overtopping risk to a small number of properties in the western end of this unit.

The short list of measures for the Improve Strategic option includes beach nourishment, timber groynes, rock groynes, a new seawall, a rock revetment / armour (east part of unit), cliff slope stabilisation and drainage, and land raising. Localised measures to mitigate potential flood risk include a setback floodwall (local flood risk measure) and deployable permanent defences such as flood gates (local flood risk measure). Further details on each short list measure is provided below:

- Beach nourishment: this measure would involve the addition of beach material to this location, helping to provide a wider / higher beach affording greater protection to the toe of the defences at the back of the beach and the currently undefended Friars Cliff section. Additional beach material may also provide an amenity / recreation benefit. In the future it is likely that beach material would need to be added to this location due to the potential impacts of sea level rise. This measure would likely have minimal landscape impact but it would probably be necessary to supplement this measure with beach control structures such as groynes to help retain beach material placed in this location.
- Timber / rock groynes: groynes would help retain beach material in this location, in turn helping to provide a wider / higher beach affording greater protection to the toe of the defences. There are currently timber and rock groynes (hybrid) in this unit and it is likely that the rock could be reused as part of this measure if required.
- Seawall / land raising: the seawall measure would involve constructing a new seawall at the back of the beach at Avon Beach / Friars cliff to replace the existing structure or upgrade it. This would most likely be undertaken when the existing structure reaches the end of its design life. Given the amenity / recreation uses of the beach a vertical structure such as a seawall is favourable here due to a small defence footprint (compared to a rock revetment / concrete revetment). There is potential to incorporate land raising as part of this approach to raise the level of the promenade and beach huts behind the wall. This would reduce the risk of flooding along the promenade in the future and may also offer wider public realm enhancements.
- Rock revetment / armour: this measure is envisaged to be most feasible in the east part of the unit, immediately to the east of the seawall beneath Steamer Point car park. Currently there is a small amount of rock armour placed at the top of the beach in this location, but with sea level rise additional rock armour / a formal rock revetment may be required here to protect the cliff toe.
- Cliff stabilisation and drainage: currently the cliff line / land behind the coastal defences is relatively stable, as indicated by the dense vegetation coverage. However, there is no guarantee that this will remain the case in the future and therefore cliff slope stabilisation and drainage measures may be required, in combination with toe defences, to minimise any erosion.

- Setback floodwall / crest raising / permanent deployable defences (i.e. flood gates): these measures could be used to mitigate localised flood risk along this frontage. Potential alignments will be investigated during the next stage of the appraisal.

5.3.2 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 is present (rock defences in a good condition). 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, with 18 properties expected to be at risk by 2072 and 173 properties at risk by 2122 under a Do Nothing scenario. Over the next 100 years the total PV damages for this ODU are estimated to be over £6.8million. A key part of the option appraisal will be to consider 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 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. The intent of the Improve Strategic option fully aligns with the SMP policy recommendations, but it is recognised at this stage that there may not be a strong economic case for this approach (to be determined during the next stage of appraisal). Therefore, in addition, a Managed Realignment Strategic option has also been included in the appraisal for consideration.

Improve Strategic Option

The intent of the Improve Strategic option in this unit would be to minimise the amount of cliff erosion in this unit and aim to hold the existing coastline. The short list of measures for the Improve Strategic option includes beach nourishment, rock groynes, a rock revetment and cliff slope stabilisation and drainage. Further details are provided below:

- Beach nourishment: currently the beach in this location shows a general accretion trend in this location, with the existing coastal defences and rock groynes performing well in retaining material. However, there is no guarantee that this trend will continue into the future with projected sea level rise. In the event that beach material begins to be lost from this location, beach nourishment could be used to periodically top up the beach here to provide continued protection to the toe of the cliff.
- Rock groynes: as part of this measure the existing rock groynes in this location could be upgraded in the future to account for changing conditions due to sea level rise / climate change. The existing rock material could be reused to reduce cost and supplemented with additional rock material if required.
- Rock revetment / rock armour: in the future it may be necessary to construct a rock revetment or place rock armour at the top of the beach in the currently undefended part of this frontage between Steamer Point and Highcliffe Castle. This would most likely be a continuation of the rock revetment / armour located to the east of this location. Depending on rates of sea level rise, it may also be necessary to upgrade the existing rock revetment / armour in the east part of this unit to provide better protection to the cliff toe.
- Cliff stabilisation and drainage: currently the cliff line behind the coastal defences is relatively stable, as indicated by the dense vegetation coverage. However, there is no guarantee that this will remain the case in the future and therefore cliff slope stabilisation and drainage measures may be required, in combination with toe defences, to minimise any erosion.

Managed Realignment Option

The intent of the Managed Realignment option would be to transition the coastline into a new position that is more sustainable with rising sea levels. Opportunities for a more gradual transition into the currently undefended Naish Cliff to reduce the outflanking risk could be explored as part of this approach. Once the coastline has transitioned into a new position, the intent would be to then hold the coastline / cliff line in its new position. Depending on the measures used for the Managed Realignment approach, it may be lower cost than the Improve option and could be more feasible from an economic standpoint, but this will require further investigation at the next stage of appraisal.

The short list of Local Measures for the Managed Realignment option includes beach recycling, a rock revetment / armour, rock groynes, offshore breakwater / reef and cliff slope stabilisation and drainage. Many of these measures are also included in the short list for the improve option which given that these measures are considered to be most appropriate for this environment and location to control the rate of cliff erosion and can be implemented in different ways, depending on the intent of the Strategic option. The use of rock is generally favoured in this location when implementing the Managed Realignment option as rock can be moved / re-used in a new defence alignment.

Further details of the short list measures and how they could be used for the Managed Realignment option are provided below:

- Beach recycling: beach material can be moved from one place to another within ODU 13 to help control rates of cliff recession. For example, moving from a place of accumulation where the cliff toe is historically stable to an area where beach levels are lower and the cliff is at risk of eroding faster than desired.
- Rock groynes: the existing rock groynes in this location have performed well in retaining beach material and as the shoreline adjusts with the Managed Realignment option the rock groynes could be moved / modified to retain material as required. Reusing the rock is likely to reduce cost compared to entirely new structures.
- Rock revetment / rock armour: opportunities for altering the rock revetment / armour at the eastern end of the Highcliffe defences could be considered as part of the Managed Realignment option to create a more gradual transition to Naish Cliff and reduce the risk of outflanking of the Highcliffe defences.
- Cliff stabilisation and drainage: currently the cliff line behind the coastal defences is relatively stable, as indicated by the dense vegetation coverage. A key reason why the existing cliff is stable is the extensive slope stabilisation in this ODU that is part of the wider defence system. If sections of the cliff are allowed to erode as part of the Managed Realignment option, then the slope stabilisation scheme will need to be redesigned and a new system put in place to hold the cliff line in its new position / help control the rate of further erosion. This could involve a potentially large cost which will need to be considered in the Managed Realignment option.
- Offshore breakwater / reef: these structures would be constructed offshore of the coastline toward the eastern end of the Highcliffe defences (near Chewton Bunny) and would aim to create a wider beach in this location. The intention with this approach would be to realign the position of the shoreline and create a more continuous sediment transport pathway between Highcliffe and Naish Cliff. This approach is likely to be technically complex and lead to significant changes in the coastal processes in the area and therefore further appraisal work is required to develop this approach further. Thought will be given to how to manage the existing groynes / defences in this location with this approach. At the moment the defences provide a key strong point in the bay and could either be kept in place or potentially even removed, allowing more space for a wider beach that would provide an alternative means of cliff toe protection and provide benefit to the Naish frontage. A more gradual change in the shoreline position could be created helping to reduce the outflanking risk here in the future.

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.

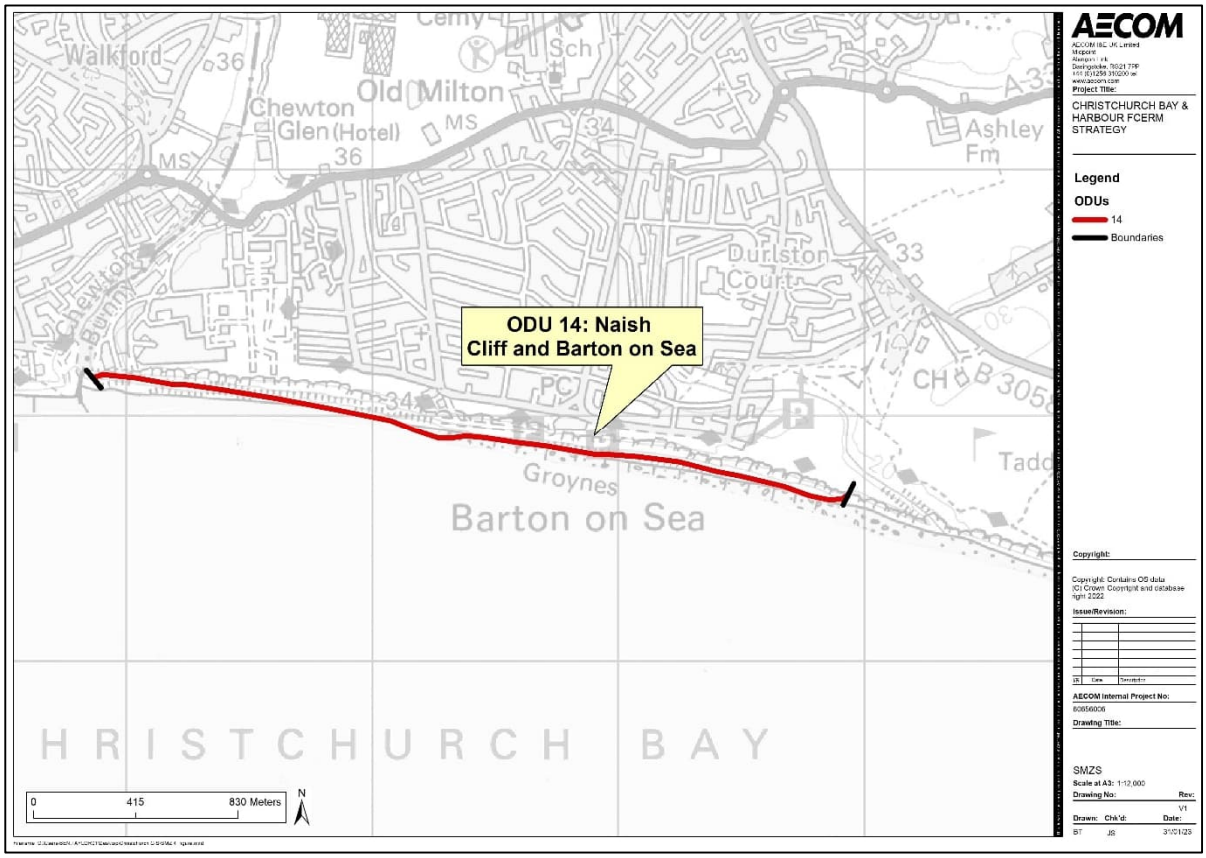

Figure 6-1: Location of ODUs within SMZ 4

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 if left undefended it erodes from sea erosion of the cliff toe and also groundwater induced cliff instability that can cause land sliding. The influence of groundwater instability is linked to levels of precipitation. A combination of cliff toe protection and cliff slope drainage and stability measures are required to 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. 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.

The main risk in this area is from coastal erosion caused by cliff toe erosion and groundwater induced cliff slope instability. There is a risk of outflanking the defences at either end of this unit. At the western end, if Naish Cliffs continue to erode and the defences at Highcliffe in ODU 13 remain in place, then the Highcliffe defences could be outflanked. Similarly at the eastern end, if the Barton on Sea defences remain in place and the currently undefended cliffs in ODU 15 erode then the Barton defences could be at risk from outflanking.

The interaction with the adjacent ODUs is therefore a crucial element in the option appraisal in this location and will be considered in detail when deciding on leading options for the frontage. The decisions made in adjacent units will have knock-on impacts and influence the decision making process in ODU 14 and vice versa. Ultimately, the Strategy will seek to find a leading option for each area that provides a coherent joined-up solution across the full Strategy frontage.

6.2 Strategic Options

A variety of Strategic options have been developed for SMZ 4, primarily focussed on managing the coastline and cliff position to control the erosion risk. The Strategic options are based on variations of the Maintain, Improve and Managed Realignment philosophies.

In this location, the complex cliff means that it is very difficult to stop cliff top recession entirely. This is because the cliff top recession is driven by both cliff toe erosion and also slope instability driven by groundwater and precipitation. The intent of the Improve Strategic option is to minimise the amount of cliff top recession along the frontage as much as possible by upgrading the defences. However this option acknowledges that some recession is still likely to occur in the future given the constraints and limitations of working with this cliff system. In order to minimise cliff top recession, it is likely that significant investment would be required which may not be deliverable or feasible given the typical funding constraints associated with linear coastal erosion defence works.

The Managed Realignment Strategic option differs to the Improve option in its intent to manage the cliff top recession. Whilst the Improve Strategic option aims to minimise the amount of cliff top recession, the Managed Realignment option would aim to evolve the coastline into a more sustainable long term position. In some areas cliff top recession would be limited / reduced, whilst in other areas more significant amounts of erosion would be allowed to occur. This process would be controlled by the maintenance and / or provision of new defences at key locations. It is likely that there would be some loss of property with the Managed Realignment option.

The Managed Realignment Strategic option would build upon the work undertaken by the SMP and would broadly seek to align with the SMP policy recommendations for this area. However, the next stage of the appraisal will not be confined by the SMP recommendations and there will be further consideration as to where defences can be placed / maintained to maximise potential benefits and the deliverability of this Strategic option. One potential approach for the Managed Realignment option would be to create a transition zone, transitioning from toe defences and cliff drainage in the central and eastern part of Barton on Sea, to potentially softer solutions such as beach nourishment in the west part of the unit.

Further appraisal in the next stage of the Strategy will be undertaken to recommend the defence alignments, interventions and timings. This will also need to consider how the options in the adjacent ODUs link to ODU 14. For example, a Managed Realignment approach in ODU 13 via the realignment of the defences at the eastern end of Highcliffe may provide more flexibility in how the coastline position in ODU 14 is managed by increasing sediment supply from the west. Conversely if the defences at Highcliffe are held in their current position, sediment supply from the west may be restricted and the risk of outflanking at ODU 13 would need to be managed accordingly.

The Strategic Options for SMZ 4 are outlined below:

Do Nothing (baseline for appraisal)

The Do Nothing scenario is a hypothetical 'walk away' scenario whereby maintenance of existing defences and / or beach management would not be undertaken. The Do Nothing scenario is not likely to be a viable way forward for the developed parts of the frontage in this unit, 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. With the Do Nothing scenario, defences would fail when they reach the end of their service life, and with projected sea level rise, the cliff line in SMZ 4 would be expected to erode significantly. The Do Nothing option may include H&S measures to make safe an FCERM asset.

Do Minimum

The Do Minimum Strategic option would involve undertaking reactive small scale maintenance to the existing defences and the remaining drainage system. This would typically take the form of patch and repair maintenance whereby localised damage to the defences / remaining drainage system 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 small amount (i.e. several years maximum). 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 but would be less than the Do Nothing scenario in the short term.

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 and the remaining drainage system on a larger scale than the Do Minimum option. This would typically be in the form of capital refurbishments to existing defences and drainage / 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. The option would not include replacing the drainage system or defences where they have already failed.

Cliff top recession would still occur with this option but to a lesser degree than the Do Nothing / Do Minimum approaches. In areas where cliff drainage measures have already failed, local accelerated erosion may occur. The Maintain option does not include any raising of the existing defences. Therefore, due to sea level rise, the standard of protection (SoP) provided by the defences would reduce over time and the rate of cliff erosion may increase over time.

Improve (erosion risk)

The Improve Strategic option would involve upgrading the existing defences and / or constructing new defences along the frontage to reduce the erosion risk to the cliffs through to the end of the appraisal period. The intent of this Strategic option would be to minimise the amount of coastal erosion / cliff top recession, although it is recognised that it is unlikely that the erosion will be able to be completely stopped. The Improve option would likely be achieved by a combination of toe defences and cliff slope stabilisation measures.

Maintain then Improve

This Strategic option would involve initially maintaining the defences along the frontage (as per the Maintain Strategic option), before transitioning into the Improve approach (as per the Improve Strategic option above). The main benefit of this approach is that it provides a period of time over which to evaluate how the beach and cliff line is responding to sea level rise before committing to upgrading the defences. It may provide a more economically viable way of implementing a Hold the Line policy in the area as costly defence upgrades are delayed until the future, closer to the point in time when most benefits would be realised.

Managed Realignment

The Managed Realignment option would involve transitioning the coastline to a more sustainable position over time, accepting that a greater amount of cliff top recession would occur compared to the Improve option in some locations. Further work will be undertaken during the next stage of the Strategy development to identify areas where existing defences should be maintained / new defences constructed as well as considering the timings of these interventions to maximise the potential benefits and deliverability of this option. It is likely that there would be some property loss with the Managed Realignment option.

Maintain then Managed Realignment

This Strategic option would involve initially maintaining the defences in SMZ 4 (as per the Maintain Strategic option above), before transitioning into the Managed Realignment approach (as per the Managed Realignment options above). The main benefit of this option is that it provides a period of time over which to adjust and transition into the Managed Realignment approach rather than implementing this from the outset. The time period over which defences would be maintained will be considered in more detail as part of the economic assessment to be undertaken as part of the detailed short list appraisal during stage 6 of the appraisal.

Adaptation / Resilience

The Adaptation / Resilience Strategic option is based on adapting to the risks caused by coastal erosion through planning policies and community level resilience measures. This option would not involve the construction of any new linear defences or beach management activities and therefore the cliff line would be left to evolve naturally (similar to the Do Nothing option). Elements of this option, such as community level resilience could also be applied to the other Strategic options, for example, to Managed Realignment or Maintain.

6.3 Short List of Local Measures

Table 6-1 summarises the results of the multicriteria appraisal and presents the short list of Local Measures for each unit that could be used to implement the broader Strategic options. For each Strategic option, the preferred solution recommended by the Strategy will likely involve a combination of the short list measures but may not include all the different measures (i.e. some may be excluded from the preferred solution). Further appraisal work in the next stage of the Strategy development will consider how the measures can be combined at the local scale to achieve the intent of each Strategic option.

The commentary following Table 6-1 provides a high level summary of the short list measures. Details of the multicriteria appraisal scoring and justification for discounting the long list measures that did not make it onto the short list can be found in the multicriteria appraisal shown in Appendix A.

Table 6-1: Summary of short list of Local Measures for SMZ 4

Strategic option(s)	Strategic option intent	ODU(s)	Short List of Local Measures
Do Nothing	No active intervention.	14 – Naish Cliff and Barton on Sea	Small scale works to make safe failing defences (health and safety)
Do Minimum	Small scale / ad-hoc defence maintenance.	14 – Naish Cliff and Barton on Sea	Patch and Repair.
Maintain	Larger scale / proactive defence maintenance.	14 – Naish Cliff and Barton on Sea	Capital refurbishment, Beach recycling.
Improve (Various approaches with respect to timings)	Aim to minimise cliff top recession, although acknowledge that some may still occur due to complex cliffs.	14 – Naish Cliff and Barton on Sea	Beach nourishment, Rock groynes, Rock revetment, Cliff slope stabilisation and drainage.
Managed Realignment (Various approaches with respect to timings)	Control rate of cliff erosion, transitioning the coastline into a more sustainable long term position.	14 – Naish Cliff and Barton on Sea	Beach Nourishment, Rock groynes, Rock revetment, Cliff slope stabilisation and drainage.
Adaptation / Resilience	Adapt to risks through planning policy and resilience measures.	14 – Naish Cliff and Barton on Sea	Community level resilience measures.

6.3.1 ODU 14 – Naish Cliff and Barton on Sea

Improve Strategic Option

The intent of the Improve Strategic option in this unit would be to minimise the amount of cliff erosion along the frontage. The short list of measures for the Improve Strategic option includes beach nourishment, rock groynes, a rock revetment and cliff slope stabilisation and drainage. Further details are provided below:

- Beach nourishment: this measure would involve the addition of beach material to this location, helping to provide a wider / higher beach affording greater protection to the cliff toe and the defences at the back of the beach as well as an amenity / recreation benefit. Currently there is a beach in front of Naish Cliff and the placement of material here in sufficient quantities is likely to enhance the level of protection to the cliff. Further to the east, there is less beach material and due to the position of the cliff toe / shoreline / coastal defences relative to the tide levels it is likely more material would need to be placed here to create a beach of substantial size.
- Rock groynes: as part of this measure the existing rock groynes in this location could be upgraded in the future to account for changing conditions due to sea level rise / climate change. The existing rock material could be reused to reduce the cost and the structures could also be supplemented with additional rock material if required. Improving the groynes may be important in retaining any additional beach material that is placed here through renourishment. Numerical modelling would be beneficial to investigate the appropriate rock groyne and beach nourishment design.
- Rock revetment / rock armour: the main defence at the toe of the cliffs at Barton on Sea is a rock revetment. As part of the Improve option it may be necessary to upgrade this revetment by raising it to ensure it continues to protect the toe of the cliff with sea level rise. The rock revetment measure could be used separately or in combination with beach nourishment in this location. To the west at Naish Cliff, the rock revetment could be extended to protect the toe of the currently undefended cliffs, although it is unlikely that this will be an economically justifiable solution. Rock at the base of the cliffs may also provide additional toe weighting to reduce the risk of land sliding.
- Cliff stabilisation and drainage: due to the complex nature of the cliffs in this location, any toe defences would need to be used in combination with cliff slope stabilisation and drainage measures in order to minimise the rate of cliff recession. There is an extensive network of drainage already in place in the eastern part of Barton on Sea but the legacy system to the west has failed over time. Replacements to the failed sections would be required as part of the Improve option.

Managed Realignment Option

The intent of the Managed Realignment option would be to transition the coastline into a new position that is more sustainable with rising sea levels. The short list of Local Measures for the Managed Realignment option is very similar to the Improve option and includes beach nourishment, a rock revetment / armour, rock groynes and cliff slope stabilisation and drainage. This is the case as these measures are considered to be most appropriate for this environment and location to control the rate of cliff erosion and can be implemented in different ways, depending on the intention of the Strategic option. Justification for including / excluding measures from the long list is the same as the Improve option. Further details are provided below:

- Beach nourishment: this measure would involve the addition of beach material to this location, most likely at Naish Cliff to help control rates of cliff erosion. Without the implementation of cliff slope stabilisation measures at Naish Cliff there would still be some erosion that would occur, albeit in a more controlled manner than without any interventions (i.e. no beach nourishment).
- Rock groynes: with the Managed Realignment option in order to maintain toe protection the rock groynes may require upgrades to retain material on the beach in the future.
- Rock revetment / rock armour: it is likely that the existing rock revetment at the base of the cliffs may need to be upgraded in parts of this unit to defend against the impacts of sea level rise in this location.
- Cliff stabilisation and drainage: in order to control the rate of cliff erosion the existing cliff drainage system may need upgrading or replacing when it reaches the end of its service life.

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.

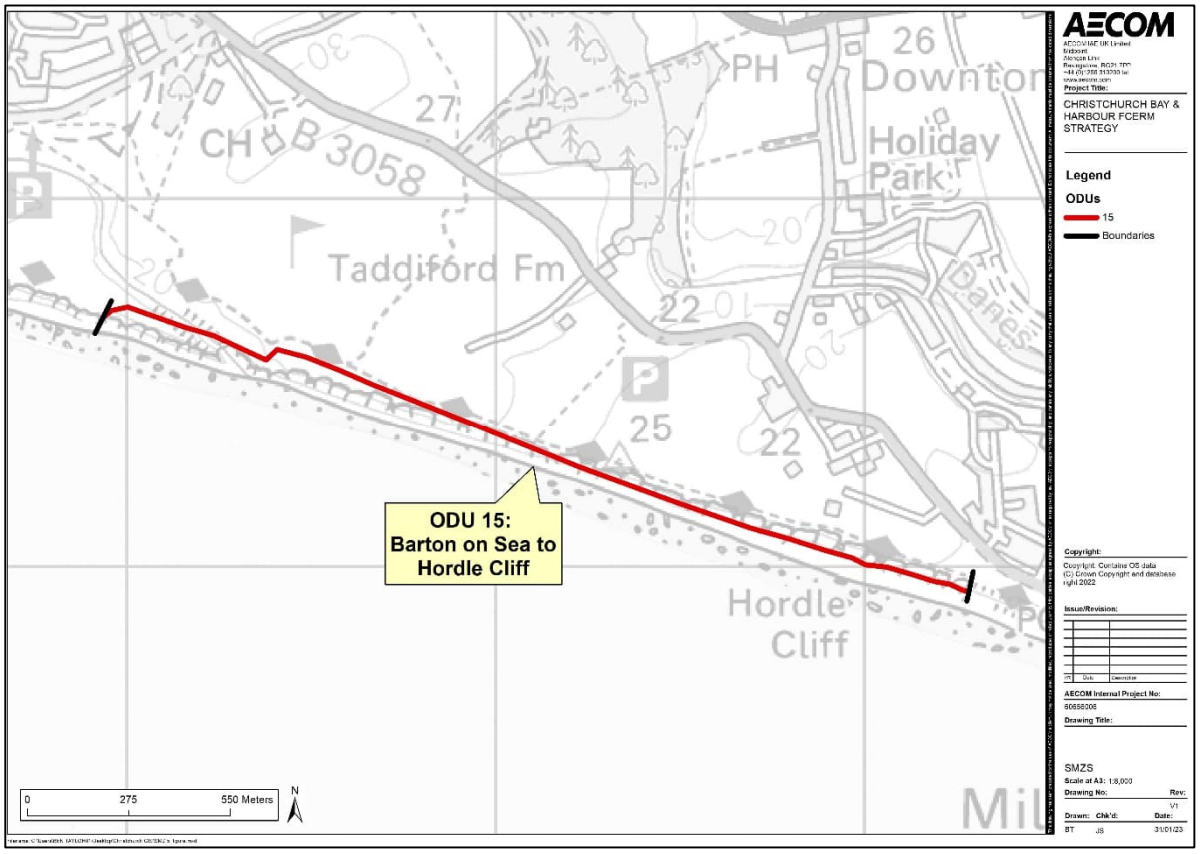

Figure 7-1: Location of ODUs within SMZ 5

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 (6 properties 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 over £0.4million. 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 Strategic Options

Given the low level of risk to properties in this unit, a smaller selection of Strategic options have been developed for this SMZ / ODU. It is highly likely that a Do Nothing / Do Minimum Strategic option is selected as the preferred way forward for this area, but options such as Maintain and Improve have also been included in the appraisal for consideration. It is unlikely that the Improve option will be economically viable and therefore an option to Do Nothing / Do Minimum then Improve later on in the appraisal period has also been included. The economic appraisal will consider the location / timings of potential defence improvements.

The Strategic options for SMZ 5 are outlined below:

Do Nothing (baseline for appraisal)

The Do Nothing scenario is a 'walk away' scenario whereby further maintenance of existing defences and / or 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 benefit and would be to reduce the risk of the structure failing.

Maintain

The Maintain 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. 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.

Improve (erosion risk)

The Improve Strategic option would aim to reduce the amount of coastal erosion / cliff top recession in this location. Given the small number of properties at risk in this location, it is acknowledged that costly hard coastal defences and cliff stabilisation / drainage measures are not likely to be feasible as part of this approach. Efforts to reduce erosion of the cliff would be based on increasing the size of the beach via beach nourishment and recycling, to improve the level of toe protection, whilst also potentially providing a benefit to adjacent areas, such as Milford on Sea. Looking to reduce the rate of erosion of the cliff would not be in line with the adopted SMP policy.

Do Nothing / Do Minimum then Improve

This Strategic option would involve initially Doing Nothing or Doing Minimum (likely for the first two epochs), before transitioning into the Improve approach (as per the Improve Strategic option above). The main benefit of this approach is that it provides a period of time over which to evaluate how the beach and cliff line is responding to sea level rise before then looking to reduce the rate of erosion.

Adaptation / Resilience

The Adaptation / Resilience Strategic option is based on adapting to the risks caused by coastal erosion through planning policies and community level resilience measures. This option would not involve any beach management activities and therefore the cliff line would be left to evolve naturally (similar to the Do Nothing option).

7.3 Short List of Local Measures

Table 7-1 summarises the results of the multicriteria appraisal and presents the short list of Local Measures for each unit that could be used to implement the broader Strategic options. For each Strategic option, the preferred solution recommended by the Strategy will likely involve a combination of the short list measures but may not include all the different measures (i.e. some may be excluded from the preferred solution). Further appraisal work in the next stage of the Strategy development will consider how the measures can be combined at the local scale to achieve the intent of each Strategic option.

The commentary following Table 7-1 provides a high level summary of the short list measures. Details of the multicriteria appraisal scoring and justification for discounting the long list measures that did not make it onto the short list can be found in the multicriteria appraisal shown in Appendix A.

Table 7-1: Summary of short list of Local Measures for SMZ 5

Strategic option(s)	Strategic option intent	ODU(s)	Short List of Local Measures
Do Nothing	No active intervention.	15 – Barton on Sea to Hordle Cliff	Health and safety works as cliff erodes
Do Minimum	Small scale / ad-hoc maintenance to rock structure at decommissioned outfall.	15 – Barton on Sea to Hordle Cliff	Patch and repair, health and safety works as cliff erodes
Maintain	Maintain beach levels to help control rates of cliff erosion.	15 – Barton on Sea to Hordle Cliff	Beach recycling.
Improve (Various approaches with respect to timings)	Aim to reduce cliff top recession by increasing beach volumes	15 – Barton on Sea to Hordle Cliff	Beach recycling, Beach nourishment
Adaptation / Resilience	Adapt to risks through planning policy and resilience measures.	15 – Barton on Sea to Hordle Cliff	Community level resilience measures.

7.3.1 ODU 15 – Barton on Sea to Hordle

The short list of measures for the Maintain and Improve options in this unit are beach recycling and beach nourishment. Further details are provided below:

- Beach recycling: this measure would involve moving beach material from another part of the Strategy frontage to this location, helping to provide a wider / higher beach to protect the cliff toe. Compared to the beach nourishment measure, beach recycling would involve moving smaller amounts of material to this location.
- Beach nourishment: this measure would involve the addition of a greater amount of beach material to this location, helping to provide a wider / higher beach affording greater protection to the cliff toe. Beach nourishment would likely involve sourcing material from outside of the existing Strategy frontage or from local offshore sources. The addition of a greater amount of beach material in this location is likely to also benefit downdrift areas, such as Milford on Sea.

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.

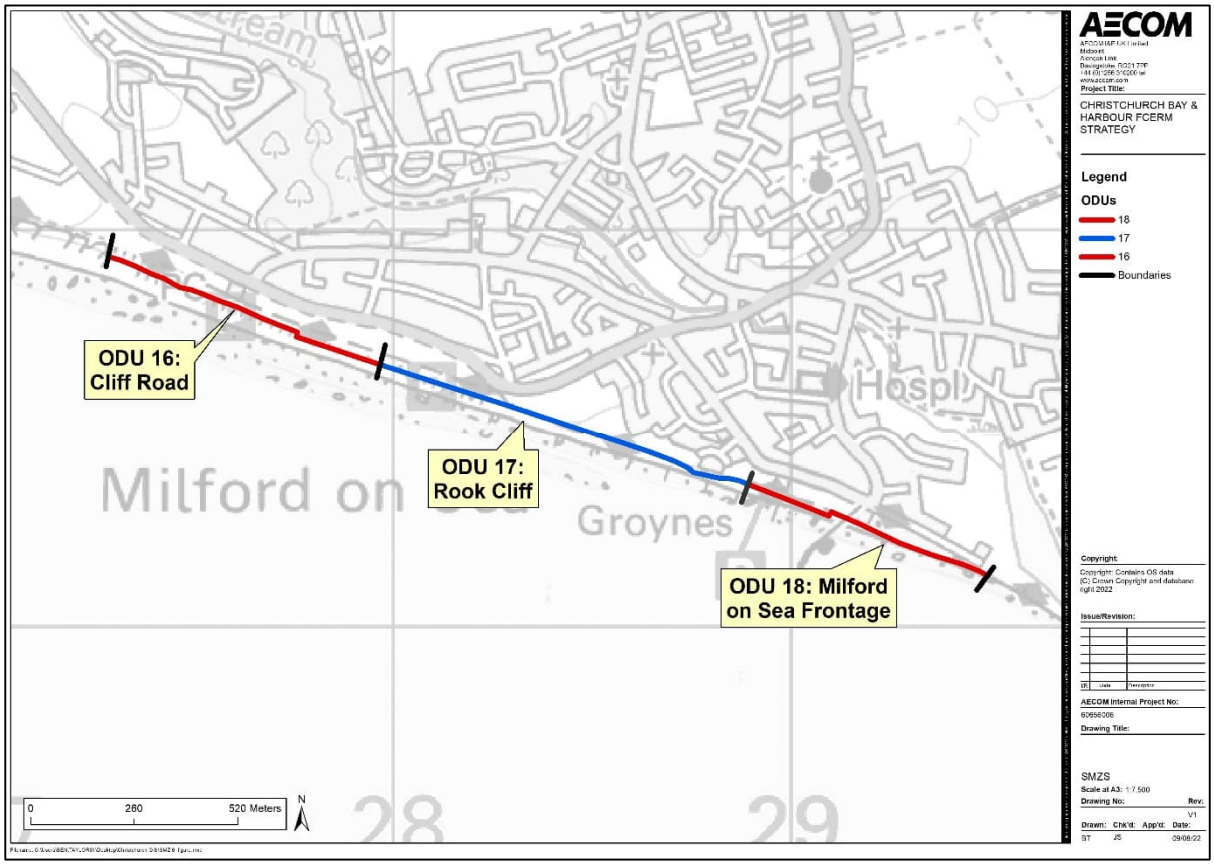

Figure 8-1: Location of ODUs within SMZ 6

SMZ 6 is an exposed, open coast environment. Hurst Spit is located immediately to the east of the zone. At the root 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 are collaborating on the development of options for the spit to ensure a joined up and cohesive approach is recommended.

In SMZ 6 the topography gets lower 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.

There are a variety of defences in SMZ 6 including concrete seawalls, a rock revetment 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 stabilise the 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.

To develop a coherent approach, the management of SMZ 6 needs to consider the links between each ODU in the zone, considering the whole frontage of Hordle Cliff, Rook Cliff, the seafront at Milford on Sea and the defence at the root of Hurst Spit.

The SMP policy in SMZ 6 varies by location. In ODU 16 at Hordle Cliff, the policy is for Managed Realignment in the short, medium and long term. The intent of the policy in this area is to allow the cliff to initially erode in this location into a more sustainable long term position, but to maintain the key road and property. The SMP refresh in 2020 recommended that a detailed study was undertaken to re-examine the SMP approach here and clarify both the policy and implementation.

In ODU 17 at Rook Cliff, the SMP policy is to Hold the Line in the short, medium and long term. However the SMP refresh, considering the serious damage to this frontage during the 2019/20 winter storms recommended investigating options for future management here and pending this investigation potentially revisit the SMP policy.

In ODU 18, the SMP policy is to Hold the Line in the short term, but then transition into Managed Realignment in the medium and long term. The SMP referred to investigating the potential to create a continuous beach between Rook Cliff and Hurst Spit as part of this approach. The SMP refresh did not recommend revisiting / amending this policy approach in this location.

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. 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.

8.2 Strategic Options

A variety of Strategic options have been developed for SMZ 6, primarily focussed on managing the coastline position to control the erosion risk, but also how to manage the localised flood risk in the east part of the zone. The Strategic options are based on variations of the Maintain, Improve and Managed Realignment philosophies.

The intent of the Improve Strategic option is to hold the position of the coastline in this zone, aiming to minimise erosion by upgrading the defences. However, in the west part of this zone, in ODUs 16 and 17, due to the nature of the cliffs in this location it may not be possible to completely stop cliff top recession. The erosion of the cliffs is driven by both erosion at the toe of the defences and also groundwater and precipitation factors that impact the slope stability (although the groundwater and precipitation factors are less influential than at Barton on Sea). With projected sea level rise, the Improve Strategic option would involve upgrading the toe defences and may also require cliff stabilisation and drainage measures to manage both of the drivers of cliff recession.

Aiming to maintain the position of the coastline would likely require extensive investment and the economic justification for this approach may be poor. In addition, as evidenced by the recent failure of the seawall at Westover, the existing defences are already under pressure in this location and even with upgraded defences, the sustainability of trying to hold the existing position of the coastline in SMZ 6 with new linear defences is questionable. A large beach recharge in this location, with the addition of more substantial beach control structures could be a potential solution, and this could also benefit Hurst Spit to the east.

A Managed Realignment Strategic option has also been included in the appraisal for this area given the potential limitations of trying to hold the coastline in its current position. The Managed Realignment Strategic option would focus on transitioning the coastline into a more sustainable long term position, creating a wider space for the beach to adjust to sea level rise. There are different ways in which this could be done that will be explored in detail during the next stage of the appraisal process. It is possible that there could be some loss of property with the Managed Realignment option.

The Shoreline management Plan previously identified ways in which Managed Realignment could be achieved. One potential method would be to let the coastline erode in a control manner between a series of strong points along the frontage. Another approach may be to encourage the foreshore to move seawards through the use of nearshore structures, such as breakwaters. Making space for a larger beach in this area would reduce the

pressure on the existing hard defences and may also provide a more continuous route for sediment transport through to Hurst Spit.

The Strategic options for SMZ 6 are outlined below:

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. The Do Nothing scenario is not likely to be a viable way forward for the developed parts of this unit, 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. With the Do Nothing scenario, defences would fail when they reach the end of their service life, and with projected sea level rise, the coastline in SMZ 6 would be expected to erode. Flood risk in the east part of the unit would increase over time as sea levels rise. The Do Nothing option may include H&S measures to make safe an FCERM asset.

Do Minimum

The Do Minimum Strategic 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 / remaining drainage system 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 small amount (i.e. several years maximum). 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 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 on a larger scale than the Do Minimum option. This would typically be in the form of capital refurbishments to existing defences and drainage / 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.

Cliff top recession would still occur with this option but to a lesser degree than the Do Nothing / Do Minimum approaches. Due to sea level rise, the standard of protection (SoP) provided the defences would reduce over time and the rate of cliff erosion and flooding may increase over time.

Improve

The Improve Strategic option would involve upgrading the existing defences and / or constructing new defences along the frontage to reduce the erosion risk through to the end of the appraisal period. The intent of this Strategic option would be to minimise the amount of coastal erosion / cliff top recession, although it is recognised that it is unlikely that the erosion will be able to be completely stopped. The Improve option would likely be achieved by upgrading the existing or constructing new toe defences and may also require cliff slope stabilisation measures. This option may also include secondary / localised flood defences to mitigate the local flood risk at the east end of the zone.

Maintain then Improve

This Strategic option would involve initially maintaining the defences along the frontage (as per the Maintain Strategic option), before transitioning into the Improve approach (as per the Improve Strategic option above). The main benefit of this approach is that it may provide a more economically viable way of upgrading the defences in the area as costly defence upgrades are delayed until the future when benefits would be closer to being realised.

Managed Realignment

The Managed Realignment option would involve transitioning the coastline to a more sustainable position over time, creating a wider space for the beach to adjust to sea level rise. Different approaches are available for implementing this approach that will be investigated in more detail during subsequent appraisal. One approach

could involve letting the coastline erode in a controlled manner between a series of strong points along the frontage. Another approach may be to encourage the foreshore to move seawards through the use of nearshore structures, such as breakwaters. This option may include secondary / localised flood defences to mitigate the local flood risk at the east end of the zone. The Managed Realignment option may lead to some loss of property in this location.

Maintain then Managed Realignment

This Strategic option would involve initially maintaining the defences in SMZ 6 (as per the Maintain Strategic option above), before transitioning into the Managed Realignment approach (as per the Managed Realignment options above). The main benefit of this option is that it provides a period of time over which to adjust and transition into the Managed Realignment approach rather than implementing this from the outset. The time period over which defences would be maintained will be considered in more detail as part of the economic assessment to be undertaken as part of the detailed short list appraisal during stage 6 of the appraisal.

Adaptation / Resilience

The Adaptation / Resilience Strategic option is based on adapting to the risks caused by coastal erosion through planning policies, community level resilience measures and property level resilience measures. This option would not involve the construction of the any new linear defences or beach management activities and therefore the coastline and cliffs line would be left to evolve naturally (similar to the Do Nothing option). Elements of this option, such as community level resilience could also be applied to the other Strategic options, for example, to Managed Realignment or Maintain.

8.3 Short List of Local Measures

Table 8-1 summarises the results of the multicriteria appraisal and presents the short list of Local Measures for each unit that could be used to implement the broader Strategic options. For each Strategic option, the preferred solution recommended by the Strategy will likely involve a combination of the short list measures but may not include all the different measures (i.e. some may be excluded from the preferred solution). Further appraisal work in the next stage of the Strategy development will consider how the measures can be combined at the local scale to achieve the intent of each Strategic option.

The commentary following Table 8-1 provides a high level summary of the short list measures. Details of the multicriteria appraisal scoring and justification for discounting the long list measures that did not make it onto the short list can be found in the multicriteria appraisal shown in Appendix A.

Table 8-1: Summary of short list of Local Measures for SMZ 6

Strategic option(s)	Strategic option intent	ODU(s)	Short List of Local Measures
Do Nothing	No active intervention.	16-18	Small scale works to make safe failing defences (health and safety)
Do Minimum	Small scale / ad-hoc defence maintenance.	16-18	Patch and repair.
Maintain	Maintain beach levels to help control rates of cliff erosion.	16-18	Capital refurbishment, Beach recycling.
Improve (Various approaches with respect to timings)	Aim to minimise cliff top recession, although acknowledge that some may still occur due to complex cliffs.	16 – Cliff Road	Beach nourishment, Timber groynes, Rock groynes, Seawall, Rock revetment, Cliff slope stabilisation and drainage.
	Aim to minimise cliff top recession, although acknowledge that some may still occur due to complex cliff. Provide localised flood defences as required.	17 – Rook Cliff	Beach nourishment, Timber groynes, Rock groynes, Seawall, Rock revetment, Cliff slope stabilisation and drainage
	Aim to minimise coastal erosion and provide localised flood defences as required.	18 – Milford on Sea frontage	Beach nourishment, Timber groynes, Rock groynes, Seawall, Concrete Revetment, Rock revetment, Setback floodwall (local flood risk), Setback embankment (local flood risk), Crest raising (local flood risk), Localised land raising (local flood risk).
Managed Realignment (Various approaches to this option and timings)	Control rate of cliff erosion, transitioning the coastline into a more sustainable long term position.	16 – Cliff Road	Beach nourishment, Beach recycling, Rock revetment, Cliff slope stabilisation and drainage.
	Control rate of cliff erosion, transitioning the coastline into a more sustainable long term position.	17 – Rook Cliff	Beach nourishment, Timber groynes, Rock groynes, Rock revetment, Cliff slope stabilisation and drainage, Offshore breakwater, Offshore reef,
	Control rate of cliff erosion, transitioning the coastline into a more sustainable long term position.	18 – Milford on Sea frontage	Beach nourishment, Timber groynes, Rock groynes, Seawall, Concrete Revetment, Rock revetment, Offshore breakwater, Offshore reef, Setback floodwall (local flood risk), Setback embankment (local flood risk), Crest raising (local flood risk).
Adaptation / Resilience	Adapt to risks through planning policy and resilience measures.	16-18	Community level resilience measures, Property level resilience measures.

8.3.1 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 / base of the cliff in this unit. The cliffs and beach are used extensively for recreation and amenity. In the past a 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 2014 winter storms. 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 2072-2122 (when 190 properties are expected to be at risk from coastal erosion). Over the next 100 years the total PV damages for this ODU are estimated to be just over £5.2million.

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 SMP refresh (2020) recommended that a detailed study was undertaken to re-examine and test the SMP policy in this location.

Improve Strategic Option

The intent of the Improve Strategic option in this unit would be to minimise the amount of cliff erosion along the frontage. The short list of measures for the Improve Strategic option includes beach nourishment, timber groynes, rock groynes, a rock revetment, a seawall and cliff slope stabilisation and drainage. Further details are provided below:

- Beach nourishment: this measure would involve the addition of beach material to this location, helping to provide a wider / higher beach affording greater protection to the cliff toe and the beach huts at the back of the beach as well as an amenity / recreation benefit. Additional material here may need to be retained with beach control structures such as groynes.
- Rock / timber groynes: construction of groynes here may be important in retaining any additional beach material that is placed here through renourishment. Numerical modelling would be beneficial to investigate the appropriate groyne and beach nourishment design.
- Rock revetment / rock armour: an alternative to building up the beach through beach nourishment may be to construct a rock structure at the toe of the cliff. This may require removal / moving of the beach huts in this location but may provide a more robust long term defence.
- Seawall: a seawall could be constructed here to provide protection to the cliff toe. This could be constructed at the toe of the cliff and designed to incorporate the beach huts into the structure or could be constructed further down the beach (similar to the wall in the east part of this unit). A wall at the toe of the structure is likely to be robust but very costly.
- Cliff stabilisation and drainage: due to the complex nature of the cliffs in this location, cliff slope stabilisation and drainage measures may be needed in order to minimise the rate of cliff recession.

Managed Realignment Strategic Option

The intent of the Managed Realignment Strategic option would be to transition the coastline into a more sustainable long term position. In this location this may involve allowing the cliffs to erode and utilising existing strong points or creating new strong points to control this process. The short list of measures for this option includes beach nourishment, beach recycling, a rock revetment and cliff slope stabilisation and drainage. Further details are provided below:

- Beach nourishment / recycling: these measures would involve the addition of beach material to this location and could be used to help control rates of cliff erosion as required. It is likely that less material would be placed as part of the Managed Realignment option compared to the Improve option and therefore it may be feasible to utilise beach recycling (taking material from another part of the frontage) rather than nourishment, but this will depend on volumes of material required.
- Rock revetment / rock armour: there may be a need to construct a new strong point to help manage the rate of erosion and provide protection to the B3058 main road. A rock revetment / rock strong point is likely to be lower cost than a concrete or steel structure and would be robust.

- Cliff stabilisation and drainage: due to the complex nature of the cliffs in this location, cliff slope stabilisation and drainage measures may be needed in addition to toe protection.

8.3.2 ODU 17 – Rook Cliff

This ODU 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, 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 in epoch 3 between 2072-2122 over 300 properties are expected to be at risk. Over the next 100 years the total PV damages for this area are estimated to be over £13.2million.

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.

Improve Strategic Option

The intent of the Improve Strategic option in this unit would be to minimise the amount of cliff erosion along the frontage. The short list of measures for the Improve Strategic option includes beach nourishment, timber groynes, rock groynes, seawall, rock revetment and cliff slope stabilisation and drainage. Further details are provided below:

- Beach nourishment: this measure would involve the addition of beach material to this location, helping to provide a wider / higher beach affording greater protection to the cliff toe as well as an amenity / recreation benefit. Given the existing rock revetment at the base of the cliff in this location and the lack of existing beach, it is uncertain how well material would be retained at this location. It is likely that a large volume of material would be needed, in addition to new beach control structures.
- Rock / timber groynes: construction of groynes here may be important in retaining any additional beach material that is placed here through renourishment. Given the uncertainty on the retention of beach material in this location with the existing defence alignment (especially in the future), numerical modelling would certainly be required to investigate the appropriate groyne and beach nourishment design.
- Seawall: currently there is a seawall at the base of the cliff with extensive rock armour / a rock revetment in front. There is however a gap in the wall immediately to the south of Needles Point Road due to the failure of the existing seawall. As part of the Improve option the seawall could be rebuilt to fill this gap and provide a robust defence to the area behind.
- Rock revetment: currently there is a rock revetment (in front of the seawall) along the length of this frontage. It generally provides a robust defence to the cliff toe but with anticipated sea level rise, it is likely that the rock defence would need to be upgraded in the future.
- Cliff stabilisation and drainage: due to the complex nature of the cliffs in this location, cliff slope stabilisation and drainage measures may be needed in order to minimise the rate of cliff recession.

Managed Realignment Strategic Option

The intent of the Managed Realignment Strategic option would be to transition the coastline into a more sustainable long term position. In this location this may involve allowing the cliffs to erode and utilising existing strong points to control this process. Alternatively it could involve encouraging the foreshore to advance seawards through the use of nearshore structures such as breakwaters. The short list of measures includes beach nourishment, timber groynes, rock groynes, rock revetment, cliff slope stabilisation and drainage, offshore breakwater / offshore reef. Further details are provided below:

- Beach nourishment: this measure would involve the addition of beach material to this location and could be used to help control rates of cliff erosion as required. This measure would potentially be most appropriate with the Managed Realignment approach looking to advance the foreshore seaward and could be supplemented with the construction of nearshore structures.

- Offshore breakwater / reef: these structures could be constructed offshore of the existing coastline (although in a nearshore location) and would provide shelter from waves, encouraging the accumulation of beach material. These structures have generally been ruled out of the appraisal in other parts of the Strategy frontage due to the typically high cost and negative environmental impacts (large defence footprint in SAC habitat). However, in this location, these measures may be appropriate if the objective of the Managed Realignment approach is to advance the foreshore seawards.
- Timber / rock groynes: groynes would not be compatible with a Managed Realignment approach that looks to use offshore / nearshore structures but would be appropriate to use with a Managed Realignment approach that looks to realign the shoreline landward in this location, helping to retain material and control the rate of erosion.
- Rock revetment: it may be necessary to maintain / upgrade the strong point at Rook Cliff as part of the Managed Realignment option. Currently the defence in this location comprises a rock revetment and therefore this measure is included in the shortlist.
- Cliff stabilisation and drainage: due to the complex nature of the cliffs in this location, cliff slope stabilisation and drainage measures may be needed in order to minimise the rate of cliff recession.

8.3.3 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 a concrete seawall. 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 embedded into the seawall / promenade at the western end of this frontage.

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 in the Keyhaven direction. Recent flooding occurred in the Valentine's storm of 2014. Over the next 100 years the total PV damages from erosion alone are estimated to be over £9million, with 58 properties expected to be at risk by 2072 and a further 79 properties by 2122.

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. The SMP recommended considering options for developing a continuous beach between Rook Cliff and Hurst Spit.

Improve Strategic Option

The intent of the Improve Strategic option in this unit would be to minimise the amount of coastline erosion along the frontage. It may also be necessary to construct local flood defences to mitigate the risk of flooding from wave overtopping and also from tidal inundation from the Sturt Pond / Keyhaven direction (behind Hurst Spit). The short list of measures for the Improve Strategic option includes beach nourishment, timber groynes, rock groynes, seawall, concrete revetment, rock revetment, setback floodwall (local flood risk), setback embankment (local flood risk) and crest raising (local flood risk). Further details are provided below:

- Beach nourishment: this measure would involve the addition of beach material to this location, helping to provide a wider / higher beach affording greater protection to the existing defences at the back of the beach as well as providing an amenity / recreation benefit.
- Rock / timber groynes: there are currently timber and rock groynes in this unit but these will need to be updated / reconfigured in the future if they are to retain additional beach material in this location.
- Seawall / concrete revetment: currently the defences at the top of the beach comprise a seawall / concrete revetment and it is likely that upgrades to these structures would be required in the future to adapt to higher sea levels and provide a desired standard of protection. When upgrading the defences, a vertical seawall may be preferable as it would have a smaller footprint than a sloped structure and would not take away the valuable beach space that is used for amenity / recreation. However, this would depend on beach levels in the future, as for the toe of the existing concrete revetment is often partially buried here and is still used by the public as an accessible space / place to sit.

- Rock revetment: likely to be a lower cost solution than a seawall / concrete revetment but would take up valuable space from the beach and therefore would not support the amenity / recreation in the area as well as the existing defences.
- Setback floodwall / setback embankment / crest raising / localised land raising (local flood risk measures): each of these measures could be constructed in the east part of the unit in the future to mitigate the flood risk caused by wave overtopping. Potential alignments will be investigated during the next stage of the appraisal process, including a setback structure adjacent to Hurst Road.

Managed Realignment Strategic Option

The intent of the Managed Realignment Strategic option would be to transition the coastline into a more sustainable long term position. In this location this may involve allowing the coastline to erode and utilising existing strong points to control this process. Alternatively it could involve encouraging the foreshore to advance seawards through the use of nearshore structures such as breakwaters. It may also be necessary to construct local flood defences to mitigate the risk of flooding from wave overtopping and also from tidal inundation from the Sturt Pond / Keyhaven direction (behind Hurst Spit). The short list of measures includes beach nourishment, timber groynes, rock groynes, seawall, rock revetment, concrete revetment, offshore breakwater, offshore reef, setback floodwall (local flood risk), setback embankment (local flood risk) and crest raising (local flood risk). Further details are provided below:

- Beach nourishment: this measure would involve the addition of beach material to this location and could be used to help control beach levels and the level of protection provided to the defences at the back of the beach. This measure would potentially be most appropriate with a Managed Realignment approach looking to advance the foreshore seaward and could be supplemented with the construction of nearshore structures.
- Offshore breakwater / reef: these structures would be constructed offshore of the existing coastline (although in a nearshore location) and would provide shelter from waves, encouraging the accumulation of beach material. These structures have generally been ruled out of the appraisal in other parts of the Strategy frontage due to the typically high cost and negative environmental impacts (large defence footprint in SAC habitat). However, in this location, these measures may be appropriate if the objective of the Managed Realignment approach is to advance the foreshore seawards.
- Timber / rock groynes: construction of groynes here would be important in retaining any beach material in this location. Groynes would not be compatible with a Managed Realignment approach that looks to use offshore / nearshore structures but would be appropriate to use with a Managed Realignment approach that looks to realign the shoreline landward in this location, helping to retain material and control the rate of erosion.
- Seawall / concrete revetment: these structures could be used in the future to consolidate the new coastline in a new position, or alternatively to upgrade the existing seawall / concrete revetment at the top of the beach as the structures reach the end of their service life.
- Rock revetment: one possible approach for the Managed Realignment option in this location is to let the coastline transition landwards between the existing strong points. In this scenario a rock revetment could be used to consolidate the shoreline in a new position in the future.
- Setback floodwall / setback embankment / crest raising (local flood risk measures): each of these measures could be constructed in the east part of the unit in the future to mitigate the flood risk caused by wave overtopping. Potential alignments will be investigated during the next stage of the appraisal process.

8.4 Interaction with Hurst Spit to Lymington Strategy

As mentioned in the previous sections, the Hurst Spit to Lymington Strategy (HS2L), is currently being developed for the adjacent coastline between Hurst Spit and Lymington, immediately to the east of the Strategy frontage. The boundary between these two strategies is the west end of the Hurst Spit revetment. The HS2L strategy is in a similar stage of development as this Strategy and has also defined the short list management options. Given the importance of Hurst Spit to the development of both Strategies, the teams for both projects are working collaboratively to ensure that a coherent and sustainable FCERM management approach is developed for Hurst Spit.

The HS2L short list options for Hurst Spit are:

- '**Hold the Form – Maintain'** which would use shingle recharge and recycling to the lee face of the spit to maintain the current shape and profile of the spit. The spit will rollback over time but the recharge / recycling will maintain the current shape and profile of the spit. There is potential to include groynes / breakwaters to reduce rates of material loss.
- **'Hold the Form – Sustain'** would involve regular shingle recharge and recycling to sustain the current level of protection. This would include increased volumes of recharge over time to raise the height of the spit to keep pace with climate change. There is potential for erosion of the seaward face of the spit, whilst building the spit on the lee side and potential to include groynes / breakwaters to reduce rates of material loss.
- **'Hold the Form – Improve'** would involve an initial large shingle recharge to decrease the likelihood of overwash, then interim recharge operations and regular recycling for the next 100 years. There is potential for erosion of the seaward face of the spit and also potential to include groynes / breakwaters to reduce rates of material loss.
- **'Managed Rollback'** would involve reduced level of management of the spit, allowing coastal processes to redistribute material, with some smaller ad-hoc shingle recharge operations to maintain a continuous barrier. Coastal processes would redistribute material. The spit would over-wash, rollback, lower and flatten over time.

It is understood that the revetment at the root of the Spit would be held in place with each of these HS2L options. Based on this principle the compatibility of the Strategic options and short list of Local Measures is discussed below:

- The Improve Strategic option – is likely to be compatible with the HS2L options as it would involve holding the position of the defences to the west of the breakwater and therefore the existing defence line along Milford on Sea through to the Hurst Spit revetment would remain unchanged. It is however recognised that the defences would come under increasing pressure over time due to sea level rise and increasingly greater expenditure would be required to hold the position of the defences over time. The short list Local Measures for the frontline defences in ODU 18 include beach nourishment, groynes, a seawall, concrete revetment and each of these measures would be compatible and would not be expected to negatively impact the Hurst Spit revetment.
- The Managed Realignment Strategic option(s) – different approaches to the Managed Realignment option will be investigated during the next stage of the appraisal. Initial ideas for the option include letting the coastline erode in a control manner between a series of strong points along the frontage or encouraging the foreshore to move seawards through the use of nearshore structures, such as breakwaters.
    - In a situation where the coastline erodes in a controlled manner in ODU 18 and the revetment is held in its current position; the realigned coastline to the west of the revetment would need to be controlled such that erosion does not outflank the western end of the revetment and lead to a disconnect in the shoreline position.
    - In a situation where the foreshore is moved seaward it would be the intention of this approach to provide a more continuous beach / sediment transport pathway onto Hurst Spit and therefore the spit and area in front of the revetment may benefit from increased beach levels.
    - The short list of Local Measures for the Managed Realignment Strategic options includes beach nourishment, groynes, a seawall, a concrete revetment, a rock revetment and an offshore breakwater / reef. Each of these measures would likely be compatible and would not be expected to negatively impact the Hurst Spit revetment if implemented in line with the above points.
- The Do Nothing and Do Minimum Strategic options would not be compatible with the HS2L options because they would lead to excessive / uncontrolled erosion to the west of the Hurst Spit revetment. This would risk outflanking the revetment and cause a disconnect in the shoreline position, threatening the breach the root of the spit.

9. Frontage-wide Options

9.1 Sand / Shingle Engine

A frontage-wide option of a ‘sand / shingle engine’ was previously included in the long list and has been taken forward to the short list for further consideration.

A sand / shingle engine option would involve undertaking a larger scale beach nourishment or repeated nourishments at a location updrift of the intended benefit area. The intention for this option would be over the course of several years for coastal processes to redistribute the nourished material along the shoreline in the downdrift direction, providing FCERM benefits across a larger area.

Whilst the sand / shingle engine has been taken forward onto the short list, the initial appraisal of the option has raised the following points for further consideration:

- In locations elsewhere where this approach has been successful the type of material used has generally been sand / fine material.
- The material that may be available locally for nourishment at Christchurch Bay is likely to be much coarser and would generally be more stable and take longer to redistribute as intended.
- Christchurch Bay has a relatively small tidal range compared to other sites nearby and therefore the tidal currents may be comparatively weak (although there are likely to be local variations).
- It is likely that any material placed would therefore rely on wave action to redistribute material and therefore depth at which the material is placed would be important.
- Due to the numerous beach control structures along the Christchurch Bay frontage (groynes and other structures), finding an appropriate location to place a large amount of material may be challenging. The beach at Hordle Cliff may be a potential location for placement.
- There may not be significant cost advantages of this option compared to more targeted placement of nourishment material if a local source of material is available.

It is difficult to determine at this stage whether the concept of a sand / shingle engine at Christchurch Bay would be preferable to a more targeted beach nourishment at specific locations within the bay. Further consideration on costs and potential placement approaches will be undertaken at the next stage of appraisal.

During the next stage of appraisal it will also be important to consider the option within the context of the other Strategic options and short list measures in each SMZ. Some Local Measures are likely to align well with the sand / shingle engine approach, whereas others may not. For example, the success of the sand / shingle engine concept in the eastern part of the frontage between Becton Bunny and Milford on Sea and Hurst Spit would be influenced by the approach taken to hold or realign the coastline at Milford on Sea in the future. If the position of the coastline at Milford on Sea is held in position with the Improve option, then the defences at Rook Cliff and the White House may create partial barriers to sediment transport to the east of these locations. Whereas, if a continuous beach is created at Milford on Sea as part of a Managed Realignment approach (moving foreshore seawards) then this may provide a potential uninterrupted sediment transport pathway all the way from Becton Bunny through to Hurst Spit.

10. Summary and Next Steps

In summary:

- This report provides an overview of the Short List of Strategic options and Local Measures in each location along the Strategy frontage.
- It includes a summary of the multicriteria appraisal that has been undertaken to determine the draft short list of measures in each location.
- In most locations, typically 3-4 Local Measures are included in the short list for each Strategic option. However, in some locations such as at Milford on Sea where the risks facing the coastline are very complex, many more Local Measures have been included in the Short list.

The next steps of the appraisal process are:

- Present the draft short list of Strategic options and Local Measures to key stakeholders and the local community during round 4 of the stakeholder engagement activities.
- Obtain feedback from key stakeholders and the community on the draft short list and make updates as required.
- Further develop the short list of Strategic options and Local Measures and undertake a detailed economic, technical, social and environmental appraisal to identify the leading approach in each location.
- There may be two leading approaches in each location, an FCERM-AG based approach and an aspirational approach that would be subject to achieving more funding.

Appendix A – Multicriteria Appraisal Scoring

This section outlines the scoring justification for discounting long list measures from the short list for the key Strategic options in each ODU. A screenshot of the Multicriteria Appraisal scoring is also provided for reference.

ODU 1 – Hengistbury Head East

Sustain / Improve

Based on the scores of the multicriteria appraisal, several long list measures have been discounted and are not included in the short list in ODU 1 for the Sustain / Improve Strategic option:

- Concrete seawall / concrete revetment / sheet piling – the rock revetment is a direct alternative to these structures and was included in the short list. A rock revetment is likely to be lower cost and may also have a lower carbon impact.
- Timber groynes: rock groynes already present in this location. Reuse of rocks could save cost. When compared to rock structures, the timber groynes are likely to provide a less robust defence with higher maintenance requirements.
- Timber breastwork – the timber breastwork scored poorly in the natural environment category and the landscape / built environment category in the appraisal given the typical position of the defence further down the beach relative to its alternatives.
- Gabions – more robust defences favoured for the Sustain / Improve option given different intent of option.
- Offshore breakwater / reef – both of these measures score poorly in the cost, natural environment and technical complexity categories relative to other more feasible measures.

Managed Realignment

Based on the scores of the multicriteria appraisal, several long list measures have been discounted and are not included in the short list in ODU 1 for the Managed Realignment Strategic option:

- Beach nourishment – the intent of the Managed Realignment Strategic option is to allow the cliff to erode and exposure of the cliff toe to wave activity is part of this process. Beach nourishment would increase beach levels and does not align with the intent of this option. If additional beach material is required to manage the rate of cliff erosion, then beach recycling of existing material from nearby sources is likely to be provide a more cost effective approach.
- Concrete seawall / concrete revetment / sheet piling – these structures would provide a robust and long lasting protection to the cliff toe that does not align with the intent of this option.
- Gabions – excluded as they would require frequent maintenance as they would be expected to very quickly become unsafe and require remedial works. Rock is preferable for Managed Realignment option given it can be moved as required.
- Timber groynes: rock groynes already present in this location. Reuse of rocks could save cost. When compared to rock structures, the timber groynes are likely to provide a less robust defence with higher maintenance requirements.
- Timber breastwork - the timber breastwork scored poorly in the natural environment category and the landscape / built environment category in the appraisal given the typical position of the defence further down the beach relative to its alternatives.
- Offshore breakwater / reef – both measures are likely to lead to a build-up of beach material providing enhanced protection to the cliff toe. These measures therefore do not align with the intent of this option.

SMZ	ODU	Strategic Option	Long list	Flood / erosion risk	Cost	Design life	Natural environment	Landscape / built environment	Carbon impact	Technical complexity	Maintenance / Operation	Broader outcomes	Score	Shortlist
1	1 - Hengistbury Head East	Do Nothing	-	-	-	-	-	-	-	-	-	-	-	-
		Do Minimum	Patch and repair	-	-	-	-	-	-	-	-	-	-	YES
		Maintain	Capital refurbishment	▭	✓	▭	▭	▭	▭	✓	▭	✗	10	YES
			Beach recycling	▭	✓	✗	▭	✓	▭	✓	✗	▭	10	YES
		Sustain / Improve - minimise cliff recession	Beach management (nourishment and recycling)	▭	▭	▭	▭	✓	▭	▭	✗	▭	9	YES
			Timber groynes	▭	▭	▭	✗	▭	▭	▭	▭	▭	8	
			Rock groynes	▭	▭	✓	✗	▭	▭	▭	✓	▭	10	YES
			Crest raising	-	-	-	-	-	-	-	-	-	-	
			Seawall	▭	✗	✓	✗	✗	✗	▭	✓	▭	7	
			Concrete revetment	▭	✗	✓	✗	✗	✗	▭	✓	▭	7	
			Rock revetment	▭	▭	✓	✗	✗	▭	▭	✓	▭	9	YES
			Setback floodwall	-	-	-	-	-	-	-	-	-	-	
			Timber breastwork	▭	▭	▭	✗	✗	▭	▭	▭	▭	7	
			Gabions	▭	▭	▭	▭	✗	▭	▭	▭	▭	8	
			Sheet piling	▭	✗	✓	▭	✗	✗	▭	✓	▭	8	
			Armoured sand dunes	▭	▭	▭	▭	▭	▭	▭	▭	✓	10	YES
			Sand dune enhancements	▭	▭	✗	✓	✓	✓	✗	✗	✓	10	YES
			Cliff slope stabilisation / drainage	▭	✗	✓	▭	▭	▭	▭	✓	▭	10	YES
			Offshore breakwater	▭	✗	✓	✗	✗	▭	✗	▭	▭	6	
			Offshore reef	▭	✗	✓	✗	▭	▭	✗	▭	✓	8	
			Saltmarsh restoratation / buffer zones	-	-	-	-	-	-	-	-	-	-	
			Dredging	-	-	-	-	-	-	-	-	-	-	
		Managed Realignment - managed retreat of the cliff line	Beach recycling	▭	✓	✗	▭	✓	▭	✓	✗	▭	10	YES
			Beach nourishment	-	-	-	-	-	-	-	-	-	-	
			Timber groynes	▭	▭	▭	✗	▭	▭	▭	▭	▭	8	
			Rock groynes	▭	▭	✓	✗	▭	▭	▭	✓	▭	10	YES
			Crest raising	-	-	-	-	-	-	-	-	-	-	
			Seawall	-	-	-	-	-	-	-	-	-	-	
			Concrete revetment	-	-	-	-	-	-	-	-	-	-	
			Rock revetment	▭	▭	✓	✗	✗	▭	▭	✓	▭	9	YES
			Setback floodwall	-	-	-	-	-	-	-	-	-	-	
			Timber breastwork	▭	▭	▭	✗	✗	▭	▭	▭	▭	7	
			Gabions	▭	✓	▭	▭	✗	▭	▭	✗	▭	8	
			Sheet piling	-	-	-	-	-	-	-	-	-	-	
			Armoured sand dunes	-	-	-	-	-	-	-	-	-	-	
			Sand dune enhancements	-	-	-	-	-	-	-	-	-	-	
			Cliff slope stabilisation / drainage	▭	✗	✓	▭	▭	▭	▭	✓	▭	10	YES
			Offshore breakwater	-	-	-	-	-	-	-	-	-	-	
			Offshore reef	-	-	-	-	-	-	-	-	-	-	
			Saltmarsh restoratation / buffer zones	-	-	-	-	-	-	-	-	-	-	
			Dredging	-	-	-	-	-	-	-	-	-	-	
		Adaptation / Resilience	Property level resilience and resistance	-	-	-	-	-	-	-	-	-	-	-
			Community level resilience	✗	✗	✗	✓	✓	✓	▭	✓	✗	9	YES

ODU 2 – Mudeford Sandbank

Sustain / Improve (hold Sandbank in position)

Based on the scores of the multicriteria appraisal, several long list measures have been discounted and are not included in the short list in ODU 2 for the Sustain / Improve Strategic option:

- Concrete seawall / revetment / sheet piling – the rock revetment is a direct alternative to these structures and was included in the short list. A rock revetment is likely to be lower cost and may also have a lower carbon impact. Rock revetment in keeping with existing rock defence at the end of the Sandbank and also with rock groynes along the Sandbank.
- Timber breastwork, timber groynes and gabions – the Sandbank is in an exposed location subject to significant wave action under certain conditions. When compared to rock structures, the timber groynes and gabions are likely to provide a less robust defence with higher maintenance requirements.
- Setback floodwall – there are already existing setback structures along the Sandbank which could be raised and therefore crest raising has been included in the short list instead.
- Offshore breakwater / reef – both measures score poorly on the cost, natural environment and the technical complexity categories relative to other more feasible measures. Structures immediately offshore of the Sandbank would likely significantly change the character of the area that is valued for its views across Christchurch Bay to the Isle of Wight and may not be supported by beach hut owners / visitors to the area, although this would need to be determined through further engagement.
- Dredging (on harbour side of Sandbank) – unlikely to provide significant flood risk benefit in this location. Environmental impacts and would likely require repeated interventions.

Managed Realignment (Sandbank rollback in controlled manner)

Based on the scores of the multicriteria appraisal, several long list measures have been discounted and are not included in the short list in ODU 2 for the Managed Realignment Strategic options:

- Concrete seawall / revetment / sheet piling / setback floodwall – these are long lasting defences which would typically have a design life of 50+ years. For this reason these measures do not align with the managed realignment options which require defences that can be moved over time (i.e. rock or gabions) as required or have a shorter design life.
- Timber breastwork – a similar measure to gabion baskets (lower cost / shorter service life measure relative to concrete seawall / revetment / sheet piling etc.) but gabions are easier to move once installed which is key to the delivery of this option.
- Armoured sand dunes – with the managed realignment options the dunes would need to rollback with the Sandbank. Armouring the dunes would not align with this approach as it would more likely hold them in place by potentially restricting sand movement.
- Gabions – excluded as they would require frequent maintenance as they would be expected to very quickly become unsafe and require remedial works. Rock is preferable for Managed Realignment option given it can be moved as required.
- Offshore breakwater / reef – these measures do not align with the intent of the managed realignment option as they would encourage the Sandbank to remain in place rather than rolling back.
- Saltmarsh restoration (on harbour side of Sandbank) – as the Sandbank rolls back it would be counter-intuitive to be restoring saltmarsh on the harbour side of the Sandbank as the Sandbank may be moving into areas currently occupied by saltmarsh.
- Dredging (on harbour side of Sandbank) – this measure is unlikely to provide significant flood risk benefit in this location. Environmental impacts and would likely require repeated interventions.

SMZ	ODU	Strategic Option	Long list	Flood / erosion risk	Cost	Design life	Natural environment	Landscape / built environment	Carbon impact	Technical complexity	Maintenance / Operation	Broader outcomes	Score	Shortlist
1	2 - Mudeford Sandbank	Do Nothing	-	-	-	-	-	-	-	-	-	-	-	-
		Do Minimum	Patch and repair	-	-	-	-	-	-	-	-	-	-	YES
		Maintain	Capital refurbishment	▬	▬	▬	▬	▬	▬	✓	▬	✗	9	YES
			Beach recycling	▬	▬	✗	▬	✓	▬	✓	✗	▬	9	YES
		Sustain / Improve	Beach management (nourishment and recycling)	▬	▬	▬	▬	✓	▬	▬	✗	✓	10	YES
			Timber groynes	▬	▬	▬	▬	▬	▬	▬	▬	▬	9	
			Rock groynes	▬	▬	✓	✗	▬	▬	▬	✓	▬	10	YES
			Crest raising	▬	▬	▬	✓	✗	▬	▬	✓	▬	10	YES
			Seawall	✓	✗	✓	✗	✗	✗	✗	✓	▬	7	
			Concrete revetment	✓	✗	✓	✗	✗	✗	✗	✓	▬	7	
			Rock revetment	✓	▬	✓	✗	▬	▬	▬	✓	▬	11	YES
			Setback floodwall	▬	▬	✓	▬	✗	✗	✗	✓	▬	8	
			Timber breastwork	▬	▬	▬	✗	▬	▬	▬	▬	▬	8	
			Gabions	▬	✓	▬	✗	▬	▬	▬	▬	▬	9	
			Sheet piling	✓	✗	✓	▬	✗	✗	▬	✓	▬	9	
			Armoured sand dunes	▬	▬	▬	▬	▬	▬	▬	▬	✓	10	YES
			Sand dune enhancements	▬	▬	✗	✓	✓	✓	✗	✗	✓	10	YES
			Cliff slope stabilisation / drainage	-	-	-	-	-	-	-	-	-	-	
			Offshore breakwater	▬	✗	✓	✗	✗	▬	✗	▬	▬	6	
			Offshore reef	▬	✗	✓	✗	▬	▬	✗	▬	✓	8	
			Saltmarsh restoratation / buffer zones (harbour side)	✗	▬	▬	✓	✓	✓	✗	✗	✓	10	YES
			Dredging (harbour side)	✗	▬	✗	✗	✓	✓	▬	✗	▬	7	
		Managed Realignment	Beach management (nourishment and recycling)	▬	▬	▬	▬	✓	▬	▬	✗	✓	10	YES
			Timber groynes	▬	▬	▬	▬	▬	▬	▬	▬	▬	9	
			Rock groynes	▬	▬	✓	✗	▬	▬	▬	✓	▬	10	YES
			Crest raising	-	-	-	-	-	-	-	-	-	-	
			Seawall	-	-	-	-	-	-	-	-	-	-	
			Concrete revetment	-	-	-	-	-	-	-	-	-	-	
			Rock revetment / smaller scale rock armour	✓	▬	✓	✗	▬	▬	▬	✓	▬	11	YES
			Setback floodwall	-	-	-	-	-	-	-	-	-	-	
			Timber breastwork	-	-	-	-	-	-	-	-	-	-	
			Gabions	▬	✓	▬	▬	✗	▬	▬	✗	▬	8	
			Sheet piling	-	-	-	-	-	-	-	-	-	-	
			Armoured sand dunes	-	-	-	-	-	-	-	-	-	-	
			Sand dune enhancements	▬	▬	✗	✓	✓	✓	✗	✗	✓	10	YES
			Cliff slope stabilisation / drainage	-	-	-	-	-	-	-	-	-	-	
			Offshore breakwater	-	-	-	-	-	-	-	-	-	-	
			Offshore reef	-	-	-	-	-	-	-	-	-	-	
			Saltmarsh restoration / buffer zones (harbour side)	-	-	-	-	-	-	-	-	-	-	
			Dredging (harbour side)	✗	▬	✗	▬	✓	✓	▬	✗	▬	8	
		Adaptation / Resilience	Property level resilience and resistance	✗	▬	▬	✓	✓	▬	✗	▬	✗	8	YES
			Community level resilience	✗	✗	✗	✓	✓	✓	▬	✓	✗	9	YES

ODU 3 – Christchurch Harbour South

Sustain / Improve

Based on the scores of the multicriteria appraisal, several long list measures have been discounted and are not included in the short list for the Sustain / Improve Strategic option:

- Seawall / concrete revetment / rock revetment / sheet piling: these are all frontline structures that would likely have a significant negative impact on the natural environment and landscape / built environment. The cost of a seawall / concrete revetment and sheet piling is also likely to be very high relative to other setback measures (such as the setback floodwall and embankment) and the anticipated low benefits in this area do not justify this scale of investment.
- Timber breastwork / gabions: these measures were considered in the appraisal as localised erosion defences. Given the sheltered environment within the harbour and the environmental designations, the slope armour and reinforcement option (i.e. armour lock type defence) scored more highly and was therefore taken through to the short list instead. The slope armour approach would likely have a smaller footprint / encroachment area and may also have a lower landscape impact.
- Flood storage areas: this measure is not considered to be an effective flood defence measure in this location given the downstream position of this unit and the tidal risk dominance.
- Deployable defences – this measure scored poorly on operation and maintenance as well as broader outcomes. It is likely that these defences would be challenging to deploy and there are no obvious deployment alignments that would provide a benefit to a large area with a short defence length. Due to the temporary nature of this measure, the defences may not provide confidence to businesses / properties when planning for the long term given the residual risks. It is also difficult to incorporate other aspects such as environmental enhancements / landscaping improvements with this measure.
- Land raising / reclamation – this measure is likely to be high cost and to have significant impacts on landscape. Potential for significant natural environment impacts for the reclamation measure due to intertidal habitat loss. Generally outscored by alternative measures that made the shortlist.
- Dredging – this measure is unlikely to provide significant flood risk benefit in this location. Environmental impacts and would likely require repeated interventions.

SMZ	ODU	Strategic Option	Long list	Flood / erosion risk	Cost	Design life	Natural environment	Landscape / built environment	Carbon impact	Technical complexity	Maintenance / Operation	Broader outcomes	Score	Shortlist
2	3 - Christchurch Harbour South	Do Nothing	-	-	-	-	-	-	-	-	-	-	-	-
		Do Minimum	Patch and repair	-	-	-	-	-	-	-	-	-	-	YES
		Maintain	Capital refurbishment	▬	✓	▬	▬	▬	▬	✓	▬	✗	10	YES
		Sustain / Improve	Crest raising (setback defences where present)	-	-	-	-	-	-	-	-	-	-	
			Seawall	✓	✗	✓	✗	✗	✗	▬	✓	▬	8	
			Concrete revetment	✓	✗	✓	✗	✗	✗	▬	✓	▬	8	
			Rock revetment	✓	▬	✓	✗	✗	▬	▬	✓	✗	9	
			Setback floodwall	✓	▬	✓	✓	✗	✗	▬	✓	▬	11	YES
			Timber breastwork	-	-	-	-	-	-	-	-	-	-	
			Gabions	✓	▬	▬	✗	✗	▬	▬	▬	▬	8	
			Sheet piling	✓	✗	✓	▬	✗	✗	▬	✓	▬	9	
			Setback embankment	✓	▬	✓	✓	▬	▬	▬	✓	▬	13	YES
			Flood storage areas	-	-	-	-	-	-	-	-	-	-	
			Deployable temporary defences	▬	✓	▬	✓	✓	▬	✗	✗	✗	9	
			Deployable permanent defences	✓	✗	▬	✓	✓	▬	▬	✗	✗	9	
			Slope armour and reinforcement	✓	▬	▬	▬	▬	▬	▬	▬	▬	10	YES
			Land raising	✓	✗	✓	▬	✗	▬	▬	▬	▬	9	
			Land reclaimation	✓	✗	✓	✗	▬	✗	✗	▬	✓	8	
			Saltmarsh restoration / buffer zones	▬	▬	▬	✓	✓	✓	✗	✗	✓	11	YES
			Dredging	✗	▬	✗	✗	✓	✓	▬	▬	▬	8	
		Adaptation / Resilience	Property level resilience and resistance	▬	▬	▬	✓	✓	▬	▬	▬	✗	10	YES
			Community level resilience	✗	✗	✗	✓	✓	✓	▬	✓	✗	9	YES

ODU 4 – Wick

Sustain / Improve

Based on the scores of the multicriteria appraisal, several long list measures have been discounted and are not included in the short list for the Sustain / Improve Strategic option:

- Crest raising – the existing defences in the unit mainly comprise a natural verge and a sheet pile wall. Sheet pile walls can be technically challenging to raise (often a new sheet pile would be required) and natural verges would need a new defence structure to be constructed in order to raise the SoP. Crest raising may be suitable for the existing earth embankment defence to the east of Wick and this approach has been included as part of the earth embankment measure that made it onto the short list.
- Concrete revetment / rock revetment – these measures are likely to cause significant natural environment impacts due to being sloped structures that require large defence footprints into the river channel. In addition, the area is used for navigation / mooring and the slope structures may not be compatible with these activities.
- Timber breastwork – this measure typically works by retaining beach material behind the breastwork, providing enhanced protection to the shoreline behind. Given the lack of beach in this ODU this measure is considered to be unsuitable here. There is also limited scope to create a beach in this unit due to the potential impacts on navigation that this would have and the technical complexities associated with continuously flowing water in the channel.
- Gabions – this measure was appraised as a local erosion defence for the natural verge in the east part of the unit. However gabions do not score as favourably as slope armour / reinforcement (e.g. armour lock type defence) in topics such as natural environment (due to potential defence footprint of the gabions) and landscape impact.
- Flood storage areas – there is insufficient space in this location for flood storage areas. It is also uncertain how this measure may impact flood risk given the downstream location and tidal risk.
- Deployable temporary defences (such as deployable flood barriers) – in this unit given it is likely that long lengths of temporary defences would need to be deployed. Therefore this measure scores poorly in the operation / maintenance category as well as technical complexity and broader outcomes.
- Land raising / reclamation – it is likely that these measures would have a relatively high cost and would likely have a significant impact on landscape. There is also potential for significant natural environment impacts for the reclamation measure as the habitat in the river channel would be lost. These measures were generally outscored by alternative flood defence measures that made the shortlist.
- Saltmarsh restoration – the river channel in this area is used for mooring and navigation and therefore there is limited potential to create / restore saltmarsh in this location.
- Dredging – this measure is unlikely to provide significant flood risk benefit in this location and there may be environmental impacts.

SMZ	ODU	Strategic Option	Long list	Flood / erosion risk	Cost	Design life	Natural environment	Landscape / built environment	Carbon impact	Technical complexity	Maintenance / Operation	Broader outcomes	Score	Shortlist
2	4 - Wick	Do Nothing	-	-	-	-	-	-	-	-	-	-	-	-
		Do Minimum	Patch and repair	-	-	-	-	-	-	-	-	-	-	YES
		Maintain	Capital refurbishment	▬	✓	▬	▬	▬	▬	✓	▬	✗	10	YES
		Sustain / Improve	Crest raising	▬	▬	▬	✓	✗	▬	✗	✓	▬	9	
			Seawall / Quay wall with parapet	✓	✗	✓	▬	✗	✗	▬	✓	✓	10	YES
			Concrete revetment	✓	✗	✓	✗	✗	✗	✗	✓	▬	7	
			Rock revetment	✓	▬	✓	✗	✗	▬	✗	✓	▬	9	
			Setback floodwall	▬	▬	✓	✓	✗	✗	▬	✓	▬	10	YES
			Timber breastwork	-	-	-	-	-	-	-	-	-	-	
			Gabions	✓	▬	▬	✗	✗	▬	▬	▬	▬	8	
			Sheet piling with parapet	✓	✗	✓	▬	✗	✗	▬	✓	✓	10	YES
			Setback embankment	▬	▬	✓	✓	▬	▬	▬	✓	▬	12	YES
			Flood storage areas	-	-	-	-	-	-	-	-	-	-	
			Deployable temporary defences	▬	✓	▬	✓	✓	▬	✗	✗	✗	9	
			Deployable permanent defences	▬	✗	▬	✓	✓	▬	▬	✗	✓	10	YES
			Slope armour and reinforcement	✓	▬	▬	▬	▬	▬	▬	▬	▬	10	YES
			Land raising	▬	✗	✓	▬	✗	▬	▬	▬	▬	8	
			Land reclaimation	▬	✗	✓	✗	▬	✗	✗	▬	✓	7	
			Saltmarsh restoration / buffer zones	-	-	-	-	-	-	-	-	-	-	
			Dredging	✗	▬	✗	✗	✓	✓	▬	▬	▬	8	
		Adaptation / Resilience	Property level resilience and resistance	▬	▬	▬	✓	✓	▬	▬	▬	✗	10	YES
			Community level resilience	✗	✗	✗	✓	✓	✓	▬	✓	✗	9	YES

ODU 5 – Willow Drive and the Quomps

Sustain / Improve

Based on the scores of the multicriteria appraisal, several long list measures have been discounted and are not included in the short list for the Sustain / Improve Strategic option:

- Concrete revetment / rock revetment – these measures are likely to cause significant natural environment impacts due to being sloped structures that require large defence footprints into the river channel. In addition, the area is used for navigation / mooring and the slope structures may not be compatible with these activities.
- Timber breastwork – this measure typically works by retaining beach material behind the breastwork, providing enhanced protection to the shoreline behind. Given the lack of beach in this ODU this measure is considered to be unsuitable here. There is also limited scope to create a beach in this unit due to the potential impacts on navigation that this would have and the technical complexities associated with continuously flowing water in the channel.
- Gabions / slope armour – these measures are not an appropriate solution in this location. A linear impermeable defence is imperative to providing a flood risk scheme in this location and both gabions and slope armour would not provide this function.
- Flood storage areas – there is insufficient space in this location for flood storage areas. It is also uncertain how this measure may impact flood risk given the downstream location and tidal risk.
- Deployable temporary defences (such as deployable flood barriers) – in this unit given it is likely that long lengths of temporary defences would need to be deployed. Therefore this measure scores poorly in the operation / maintenance category as well as technical complexity and broader outcomes.
- Land raising / reclamation – it is likely that these measures would have a relatively high cost and would likely have a significant impact on landscape. There is also potential for significant natural environment impacts for the reclamation measure as the habitat in the river channel would be lost. These measures were generally outscored by alternative flood defence measures that made the shortlist.
- Saltmarsh restoration – the river channel in this area is used for mooring and navigation and therefore there is limited potential to create / restore saltmarsh in this location.
- Dredging – this measure is unlikely to provide significant flood risk benefit in this location and there may be environmental impacts.

SMZ	ODU	Strategic Option	Long list	Flood / erosion risk	Cost	Design life	Natural environment	Landscape / built environment	Carbon impact	Technical complexity	Maintenance / Operation	Broader outcomes	Score	Shortlist
2	5 - Willow Drive and the Quomps	Do Nothing	-	-	-	-	-	-	-	-	-	-	-	-
		Do Minimum	Patch and repair	-	-	-	-	-	-	-	-	-	-	YES
		Maintain	Capital refurbishment	▬	✓	▬	▬	▬	▬	✓	▬	✗	10	YES
		Sustain / Improve	Crest raising of existing setback defences	✓	▬	▬	✓	✗	▬	▬	✓	▬	11	YES
			Seawall / Quay wall with parapet	✓	✗	✓	▬	✗	✗	▬	✓	✓	10	YES
			Concrete revetment	✓	✗	✓	✗	✗	✗	✗	✓	▬	7	
			Rock revetment	✓	▬	✓	✗	✗	▬	✗	✓	▬	9	
			Setback floodwall	✓	▬	✓	✓	✗	✗	▬	✓	▬	11	YES
			Timber breastwork	-	-	-	-	-	-	-	-	-	-	
			Gabions	-	-	-	-	-	-	-	-	-	-	
			Sheet piling with parapet	✓	✗	✓	▬	✗	✗	▬	✓	✓	10	YES
			Setback embankment	✓	▬	✓	✓	▬	▬	▬	✓	▬	13	YES
			Flood storage areas	-	-	-	-	-	-	-	-	-	-	
			Deployable temporary defences	▬	✓	▬	✓	✓	▬	✗	✗	✗	9	
			Deployable permanent defences	▬	✗	▬	✓	✓	▬	▬	✗	✓	10	YES
			Slope armour and reinforcement	-	-	-	-	-	-	-	-	-	-	
			Land raising	▬	✗	✓	▬	✗	▬	✗	▬	▬	7	
			Land reclaimation	▬	✗	✓	✗	▬	✗	✗	▬	✓	7	
			Saltmarsh restoration / buffer zones	-	-	-	-	-	-	-	-	-	-	
			Dredging	✗	▬	✗	✗	✓	✓	▬	▬	▬	8	
		Adaptation / Resilience	Property level resilience and resistance	▬	▬	▬	✓	✓	▬	▬	▬	✗	10	YES
			Community level resilience	✗	✗	✗	✓	✓	✓	▬	✓	✗	9	YES

ODU 6 – River Avon West Bank

Sustain / Improve

Based on the scores of the multicriteria appraisal, several long list measures have been discounted and are not included in the short list for the Sustain / Improve Strategic option:

- Concrete revetment / rock revetment – these measures are likely to cause significant natural environment impacts due to being sloped structures that require large defence footprints into the river channel. In addition, the area is used for navigation / mooring and the slope structures may not be compatible with these activities.
- Timber breastwork – this measure typically works by retaining beach material behind the breastwork, providing enhanced protection to the shoreline behind. Given the lack of beach in this ODU this measure is considered to be unsuitable here. There is also limited scope to create a beach in this unit due to the potential impacts on navigation that this would have and the technical complexities associated with continuously flowing water in the channel.
- Gabions / slope armour – these measures are not an appropriate solution in this location. A linear impermeable defence is imperative to providing a flood risk scheme in this location and both gabions and slope armour would not provide this function.
- Flood storge areas – it is uncertain how this measure may impact flood risk given the downstream location and tidal risk. May provide a fluvial benefit but unlikely to significantly alter the tidal risk to this location.
- Deployable temporary defences (such as deployable flood barriers) – in this unit given it is likely that long lengths of temporary defences would need to be deployed. Therefore this measure scores poorly in the operation / maintenance category as well as technical complexity and broader outcomes.
- Land reclamation - high cost and likely to have significant impact on landscape. Potential for significant natural environment impacts and also worsening the fluvial flood risk from the River Avon by constricting the flows, potentially leading to detriment flood risk.
- Saltmarsh restoration – the river channel in this area is used for mooring and navigation and therefore there is limited potential to create / restore saltmarsh in this location.
- Dredging – this measure is unlikely to provide significant flood risk benefit in this location. However, as you move further up the river channel this measure may provide more of a benefit. In the lower reaches of the unit this option is not likely to improve flood risk given tidal dominance.

SMZ	ODU	Strategic Option	Long list	Flood / erosion risk	Cost	Design life	Natural environment	Landscape / built environment	Carbon impact	Technical complexity	Maintenance / Operation	Broader outcomes	Score	Shortlist
2	6 - River Avon West Bank	Do Nothing	-	-	-	-	-	-	-	-	-	-	-	-
		Do Minimum	Patch and repair	-	-	-	-	-	-	-	-	-	-	YES
		Maintain	Capital refurbishment	▬	✓	▬	▬	▬	▬	✓	▬	✗	10	YES
		Sustain / Improve	Crest raising of existing defences	▬	▬	▬	✓	✗	▬	▬	✓	▬	10	YES
			Seawall / Quay wall with parapet	✓	✗	✓	▬	✗	✗	▬	✓	✓	10	YES
			Concrete revetment	✓	✗	✓	✗	✗	✗	✗	✓	▬	7	
			Rock revetment	✓	▬	✓	✗	✗	▬	✗	✓	▬	9	
			Setback floodwall	✓	▬	✓	✓	✗	✗	▬	✓	▬	11	YES
			Timber breastwork	-	-	-	-	-	-	-	-	-	-	
			Gabions	-	-	-	-	-	-	-	-	-	-	
			Sheet piling with parapet	✓	✗	✓	▬	✗	✗	▬	✓	✓	10	YES
			Setback embankment	✓	▬	✓	✓	▬	▬	▬	✓	▬	13	YES
			Flood storage areas	✗	✓	✓	▬	▬	▬	✗	▬	▬	9	
			Deployable temporary defences	▬	✓	▬	✓	✓	▬	✗	✗	✗	9	
			Deployable permanent defences	▬	✗	▬	✓	✓	▬	▬	✗	✓	10	YES
			Slope armour and reinforcement	-	-	-	-	-	-	-	-	-	-	
			Land raising	▬	✗	✓	✓	▬	▬	▬	▬	▬	10	YES
			Land reclaimation	▬	✗	✓	✗	▬	✗	✗	▬	✓	7	
			Saltmarsh restoration / buffer zones	-	-	-	-	-	-	-	-	-	-	
			Dredging	✗	▬	✗	✗	✓	✓	▬	▬	▬	8	
		Adaptation / Resilience	Property level resilience and resistance	▬	▬	▬	✓	✓	▬	▬	▬	✗	10	YES
			Community level resilience	✗	✗	✗	✓	✓	✓	▬	✓	✗	9	YES

ODU 7 – Rossiters Quay

Sustain / Improve

Based on the scores of the multicriteria appraisal, several long list measures have been discounted and are not included in the short list for the Sustain / Improve Strategic option:

- Concrete revetment / rock revetment: these measures are likely to cause significant natural environment impacts due to being sloped structures that require large defence footprints into the river channel. In addition, the area is used for navigation / mooring and the slope structures may not be compatible with these activities.
- Timber breastwork: this measure typically works by retaining beach material behind the breastwork, providing enhanced protection to the shoreline behind. Given the lack of beach in this ODU this measure is considered to be unsuitable here. There is also limited scope to create a beach in this unit due to the river environment and potential impacts on navigation that this would have.
- Gabions / slope armour: these measures are not an appropriate solution in this location. A linear impermeable defence is imperative to providing a flood risk scheme in this location and both gabions and slope armour would not provide this function.
- Flood storge areas: insufficient space to implement this measure in this location. It is also uncertain how this measure would impact flood risk given the downstream location and tidal risk. May provide a fluvial benefit but unlikely to significantly alter the tidal risk to this location.
- Deployable temporary defences (such as deployable flood barriers): in this unit it is likely that long lengths of temporary defences would need to be deployed. Therefore this measure scores poorly in the operation / maintenance category as well as technical complexity and broader outcomes.
- Land reclamation: high cost and likely to have significant impact on landscape. Potential for significant natural environment impacts and also worsening the fluvial flood risk from the River Avon by constricting the flows, potentially leading to detriment flood risk.
- Saltmarsh restoration: the river channel in this area is used for mooring and navigation and therefore there is limited potential to create / restore saltmarsh in this location.
- Dredging: this measure is unlikely to provide significant flood risk benefit in this location. However, as you move further up the river channel this measure may provide more of a benefit. In the lower reaches of the unit this option is not likely to improve flood risk given tidal dominance.

SMZ	ODU	Strategic Option	Long list	Flood / erosion risk	Cost	Design life	Natural environment	Landscape / built environment	Carbon impact	Technical complexity	Maintenance / Operation	Broader outcomes	Score	Shortlist
2	7 - Rossiters Quay	Do Nothing	-	-	-	-	-	-	-	-	-	-	-	-
		Do Minimum	Patch and repair	-	-	-	-	-	-	-	-	-	-	YES
		Maintain	Capital refurbishment	▬	✓	▬	▬	▬	▬	✓	▬	✗	10	YES
		Sustain / Improve	Crest raising of existing defences	▬	▬	▬	✓	✗	▬	▬	✓	▬	10	YES
			Seawall / Quay wall with parapet	✓	✗	✓	▬	✗	✗	▬	✓	✓	10	YES
			Concrete revetment	✓	✗	✓	✗	✗	✗	✗	✓	▬	7	
			Rock revetment	✓	▬	✓	✗	✗	▬	✗	✓	▬	9	
			Setback floodwall	✓	▬	✓	✓	✗	✗	▬	✓	▬	11	YES
			Timber breastwork	-	-	-	-	-	-	-	-	-	-	
			Gabions	-	-	-	-	-	-	-	-	-	-	
			Sheet piling with parapet	✓	✗	✓	▬	✗	✗	▬	✓	✓	10	YES
			Setback embankment	✓	▬	✓	✓	▬	▬	▬	✓	▬	13	YES
			Flood storage areas	-	-	-	-	-	-	-	-	-	-	
			Deployable temporary defences	▬	✓	▬	✓	✓	▬	✗	✗	✗	9	
			Deployable permanent defences	▬	✗	▬	✓	✓	▬	▬	✗	✓	10	YES
			Slope armour and reinforcement	-	-	-	-	-	-	-	-	-	-	
			Land raising	▬	✗	✓	✓	▬	▬	▬	▬	▬	10	YES
			Land reclaimation	▬	✗	✓	✗	▬	✗	✗	▬	✓	7	
			Saltmarsh restoration / buffer zones	-	-	-	-	-	-	-	-	-	-	
			Dredging	✗	▬	✗	✗	✓	✓	▬	▬	▬	8	
		Adaptation / Resilience	Property level resilience and resistance	▬	▬	▬	✓	✓	▬	▬	▬	✗	10	YES
			Community level resilience	✗	✗	✗	✓	✓	✓	▬	✓	✗	9	YES

ODU 8 – River Avon East Bank

Sustain / Improve

Based on the scores of the multicriteria appraisal, several long list measures have been discounted and are not included in the short list for the Sustain / Improve Strategic option:

- Concrete revetment / rock revetment / seawall / sheet pile wall (frontline measures): these frontline measures are likely to cause significant natural environment impacts due to being sloped structures that require large defence footprints into the river channel. These measures are likely higher cost than setback structures and could increase fluvial flood risk by constraining the river channel and the natural flood plain.
- Crest raising: the existing defence on the east bank of the River Avon is a natural verge and it is not feasible to raise this without an entirely new structure. In addition, being a frontline approach there is a risk that this could increase fluvial flood risk by constraining the river channel and the natural flood plain in this location.
- Timber breastwork / gabions / slope armour: these measures are not an appropriate solution in this location. A linear impermeable defence is imperative to providing a flood risk scheme in this location and gabions, timber breastwork and slope armour would not provide this function.
- Flood storage areas: there is a natural flood plain already to the east of the river bank and it is unlikely that additional space in this unit could be made for additional flood storage.
- Deployable temporary defences (such as deployable flood barriers): in this unit it is likely that long lengths of temporary defences would need to be deployed. Therefore this measure scores poorly in the operation / maintenance category as well as technical complexity and broader outcomes.
- Land raising / reclamation: high cost and could have significant negative impact on fluvial flood risk in this location if this approach were to constrain the river channel / natural flood plain.
- Saltmarsh restoration: the river channel in this area is too constrained / unsuitable environment for saltmarsh creation
- Dredging: this measure is unlikely to provide significant flood risk benefit in this location. However, as you move further up the river channel this measure may provide more of a benefit to fluvial flood risk.

SMZ	ODU	Strategic Option	Long list	Flood / erosion risk	Cost	Design life	Natural environment	Landscape / built environment	Carbon impact	Technical complexity	Maintenance / Operation	Broader outcomes	Score	Shortlist
2	8 - River Avon East Bank	Do Nothing	-	-	-	-	-	-	-	-	-	-	-	-
		Do Minimum	Patch and repair	-	-	-	-	-	-	-	-	-	-	YES
		Maintain	Capital refurbishment	▬	✓	▬	▬	▬	▬	✓	▬	✗	10	YES
		Sustain / Improve	Crest raising of existing defences	-	-	-	-	-	-	-	-	-	-	
			Seawall / Quay wall with parapet	▬	✗	✓	▬	✗	✗	✗	✓	✓	8	
			Concrete revetment	▬	✗	✓	✗	✗	✗	✗	✓	▬	6	
			Rock revetment	▬	▬	✓	✗	✗	▬	✗	✓	▬	8	
			Setback floodwall	✓	▬	✓	✓	✗	✗	▬	✓	▬	11	YES
			Timber breastwork	-	-	-	-	-	-	-	-	-	-	
			Gabions	-	-	-	-	-	-	-	-	-	-	
			Sheet piling with parapet	▬	✗	✓	▬	✗	✗	✗	✓	✓	8	
			Setback embankment	✓	▬	✓	✓	▬	▬	▬	✓	▬	13	YES
			Flood storage areas	✗	✓	✓	▬	▬	▬	✗	▬	▬	9	
			Deployable temporary defences	▬	✓	▬	✓	✓	▬	✗	✗	✗	9	
			Deployable permanent defences	▬	✗	▬	✓	✓	▬	▬	✗	✓	10	YES
			Slope armour and reinforcement	-	-	-	-	-	-	-	-	-	-	
			Land raising	▬	✗	✓	✓	▬	▬	✗	▬	▬	9	
			Land reclaimation	▬	✗	✓	✗	▬	✗	✗	▬	✓	7	
			Saltmarsh restoration / buffer zones	-	-	-	-	-	-	-	-	-	-	
			Dredging	✗	▬	✗	✗	✓	✓	▬	▬	▬	8	
		Adaptation / Resilience	Property level resilience and resistance	▬	▬	▬	✓	✓	▬	▬	▬	✗	10	YES
			Community level resilience	✗	✗	✗	✓	✓	✓	▬	✓	✗	9	YES

ODU 9 – Stanpit

Sustain / Improve

Based on the scores of the multicriteria appraisal, several long list measures have been discounted and are not included in the short list for the Sustain / Improve Strategic option:

- Concrete revetment (frontline measure): this measure is unsuitable for a defence on the east bank of the River Avon due to defence footprint and impact on navigation / fluvial flows. Around the Stanpit area this measure is outscored by a rock revetment and therefore not included in the short list.
- Crest raising existing defences: most of the existing defences in this unit comprise a natural verge and therefore generally a completely new defence would be required to raise the SoP.
- Timber breastwork / gabions: these measures were considered as erosion defences around the Stanpit area but were outscored by the rock revetment / slope armour and reinforcement measures. Not suitable for the east bank of the River Avon.
- Flood storage areas: given the downstream location of this unit it is unlikely to benefit the fluvial flood risk significantly and would not be expected to impact tidal flood risk in this location.
- Deployable temporary defences (such as deployable flood barriers): in this unit it is likely that long lengths of temporary defences would need to be deployed. Therefore this measure scores poorly in the operation / maintenance category as well as technical complexity and broader outcomes.
- Land reclamation: high cost and generally outscored by other measures in this location. Land reclamation on the east bank of the River Avon also unviable due to potential impact on fluvial risk. Land reclamation around the Stanpit area would impact saltmarsh habitat and have negative natural environmental impacts.
- Dredging: this measure is unlikely to provide significant flood risk benefit in this location. However, as you move further up the river channel this measure may provide more of a benefit to fluvial flood risk.

SMZ	ODU	Strategic Option	Long list	Flood / erosion risk	Cost	Design life	Natural environment	Landscape / built environment	Carbon impact	Technical complexity	Maintenance / Operation	Broader outcomes	Score	Shortlist
2	9 - Stanpit	Do Nothing	-	-	-	-	-	-	-	-	-	-	-	-
		Do Minimum	Patch and repair	-	-	-	-	-	-	-	-	-	-	YES
		Maintain	Capital refurbishment	▬	✓	▬	▬	▬	▬	✓	▬	✗	10	YES
		Sustain / Improve	Crest raising of existing frontline defences	-	-	-	-	-	-	-	-	-	-	
			Seawall / quay wall with parapet wall	✓	✗	✓	▬	✗	✗	▬	✓	✓	10	YES
			Concrete revetment	✓	✗	✓	✗	✗	✗	✗	✓	▬	7	
			Rock revetment	✓	▬	✓	✗	▬	▬	▬	✓	▬	11	YES
			Setback floodwall	✓	▬	✓	✓	✗	✗	▬	✓	▬	11	YES
			Timber breastwork	-	-	-	-	-	-	-	-	-	-	
			Gabions	✓	▬	▬	✗	✗	▬	▬	▬	▬	8	
			Sheet piling with parapet	✓	✗	✓	▬	✗	✗	▬	✓	✓	10	YES
			Setback embankment	✓	▬	✓	✓	▬	▬	▬	✓	▬	13	YES
			Flood storage areas	-	-	-	-	-	-	-	-	-	-	
			Deployable temporary defences	▬	✓	▬	✓	✓	▬	✗	✗	✗	9	
			Deployable permanent defences	▬	✗	▬	✓	✓	▬	▬	✗	✓	10	YES
			Slope armour and reinforcement	✓	▬	▬	▬	▬	▬	▬	▬	▬	10	YES
			Land raising	▬	✗	✓	✓	▬	▬	✗	▬	✓	10	YES
			Land reclaimation	▬	✗	✓	✗	▬	✗	✗	▬	✓	7	
			Saltmarsh restoration / buffer zones	▬	▬	▬	✓	✓	✓	✗	✗	✓	11	YES
			Dredging	✗	▬	✗	✗	✓	✓	▬	▬	▬	8	
			Tidal barrier	-	-	-	-	-	-	-	-	-	-	
		Adaptation / Resilience	Property level resilience and resistance	▬	▬	▬	✓	✓	▬	▬	▬	✗	10	YES
			Community level resilience	✗	✗	✗	✓	✓	✓	▬	✓	✗	9	YES

ODU 10 – Mudeford

Sustain / Improve

Based on the scores of the multicriteria appraisal, several long list measures have been discounted and are not included in the short list for the Sustain / Improve Strategic option:

- Concrete revetment / rock revetment: these measures are likely to cause significant natural environment impacts due to being sloped structures that require large defence footprints into the harbour area. In addition, the area is used for navigation / mooring and the slope structures, particularly made from rock, may not be compatible with these activities.
- Timber breastwork: this measure typically works by retaining beach material behind the breastwork, providing enhanced protection to the shoreline behind. Given the lack of beach in this ODU this measure is considered to be unsuitable here. There is also limited scope to create a beach in this unit due to the harbour environment and potential impacts on navigation that this would have.
- Gabions / slope armour: these measures are not an appropriate solution in this location. A linear impermeable defence is imperative to providing a flood risk scheme in this location and both gabions and slope armour would not provide this function.
- Setback embankment: there is insufficient space available for a setback embankment in this location. A setback floodwall would provide the more appropriate solution here.
- Flood storage areas: given the downstream location of this unit it is unlikely to benefit the fluvial flood risk significantly and would not be expected to impact tidal flood risk in this location.
- Deployable temporary defences (such as deployable flood barriers): in this unit it is likely that long lengths of temporary defences would need to be deployed. Therefore this measure scores poorly in the operation / maintenance category as well as technical complexity and broader outcomes.
- Land raising / reclamation: high cost and generally outscored by other measures in this location. Land raising likely not viable due to density of buildings along the shoreline and other lower cost solutions likely provide similar benefits. Land reclamation also unviable as would impact intertidal habitat and have negative natural environmental impacts.
- Dredging: this measure is unlikely to provide significant flood risk benefit in this location. However, as you move further up the river channels from the harbour this measure may provide more of a benefit to fluvial flood risk.

SMZ	ODU	Strategic Option	Long list	Flood / erosion risk	Cost	Design life	Natural environment	Landscape / built environment	Carbon impact	Technical complexity	Maintenance / Operation	Broader outcomes	Score	Shortlist
2	10 - Mudeford	Do Nothing	-	-	-	-	-	-	-	-	-	-	-	-
		Do Minimum	Patch and repair	-	-	-	-	-	-	-	-	-	-	YES
		Maintain	Capital refurbishment	▬	✓	▬	▬	▬	▬	✓	▬	✗	10	YES
		Sustain / Improve	Crest raising	▬	▬	▬	✓	✗	▬	▬	▬	▬	9	YES
			Seawall / Quay wall with parapet	✓	✗	✓	▬	✗	✗	▬	▬	✓	9	YES
			Concrete revetment	✓	✗	✓	✗	✗	✗	✗	▬	▬	6	
			Rock revetment	✓	▬	✓	✗	✗	▬	✗	▬	▬	8	
			Setback floodwall	▬	▬	✓	✓	✗	✗	▬	▬	▬	9	YES
			Timber breastwork	-	-	-	-	-	-	-	-	-	-	
			Gabions	-	-	-	-	-	-	-	-	-	-	
			Sheet piling with parapet	✓	✗	✓	▬	✗	✗	▬	▬	✓	9	YES
			Setback embankment	-	-	-	-	-	-	-	-	-	-	
			Flood storage areas	-	-	-	-	-	-	-	-	-	-	
			Deployable temporary defences	▬	▬	▬	✓	✓	▬	✗	✗	✗	8	
			Deployable permanent defences	▬	✗	▬	✓	✓	▬	▬	✗	✓	10	YES
			Slope armour and reinforcement	-	-	-	-	-	-	-	-	-	-	
			Land raising	▬	✗	✓	▬	✗	▬	✗	▬	▬	7	
			Land reclaimation	✓	✗	✓	✗	▬	✗	✗	▬	✓	8	
			Saltmarsh restoration / buffer zones	▬	▬	▬	✓	✓	✓	✗	✗	▬	10	YES
			Dredging	✗	▬	✗	✗	✓	✓	▬	▬	▬	8	
		Adaptation / Resilience	Property level resilience and resistance	▬	▬	▬	✓	✓	▬	▬	▬	✗	10	YES
			Community level resilience	✗	✗	✗	✓	✓	✓	▬	✓	✗	9	YES

ODU 11 – Mudeford Quay

Sustain / Improve

Based on the scores of the multicriteria appraisal, several long list measures have been discounted and are not included in the short list for the Sustain / Improve Strategic option:

- Concrete revetment / rock revetment: these measures are likely to cause significant natural environment impacts due to being sloped structures that require large defence footprints into the harbour area. These measures also score poorly in the landscape / built environment category, with the concrete revetment also typically being a high cost solution.
- Timber breastwork: this measure typically works by retaining beach material behind the breastwork, providing enhanced protection to the shoreline behind. Given the lack of beach in this ODU this measure is considered to be unsuitable here. There is also limited scope to create a beach in this unit due to the harbour environment and potential impacts on navigation that this would have.
- Gabions / slope armour: these measures are not an appropriate solution in this location. A linear impermeable defence is imperative to providing a flood risk scheme in this location and both gabions and slope armour would not provide this function.
- Flood storage areas: given the downstream location of this unit it is unlikely to benefit the fluvial flood risk significantly and would not be expected to impact tidal flood risk in this location.
- Deployable temporary defences (such as deployable flood barriers): in this unit it is likely that long lengths of temporary defences would need to be deployed. Therefore this measure scores poorly in the operation / maintenance category as well as technical complexity and broader outcomes.
- Land reclamation: a typically high cost measure with significant negative environmental impacts. If undertaken in the open coast part of this unit it could also negatively impact the navigation in the run and constrain flows in and out of the harbour, potentially increasing fluvial flood risk within the harbour.
- Dredging: this measure is unlikely to provide significant flood risk benefit in this location. However, as you move further up the river channels from the harbour this measure may provide more of a benefit to fluvial flood risk.

SMZ	ODU	Strategic Option	Long list	Flood / erosion risk	Cost	Design life	Natural environment	Landscape / built environment	Carbon impact	Technical complexity	Maintenance / Operation	Broader outcomes	Score	Shortlist
2	11 - Mudeford Quay	Do Nothing	-	-	-	-	-	-	-	-	-	-	-	-
		Do Minimum	Patch and repair	-	-	-	-	-	-	-	-	-	-	YES
		Maintain	Capital refurbishment	▬	✓	▬	▬	▬	▬	✓	▬	✗	10	YES
		Sustain / Improve	Crest raising	▬	▬	▬	✓	✗	▬	▬	✓	▬	10	YES
			Seawall / Quay wall with parapet	✓	✗	✓	▬	✗	✗	▬	✓	✓	10	YES
			Concrete revetment	✓	✗	✓	✗	✗	✗	✗	✓	▬	7	
			Rock revetment	✓	▬	✓	✗	✗	▬	✗	✓	▬	9	
			Setback floodwall	✓	▬	✓	✓	✗	✗	▬	✓	▬	11	YES
			Timber breastwork	-	-	-	-	-	-	-	-	-	-	
			Gabions	-	-	-	-	-	-	-	-	-	-	
			Sheet piling with parapet	✓	✗	✓	▬	✗	✗	▬	✓	✓	10	YES
			Setback embankment	✓	▬	✓	✓	▬	▬	▬	✓	▬	13	YES
			Flood storage areas	-	-	-	-	-	-	-	-	-	-	
			Deployable temporary defences	▬	✓	▬	✓	✓	▬	✗	✗	✗	9	
			Deployable permanent defences	▬	✗	▬	✓	✓	▬	▬	✗	✓	10	YES
			Slope armour and reinforcement	-	-	-	-	-	-	-	-	-	-	
			Land raising	▬	✗	✓	✓	▬	▬	▬	▬	▬	10	YES
			Land reclaimation	▬	✗	✓	✗	▬	✗	✗	▬	✗	5	
			Saltmarsh restoration / buffer zones	▬	▬	▬	✓	✓	✓	✗	✗	▬	10	YES
			Dredging	✗	▬	✗	✗	✓	✓	▬	▬	▬	8	
		Adaptation / Resilience	Property level resilience and resistance	▬	▬	▬	✓	✓	▬	▬	▬	✗	10	YES
			Community level resilience	✗	✗	✗	✓	✓	✓	▬	✓	✗	9	YES

ODU 12 – Avon Beach and Friars Cliff

Improve

Based on the scores of the multicriteria appraisal, several long list measures have been discounted and are not included in the short list for the Improve Strategic option:

- Concrete revetment: given the amenity / recreational use of the beach and the environmental designations a vertical structure (seawall) is considered to be more appropriate in this location, to minimise defence footprint and maximise beach space.
- Timber breastwork: this measure was ruled out as it would typically be located further down the beach and would likely interfere with the amenity and recreational use of the beach. Beach control structures such as groynes are currently present and continuing with these structures to manage beach material is considered preferable as it would limit changes to the beach.
- Gabions / slope armour: this frontage is an exposed coastal location and more robust structures have been favoured on the short list. In this environment these measures would typically have a shorter design life and need more frequently replacement than structures such as seawalls.
- Sheet piling: given the amenity / recreational use of this part of the frontage a concrete / masonry structure at the back of the beach is likely to be more visually pleasing and have a lesser impact on the character of the area (considering the seawall already in place). Sheet piling could be used as part of the buried foundations / scour protection for a new seawall but steel is not considered a less appropriate material here if left visually exposed.
- Deployable temporary defences (flood risk measure): this measure would have high operational requirements associated with deployment. Unlikely to deliver broader outcomes as residual risk of failure is high relative to other local flood risk measures.
- Offshore breakwater / reef – both measures are likely to have a high cost and natural environment impact / visual impact. In addition, given proximity of this location to the entrance to Christchurch Harbour and the dynamic nature of the Run, any offshore structures here are likely to impact navigation, health and safety.

SMZ	ODU	Strategic Option	Long list	Flood / erosion risk	Cost	Design life	Natural environment	Landscape / built environment	Carbon impact	Technical complexity	Maintenance / Operation	Broader outcomes	Score	Shortlist
3	12- Avon Beach and Friars Cliff	Do Nothing	-	-	-	-	-	-	-	-	-	-	-	-
		Do Minimum	Patch and repair	-	-	-	-	-	-	-	-	-	-	YES
		Maintain	Capital refurbishment	▬	✓	▬	▬	▬	▬	✓	▬	✗	10	YES
			Beach recycling	▬	✓	✗	▬	✓	▬	✓	✗	▬	10	YES
		Improve (erosion risk)	Beach nourishment	▬	▬	▬	▬	✓	▬	▬	✗	✓	10	YES
			Timber groynes	▬	▬	▬	▬	▬	▬	▬	▬	▬	9	YES
			Rock groynes	▬	▬	✓	✗	▬	▬	▬	✓	▬	10	YES
			Crest raising	▬	▬	▬	✓	✗	▬	▬	✓	▬	10	YES
			Seawall	▬	✗	✓	▬	✗	✗	▬	✓	✓	9	YES
			Concrete revetment	▬	✗	✓	✗	✗	✗	▬	✓	▬	7	
			Rock revetment	▬	▬	✓	✗	✗	▬	▬	✓	▬	9	YES
			Setback floodwall	▬	▬	✓	✓	✗	✗	▬	✓	▬	10	YES
			Timber breastwork	▬	▬	▬	✗	✗	▬	▬	▬	▬	7	
			Gabions	▬	✓	✗	▬	✗	▬	▬	▬	▬	8	
			Sheet piling	▬	✗	✓	▬	✗	✗	▬	✓	▬	8	
			Deployable temporary defences	▬	▬	▬	✓	✓	▬	✗	✗	✗	8	
			Deployable permanent defences	▬	▬	▬	✓	▬	▬	▬	▬	▬	10	YES
			Slope armour and reinforcement	▬	✓	✗	▬	✗	▬	▬	▬	▬	8	
			Cliff slope stabilisation / drainage	▬	✗	✓	▬	▬	▬	▬	✓	▬	10	YES
			Land raising	▬	✗	✓	▬	✗	▬	▬	▬	✓	9	YES
			Offshore breakwater	▬	✗	✓	✗	✗	▬	✗	▬	▬	6	
			Offshore reef	▬	✗	✓	✗	▬	▬	✗	▬	✓	8	
		Adaptation / Resilience	Property level resilience and resistance	▬	▬	▬	✓	✓	▬	▬	▬	✗	10	YES
			Community level resilience	✗	✗	✗	✓	✓	✓	▬	✓	✗	9	YES

ODU 13 – Highcliffe

Improve / Managed Realignment

Based on the scores of the multicriteria appraisal, several long list measures have been discounted and are not included in the short list in ODU 13 for the Improve and/or Managed Realignment Strategic options:

- Timber groynes: the existing rock groynes are currently performing well in retaining material in this location. There is no justification to change these structures to timber and reuse of the rock material is likely to provide cost savings.
- Seawall / concrete revetment / sheet piling: these measures are likely high cost relative to the rock revetment / rock armour measure and could also have a greater carbon impact given the potential to re-use the rock material as required.
- Timber breastwork: this measure was ruled out as it would typically be located further down the beach and would likely interfere with the amenity and recreational use of the beach. Rock groynes are currently present and continuing with these structures to manage beach material is considered preferable as it would limit changes to the beach.
- Gabions / slope armour: this frontage is an exposed coastal location and more robust structures have been favoured on the short list. In this environment these measures would typically have a shorter design life and need more frequently replacement than a rock revetment / rock armour.
- Setback floodwall / deployable flood defences / land raising: not appraised given coastal flood risk in this location is minimal.

SMZ	ODU	Strategic Option	Long list	Flood / erosion risk	Cost	Design life	Natural environment	Landscape / built environment	Carbon impact	Technical complexity	Maintenance / Operation	Broader outcomes	Score	Shortlist
3	1 3- Highcliffe	Do Nothing	-	-	-	-	-	-	-	-	-	-	-	-
		Do Minimum	Patch and repair	-	-	-	-	-	-	-	-	-	-	YES
		Maintain	Capital refurbishment	▬	✓	▬	▬	▬	▬	✓	▬	✗	10	YES
			Beach recycling	▬	✓	✗	▬	✓	▬	✓	✗	▬	10	YES
		Improve (erosion risk)	Beach nourishment	▬	▬	▬	▬	✓	▬	▬	✗	✓	10	YES
			Timber groynes	▬	▬	▬	▬	▬	▬	▬	▬	▬	9	
			Rock groynes	▬	▬	✓	✗	✓	▬	▬	✓	▬	11	YES
			Crest raising	-	-	-	-	-	-	-	-	-	-	
			Seawall	▬	✗	✓	▬	✗	✗	▬	✓	▬	8	
			Concrete revetment	▬	✗	✓	✗	✗	✗	▬	✓	▬	7	
			Rock revetment	▬	▬	✓	✗	▬	▬	▬	✓	▬	10	YES
			Setback floodwall	-	-	-	-	-	-	-	-	-	-	
			Timber breastwork	▬	▬	▬	✗	▬	▬	▬	▬	▬	8	
			Gabions	▬	✓	✗	▬	✗	▬	▬	▬	▬	8	
			Sheet piling	▬	✗	✓	▬	✗	✗	▬	✓	▬	8	
			Deployable temporary defences	-	-	-	-	-	-	-	-	-	-	
			Deployable permanent defences	-	-	-	-	-	-	-	-	-	-	
			Slope armour and reinforcement	▬	✓	✗	▬	✗	▬	▬	▬	▬	8	
			Cliff slope stabilisation / drainage	▬	✗	✓	▬	▬	▬	▬	✓	▬	10	YES
			Land raising	-	-	-	-	-	-	-	-	-	-	
		Managed Realignment	Beach recycling	▬	✓	✗	▬	✓	▬	✓	✗	▬	10	YES
			Beach nourishment	-	-	-	-	-	-	-	-	-	-	
			Timber groynes	▬	▬	▬	▬	▬	▬	✗	▬	▬	8	
			Rock groynes	▬	▬	✓	✗	✓	▬	▬	✓	▬	11	YES
			Crest raising	-	-	-	-	-	-	-	-	-	-	
			Seawall	▬	✗	✓	▬	✗	✗	▬	✓	▬	8	
			Concrete revetment	▬	✗	✓	✗	✗	✗	▬	✓	▬	7	
			Rock revetment	▬	▬	✓	✗	▬	▬	▬	✓	▬	10	YES
			Setback floodwall	-	-	-	-	-	-	-	-	-	-	
			Timber breastwork	▬	▬	▬	✗	▬	▬	▬	▬	▬	8	
			Gabions	▬	✓	✗	▬	✗	▬	▬	▬	▬	8	
			Sheet piling	▬	✗	✓	▬	✗	✗	▬	✓	▬	8	
			Deployable temporary defences	-	-	-	-	-	-	-	-	-	-	
			Deployable permanent defences	-	-	-	-	-	-	-	-	-	-	
			Slope armour and reinforcement	▬	✓	✗	▬	✗	▬	▬	▬	▬	8	
			Cliff slope stabilisation / drainage	▬	✗	✓	▬	▬	▬	▬	✓	▬	10	YES
			Land raising	-	-	-	-	-	-	-	-	-	-	
			Offshore breakwater	▬	✗	✓	▬	▬	▬	✗	▬	✓	9	YES
			Offshore reef	▬	✗	✓	▬	▬	▬	✗	▬	✓	9	YES
		Adaptation / Resilience	Property level resilience and resistance	-	-	-	-	-	-	-	-	-	-	-
			Community level resilience	✗	✗	✗	✓	✓	✓	▬	✓	✗	9	YES

ODU 14 – Naish Cliff and Barton on Sea

Improve / Managed Realignment

Based on the scores of the multicriteria appraisal, several long list measures have been discounted and are not included in the short list in ODU 14 for the Improve and Managed Realignment Strategic options:

- Timber groynes: the area currently has rock groynes and reuse of the rock material is likely to provide cost savings compared to new timber groynes. Rock groynes typically have a longer design life and less maintenance.
- Seawall / concrete revetment / sheet piling: these measures are likely high cost relative to the rock revetment / rock armour measure and could also have a greater carbon impact given the potential to re-use the rock material as required.
- Gabions / slope armour / timber breastwork: this frontage is an exposed coastal location and more robust structures have been favoured on the short list. In this environment these measures would typically have a shorter design life and need more frequently replacement than a rock revetment / rock armour.
- Setback floodwall / deployable flood defences / land raising: not appraised given coastal flood risk in this location is minimal
- Offshore breakwater / reef – both measures are likely to have a high cost and natural environment impact / visual impact. Continued use of rock armour / rock groynes along the shoreline considered preferable here. The intention of the Managed Realignment option here is to move the coastline landward and these measures do not align with this intent for this option.

SMZ	ODU	Strategic Option	Long list	Flood / erosion risk	Cost	Design life	Natural environment	Landscape / built environment	Carbon impact	Technical complexity	Maintenance / Operation	Broader outcomes	Score	Shortlist
4	1 4- Naish Cliff and Barton on Sea	Do Nothing	-	-	-	-	-	-	-	-	-	-	-	-
		Do Minimum	Patch and repair	-	-	-	-	-	-	-	-	-	-	YES
		Maintain	Capital refurbishment	▬	✓	▬	▬	▬	▬	✓	▬	✗	10	YES
			Beach recycling	▬	✓	✗	▬	✓	▬	✓	✗	▬	10	YES
		Improve (erosion risk)	Beach nourishment	▬	▬	▬	▬	✓	▬	▬	✗	✓	10	YES
			Timber groynes	▬	▬	▬	▬	▬	▬	▬	▬	▬	9	
			Rock groynes	▬	▬	✓	✗	▬	▬	▬	✓	▬	10	YES
			Crest raising	-	-	-	-	-	-	-	-	-	-	
			Seawall	▬	✗	✓	▬	✗	✗	▬	✓	▬	8	
			Concrete revetment	▬	✗	✓	✗	✗	✗	▬	✓	▬	7	
			Rock revetment	▬	▬	✓	✗	▬	▬	▬	✓	▬	10	YES
			Timber breastwork	▬	▬	▬	✗	▬	▬	✗	▬	▬	7	
			Gabions	▬	▬	✗	▬	▬	▬	▬	✗	▬	7	
			Sheet piling	▬	✗	✓	▬	✗	✗	▬	✓	▬	8	
			Slope armour and reinforcement	▬	✓	✗	▬	✗	▬	▬	▬	▬	8	
			Cliff slope stabilisation / drainage	▬	✗	✓	▬	▬	▬	▬	✓	▬	10	YES
			Land reclaimation	▬	✗	✓	✗	✗	✗	✗	▬	✓	6	
			Offshore breakwater	▬	✗	✓	▬	▬	▬	✗	▬	▬	8	
			Offshore reef	▬	✗	✓	▬	▬	▬	✗	▬	▬	8	
		Managed Realignment - transition the coastline to a more sustainable position	Beach nourishment	▬	▬	▬	▬	✓	▬	▬	✗	✓	10	YES
			Timber groynes	▬	▬	▬	▬	▬	▬	▬	▬	▬	9	
			Rock groynes	▬	▬	✓	✗	▬	▬	▬	✓	▬	10	YES
			Crest raising	-	-	-	-	-	-	-	-	-	-	
			Seawall	▬	✗	✓	▬	✗	✗	▬	✓	▬	8	
			Concrete revetment	▬	✗	✓	✗	✗	✗	▬	✓	▬	7	
			Rock revetment	▬	▬	✓	✗	▬	▬	▬	✓	▬	10	YES
			Timber breastwork	▬	▬	▬	✗	▬	▬	✗	▬	▬	7	
			Gabions	▬	▬	✗	▬	▬	▬	▬	✗	▬	7	
			Sheet piling	▬	✗	✓	▬	✗	✗	▬	✓	▬	8	
			Slope armour and reinforcement	▬	✓	✗	▬	✗	▬	▬	▬	▬	8	
			Cliff slope stabilisation / drainage	▬	✗	✓	▬	▬	▬	▬	✓	▬	10	YES
			Land reclaimation	-	-	-	-	-	-	-	-	-	-	
		Adaptation / Resilience	Community level resilience	✗	✗	✗	✓	✓	✓	▬	✓	✗	9	YES

ODU 15 –Barton on Sea to Hordle

Improve

Based on the scores of the multicriteria appraisal, several long list measures have been discounted and are not included in the short list in ODU 15 for the Improve Strategic option:

- Seawall / concrete revetment / sheet piling / rock revetment / rock groynes / timber groynes: these measures are all hard defences that are likely to have a high cost relative to the very low benefits that could be delivered in this location, and would therefore be unfeasible from an economic, funding and deliverability perspective. These measures would also limit the amount of source material from the cliffs in this location.
- Gabions / slope armour / timber breastwork: these are likely to be lower cost solutions that the defences above, but the cost would still likely outweigh the benefits being delivered. In this environment these measures would typically have a shorter design life and need more frequently replacement than the structures above.
- Slope stabilisation and drainage: this is typically a high cost solution and the cost would likely outweigh the benefits being delivered.
- Land reclamation: not an appropriate solution here due to high cost and impact on coastal processes.
- Offshore breakwater / reef – both measures are likely to have a high cost and natural environment impact / visual impact.

SMZ	ODU	Strategic Option	Long list	Flood / erosion risk	Cost	Design life	Natural environment	Landscape / built environment	Carbon impact	Technical complexity	Maintenance / Operation	Broader outcomes	Score	Shortlist
5	15- Barton on Sea to Hordle	Do Nothing	-	-	-	-	-	-	-	-	-	-	-	-
		Do Minimum	Patch and repair	-	-	-	-	-	-	-	-	-	-	YES
		Maintain	Capital refurbishment	-	-	-	-	-	-	-	-	-	-	
			Beach recycling	▬	✓	✗	▬	✓	▬	✓	✗	▬	10	YES
		Improve (erosion risk)	Beach recycling	▬	✓	✗	▬	✓	▬	✓	✗	▬	10	YES
			Beach nourishment	▬	▬	▬	▬	✓	▬	▬	✗	✓	10	YES
			Timber groynes	▬	✗	▬	▬	▬	▬	▬	▬	▬	8	
			Rock groynes	▬	✗	✓	✗	▬	▬	▬	✓	▬	9	
			Crest raising	-	-	-	-	-	-	-	-	-	-	
			Seawall	▬	✗	✓	▬	✗	✗	▬	✓	▬	8	
			Concrete revetment	▬	✗	✓	✗	✗	✗	▬	✓	▬	7	
			Rock revetment	▬	✗	✓	✗	▬	▬	▬	✓	▬	9	
			Timber breastwork	▬	✗	▬	✗	▬	▬	▬	▬	▬	7	
			Gabions	▬	✗	✗	▬	▬	▬	▬	✗	▬	6	
			Sheet piling	▬	✗	✓	▬	✗	✗	▬	✓	▬	8	
			Slope armour and reinforcement	▬	✗	✗	▬	✗	▬	▬	▬	▬	6	
			Cliff slope stabilisation / drainage	▬	✗	✓	▬	▬	▬	▬	▬	▬	9	
			Land reclaimation	▬	✗	✓	✗	✗	✗	✗	▬	✓	6	
			Offshore breakwater	▬	✗	✓	✗	✗	▬	✗	▬	▬	6	
			Offshore reef	▬	✗	✓	✗	▬	▬	✗	▬	✓	8	
		Adaptation / Resilience	Community level resilience	✗	✗	✗	✓	✓	✓	▬	✓	✗	9	YES

ODU 16 – Cliff Road

Based on the scores of the multicriteria appraisal, several long list measures have been discounted and are not included in the short list in ODU 16 for the Improve and Managed Realignment Strategic options:

Improve

- Concrete revetment / sheet piling: these measures are likely high cost and could also have a large carbon impact. Seawall favoured to concrete revetment as lower defence footprint.
- Gabions / slope armour / timber breastwork: this frontage is an exposed coastal location and more robust structures have been favoured on the short list. In this environment these measures would typically have a shorter design life and need more frequently replacement than a rock / seawall.
- Crest raising / setback floodwall / setback embankment / deployable flood defences / land raising: not appraised given coastal flood risk in this location is minimal.

Managed Realignment

- Timber / rock groynes: ethos of Managed Realignment approach is to improve beach in ODUs 17 and 18 and groynes in ODU 16 would trap material and make it harder to achieve objectives in adjacent units.
- Seawall / concrete revetment / sheet piling: considered as potential measures for the new strong point but these measures are likely high cost relative to the rock revetment / rock armour measure and could also have a greater carbon impact.
- Gabions / slope armour / timber breastwork: considered as potential measures for the new strong point but this frontage is an exposed coastal location and more robust structures have been favoured on the short list. In this environment these measures would typically have a shorter design life and need more frequently replacement than a rock / seawall.
- Crest raising / setback floodwall / setback embankment / deployable flood defences / land raising: not appraised given coastal flood risk in this location is minimal.

SMZ	ODU	Strategic Option	Long list	Flood / erosion risk	Cost	Design life	Natural environment	Landscape / built environment	Carbon impact	Technical complexity	Maintenance / Operation	Broader outcomes	Score	Shortlist
6	16 - Cliff Road	Do Nothing	-	-	-	-	-	-	-	-	-	-	-	-
		Do Minimum	Patch and repair	-	-	-	-	-	-	-	-	-	-	YES
		Maintain	Capital refurbishment	▬	✓	▬	▬	▬	▬	✓	▬	✗	10	YES
			Beach recycling / small scale recharge (as currently undertaken)	▬	✓	✗	▬	✓	▬	✓	✗	▬	10	YES
		Improve (erosion risk)	Beach nourishment	▬	▬	▬	▬	✓	▬	▬	✗	✓	10	YES
			Timber groynes	▬	▬	▬	▬	▬	▬	▬	▬	▬	9	YES
			Rock groynes	▬	▬	✓	✗	▬	▬	▬	✓	▬	10	YES
			Crest raising	-	-	-	-	-	-	-	-	-	-	
			Seawall	▬	✗	✓	▬	✗	✗	▬	✓	✓	9	YES
			Concrete revetment	▬	✗	✓	✗	✗	✗	▬	✓	▬	7	
			Rock revetment	▬	▬	✓	✗	✗	▬	▬	✓	▬	9	YES
			Setback floodwall	-	-	-	-	-	-	-	-	-	-	
			Timber breastwork	▬	▬	▬	✗	▬	▬	▬	▬	▬	8	
			Gabions	▬	▬	✗	▬	▬	▬	▬	✗	▬	7	
			Sheet piling	▬	✗	✓	▬	✗	✗	▬	✓	▬	8	
			Embankment	-	-	-	-	-	-	-	-	-	-	
			Flood storage areas	-	-	-	-	-	-	-	-	-	-	
			Deployable temporary defences	-	-	-	-	-	-	-	-	-	-	
			Deployable permanent defences	-	-	-	-	-	-	-	-	-	-	
			Slope armour and reinforcement	▬	✓	✗	▬	✗	▬	▬	▬	▬	8	
			Cliff slope stabilisation / drainage	▬	✗	✓	▬	▬	▬	▬	✓	▬	10	YES
			Land raising	-	-	-	-	-	-	-	-	-	-	
			Land reclaimation	▬	✗	✓	✗	✗	✗	✗	▬	✓	6	
		Managed Realignment	Beach recycling (during realignment and after realignment)	▬	✓	✗	▬	✓	▬	✓	✗	▬	10	YES
			Beach nourishment (after realignment)	▬	▬	▬	▬	✓	▬	▬	✗	✓	10	YES
			Timber groynes	▬	▬	▬	▬	▬	▬	✗	✗	▬	7	
			Rock groynes	▬	▬	✓	✗	▬	▬	✗	▬	▬	8	
			Crest raising	-	-	-	-	-	-	-	-	-	-	
			Seawall (after realignment)	▬	✗	✓	▬	✗	✗	▬	✓	▬	8	
			Concrete revetment (after realignment)	▬	✗	✓	✗	✗	✗	▬	✓	▬	7	
			Rock revetment (localised, after realignment)	▬	▬	✓	✗	✗	▬	▬	✓	▬	9	YES
			Setback floodwall	-	-	-	-	-	-	-	-	-	-	
			Timber breastwork (after realignment)	▬	▬	▬	✗	▬	▬	▬	▬	▬	8	
			Gabions (after realignment)	▬	▬	✗	▬	▬	▬	▬	✗	▬	7	
			Sheet piling (after realignment)	▬	✗	✓	▬	✗	✗	▬	✓	▬	8	
			Embankment	-	-	-	-	-	-	-	-	-	-	
			Flood storage areas	-	-	-	-	-	-	-	-	-	-	
			Deployable temporary defences	-	-	-	-	-	-	-	-	-	-	
			Deployable permanent defences	-	-	-	-	-	-	-	-	-	-	
			Slope armour and reinforcement	▬	✓	✗	▬	✗	▬	▬	▬	▬	8	
			Cliff slope stabilisation / drainage (after realignment)	▬	✗	✓	▬	▬	▬	▬	✓	▬	10	YES
			Land raising	-	-	-	-	-	-	-	-	-	-	
			Land reclaimation	-	-	-	-	-	-	-	-	-	-	
		Adaptation / Resilience	Property level resilience and resistance (beach huts - moving)	✗	▬	▬	✓	✓	▬	✗	▬	✗	8	
			Community level resilience	✗	✗	✗	✓	✓	✓	▬	✓	✗	9	YES

ODU 17 – Rook Cliff

Based on the scores of the multicriteria appraisal, several long list measures have been discounted and are not included in the short list in ODU 17 for the Improve and Managed Realignment Strategic options:

Improve

- Concrete revetment / sheet piling: these measures are likely high cost and could also have a large carbon impact. Seawall favoured to concrete revetment as lower defence footprint.
- Gabions / slope armour / timber breastwork: this frontage is an exposed coastal location and more robust structures have been favoured on the short list. In this environment these measures would typically have a shorter design life and need more frequently replacement than a rock / seawall.
- Deployable temporary defences (such as deployable flood barriers) – in this unit given it is likely that long lengths of temporary defences would need to be deployed. Therefore this measure scores poorly in the operation / maintenance category as well as technical complexity and broader outcomes. Flood risk here driven by wave overtopping which is inherently uncertain so risk of frequently deploying defences when not needed. Passive structure favourable here.
- Offshore breakwater / reef – considered as part of managed realignment option instead as would change shoreline position
- Setback floodwall / setback embankment / crest raising / localised land raising (local flood risk measures): these measures were ruled as erosion risk is the key issue here, not flood risk

Managed Realignment

- Seawall / concrete revetment / sheet piling: existing structure is rock revetment which can be moved as required to facilitate the managed realignment option(s). Seawall, concrete revetment and sheet piling are permanently fixed and do not provide flexibility in approach.
- Gabions / slope armour / timber breastwork: exposed open coast environment, these structures would not provide robust defence and would need to be replaced / repaired frequently.
- Deployable temporary defences (such as deployable flood barriers) – in this unit given it is likely that long lengths of temporary defences would need to be deployed. Therefore this measure scores poorly in the operation / maintenance category as well as technical complexity and broader outcomes. Flood risk here driven by wave overtopping which is inherently uncertain so risk of frequently deploying defences when not needed. Passive structure favourable here.
- Setback floodwall / setback embankment / crest raising / localised land raising (local flood risk measures): these measures were ruled as erosion risk is the key issue here, not flood risk

SMZ	ODU	Strategic Option	Long list	Flood / erosion risk	Cost	Design life	Natural environment	Landscape / built environment	Carbon impact	Technical complexity	Maintenance / Operation	Broader outcomes	Score	Shortlist
6	17 - Rook Cliff	Do Nothing	-	-	-	-	-	-	-	-	-	-	-	-
		Do Minimum	Patch and repair	-	-	-	-	-	-	-	-	-	-	YES
		Maintain	Capital refurbishment	▬	✓	▬	▬	▬	▬	✓	▬	✗	10	YES
			Beach recycling / small scale recharge (as currently undertaken)	▬	✓	✗	▬	✓	▬	✓	✗	▬	10	YES
		Improve (erosion risk)	Beach nourishment	▬	▬	▬	▬	✓	▬	▬	✗	✓	10	YES
			Timber groynes	▬	▬	▬	▬	▬	▬	▬	▬	▬	9	YES
			Rock groynes	▬	▬	✓	✗	▬	▬	▬	✓	▬	10	YES
			Crest raising	-	-	-	-	-	-	-	-	-	-	
			Seawall (gap in existing seawall west of White House)	▬	✗	✓	▬	✗	✗	▬	✓	✓	9	YES
			Concrete revetment	▬	✗	✓	✗	✗	✗	▬	✓	▬	7	
			Rock revetment	▬	▬	✓	✗	▬	▬	▬	✓	▬	10	YES
			Setback floodwall (localised flood risk - east part of unit only)	-	-	-	-	-	-	-	-	-	-	
			Timber breastwork	▬	▬	▬	✗	▬	▬	▬	▬	▬	8	
			Gabions	▬	▬	✗	▬	▬	▬	▬	✗	▬	7	
			Sheet piling	▬	✗	✓	▬	✗	✗	▬	✓	▬	8	
			Setback embankment (localised flood risk - east part of unit only)	-	-	-	-	-	-	-	-	-	-	
			Flood storage areas	-	-	-	-	-	-	-	-	-	-	
			Deployable temporary defences (localised flood risk - east part of unit only)	-	-	-	-	-	-	-	-	-	-	
			Deployable permanent defences (localised flood risk - east part of unit only)	-	-	-	-	-	-	-	-	-	-	
			Slope armour and reinforcement	▬	✓	✗	▬	✗	▬	▬	▬	▬	8	
			Cliff slope stabilisation / drainage (Rook Cliff, not at White House)	▬	✗	✓	▬	▬	▬	▬	✓	▬	10	YES
			Land raising (east end of unit)	-	-	-	-	-	-	-	-	-	-	
			Land reclaimation	▬	✗	✓	✗	✗	✗	✗	▬	✓	6	
		Managed Realignment	Beach nourishment	▬	▬	▬	▬	✓	▬	▬	✗	✓	10	YES
			Timber groynes (on realigned position)	▬	▬	▬	▬	▬	▬	▬	▬	▬	9	YES
			Rock groynes (on realigned position)	▬	▬	✓	✗	▬	▬	▬	✓	▬	10	YES
			Crest raising (east part of unit at White House where defence would stay in position (strong point))	-	-	-	-	-	-	-	-	-	-	
			Seawall	▬	✗	✓	▬	✗	✗	▬	✓	▬	8	
			Concrete revetment	▬	✗	✓	✗	✗	✗	▬	✓	▬	7	
			Rock revetment (for realigned coastline)	▬	▬	✓	✗	▬	▬	▬	✓	▬	10	YES
			Setback floodwall (localised flood risk - east part of unit only)	-	-	-	-	-	-	-	-	-	-	
			Timber breastwork	▬	▬	▬	✗	▬	▬	▬	▬	▬	8	
			Gabions	▬	▬	✗	▬	▬	▬	▬	✗	▬	7	
			Sheet piling	▬	✗	✓	▬	✗	✗	▬	✓	▬	8	
			Setback embankment (localised flood risk - east part of unit only)	-	-	-	-	-	-	-	-	-	-	
			Flood storage areas	-	-	-	-	-	-	-	-	-	-	
			Deployable temporary defences (localised flood risk - east part of unit only)	-	-	-	-	-	-	-	-	-	-	
			Deployable permanent defences (localised flood risk - east part of unit only)	-	-	-	-	-	-	-	-	-	-	
			Slope armour and reinforcement	▬	✓	✗	▬	✗	▬	▬	▬	▬	8	
			Cliff slope stabilisation / drainage (Rook Cliff, not at White House)	▬	✗	✓	▬	▬	▬	▬	✓	▬	10	YES
			Land raising (east end of unit)	-	-	-	-	-	-	-	-	-	-	
			Land reclaimation	-	-	-	-	-	-	-	-	-	-	
			Offshore breakwater	▬	✗	✓	▬	▬	▬	✗	▬	✓	9	YES
			Offshore reef	▬	✗	✓	▬	▬	▬	✗	▬	✓	9	YES
		Adaptation / Resilience	Property level resilience and resistance	-	-	-	-	-	-	-	-	-	-	
			Community level resilience	✗	✗	✗	✓	✓	✓	▬	✓	✗	9	YES

ODU 18 – Milford on Sea frontage

Based on the scores of the multicriteria appraisal, several long list measures have been discounted and are not included in the short list in ODU 18 for the Improve and Managed Realignment Strategic options:

Improve

- Sheet piling: area used extensive for amenity / recreation and visual impact of sheet piling would likely change character of area. Other more favourable approaches. However sheet piling could be used as buried foundations to another structure, e.g. a seawall.
- Gabions / slope armour / timber breastwork: this frontage is an exposed coastal location and more robust structures have been favoured on the short list. In this environment these measures would typically have a shorter design life and need more frequently replacement than a rock / seawall.
- Deployable temporary defences (such as deployable flood barriers) – in this unit given it is likely that long lengths of temporary defences would need to be deployed. Therefore this measure scores poorly in the operation / maintenance category as well as technical complexity and broader outcomes. Flood risk here driven by wave overtopping which is inherently uncertain so risk of frequently deploying defences when not needed. Passive structure favourable here.
- Offshore breakwater / reef – considered as part of managed realignment option instead as would change shoreline position

Managed Realignment

- Sheet piling: area used extensive for amenity / recreation and visual impact of sheet piling would likely change character of area. Other more favourable approaches. However sheet piling could be used as buried foundations to another structure, e.g. a seawall.
- Gabions / slope armour / timber breastwork: exposed open coast environment, these structures would not provide robust defence and would need to be replaced / repaired frequently.
- Deployable temporary defences (such as deployable flood barriers) – in this unit given it is likely that long lengths of temporary defences would need to be deployed. Therefore this measure scores poorly in the operation / maintenance category as well as technical complexity and broader outcomes. Flood risk here driven by wave overtopping which is inherently uncertain so risk of frequently deploying defences when not needed. Passive structure favourable here.
- Land raising – not feasible as part of MR approach due to potential coastline movements / erosion of new raised area

SMZ	ODU	Strategic Option	Long list	Flood / erosion risk	Cost	Design life	Natural environment	Landscape / built environment	Carbon impact	Technical complexity	Maintenance / Operation	Broader outcomes	Score	Shortlist
6	18 - Milford on Sea frontage	Do Nothing	-	-	-	-	-	-	-	-	-	-	-	-
		Do Minimum	Patch and repair	-	-	-	-	-	-	-	-	-	-	YES
		Maintain	Capital refurbishment	▬	✓	▬	▬	▬	▬	✓	▬	✗	10	YES
			Beach recycling / small scale recharge (as currently undertaken)	▬	✓	✗	▬	✓	▬	✓	✗	▬	10	YES
		Improve (erosion risk) (HLT)	Beach nourishment	▬	▬	▬	▬	✓	▬	▬	✗	✓	10	YES
			Timber groynes	▬	▬	▬	▬	▬	▬	▬	▬	▬	9	YES
			Rock groynes	▬	▬	✓	✗	▬	▬	▬	✓	▬	10	YES
			Crest raising (existing)	▬	▬	▬	✓	✗	▬	▬	✓	▬	10	YES
			Seawall (new)	✓	✗	✓	✓	✗	✗	▬	✓	✓	11	YES
			Concrete revetment (new)	✓	✗	✓	▬	✗	✗	▬	✓	✓	10	YES
			Rock revetment	✓	▬	✓	✗	▬	▬	▬	✓	✗	10	YES
			Setback floodwall (localised flood risk)	▬	▬	✓	✓	✗	✗	▬	✓	▬	10	YES
			Timber breastwork	▬	▬	▬	✗	▬	▬	▬	▬	▬	8	
			Gabions	▬	▬	✗	▬	▬	▬	▬	✗	▬	7	
			Sheet piling	▬	✗	✓	▬	✗	✗	▬	✓	▬	8	
			Setback embankment / bund (localised flood risk)	▬	▬	✓	✓	▬	▬	▬	✓	▬	12	YES
			Flood storage areas	-	-	-	-	-	-	-	-	-	-	
			Deployable temporary defences (localised flood risk)	▬	▬	▬	✓	✓	▬	✗	✗	✗	8	
			Deployable permanent defences (localised flood risk)	▬	✗	▬	✓	✓	▬	▬	✗	✗	8	
			Slope armour and reinforcement	-	-	-	-	-	-	-	-	-	-	
			Cliff slope stabilisation / drainage	-	-	-	-	-	-	-	-	-	-	
			Land raising	▬	✗	✓	▬	▬	▬	▬	▬	▬	9	YES
			Land reclaimation	▬	✗	✓	✗	✗	✗	✗	▬	✓	6	
		Managed Realignment	Beach nourishment	▬	▬	▬	▬	✓	▬	▬	✗	✓	10	YES
			Timber groynes (on realigned position)	▬	▬	▬	▬	▬	▬	▬	▬	▬	9	YES
			Rock groynes (on realigned position)	▬	▬	✓	✗	▬	▬	▬	✓	▬	10	YES
			Crest raising	▬	▬	▬	✓	✗	▬	▬	✓	▬	10	YES
			Seawall (for realigned coastline)	✓	✗	✓	✓	✗	✗	▬	✓	▬	10	YES
			Concrete revetment (for realigned coastline)	✓	✗	✓	▬	✗	✗	▬	✓	▬	9	YES
			Rock revetment (for realigned coastline)	✓	▬	✓	▬	▬	▬	▬	✓	▬	12	YES
			Setback floodwall (localised flood risk)	▬	▬	✓	✓	✗	✗	▬	✓	▬	10	YES
			Timber breastwork	▬	▬	▬	✗	▬	▬	▬	▬	▬	8	
			Gabions	▬	▬	✗	▬	▬	▬	▬	✗	▬	7	
			Sheet piling	▬	✗	✓	▬	✗	✗	▬	✓	▬	8	
			Setback embankment / bund (localised flood risk)	▬	▬	✓	✓	▬	▬	▬	✓	▬	12	YES
			Flood storage areas	-	-	-	-	-	-	-	-	-	-	
			Deployable temporary defences (localised flood risk)	▬	▬	▬	✓	✓	▬	✗	✗	✗	8	
			Deployable permanent defences (localised flood risk)	▬	✗	▬	✓	✓	▬	▬	✗	✗	8	
			Slope armour and reinforcement	-	-	-	-	-	-	-	-	-	-	
			Cliff slope stabilisation / drainage	-	-	-	-	-	-	-	-	-	-	
			Land raising	-	-	-	-	-	-	-	-	-	-	
			Land reclaimation	-	-	-	-	-	-	-	-	-	-	
			Offshore breakwater	▬	✗	✓	▬	▬	▬	✗	▬	✓	9	YES
			Offshore reef	▬	✗	✓	▬	▬	▬	✗	▬	✓	9	YES
		Adaptation / Resilience	Property level resilience and resistance	-	-	-	-	-	-	-	-	-	-	
			Community level resilience	✗	✗	✗	✓	✓	✓	▬	✓	✗	9	YES

Appendix B - Sensitivity Test

Cost sensitivity

A sensitivity test has been undertaken to determine the potential impact on the multicriteria appraisal scoring if the indicative cost of measures is not included as an appraisal category. Excluding the cost category from the appraisal brings the total scores of the measures closer together by either reducing the total score of a measure or increasing the total score. Table A-1 below summarises the results of this sensitivity test and proposed changes to the short list following this sensitivity test.

Table A-1: Cost sensitivity test

SMZ	ODU	Strategic option	Main changes to short list when cost excluded from appraisal	Proposed change to short list following sensitivity test
1	1	Sustain / Improve	Inclusion of: Sheet piling (toe protection) and offshore reef.	No change. Both of these measures would not provide any clear benefits compared to the existing short list measures in this location.
		Managed Realignment	No change.	No change.
	2	Sustain / Improve	Inclusion of: Sheet piling.	No change. Measure still has large negative impacts associated with it, such as landscape / visual impact as not in line with character of area.
		Managed Realignment	No change.	No change.
2	3	Sustain / Improve	Inclusion of: Land raising.	No change. Other short list measures considered more feasible here, such as localised protection to properties at risk.
	4	Sustain / Improve	No change.	No change.
	5	Sustain / Improve	No change.	No change.
	6	Sustain / Improve	No change.	No change.
	7	Sustain / Improve	No change.	No change.
	8	Sustain / Improve	No change.	No change.
	9	Sustain / Improve	No change.	No change.
	10	Sustain / Improve	Inclusion of: Land reclamation.	No change. Uncertainty around detriment flood risk impact and large impact on natural environment likely make this unfeasible.
	11	Sustain / Improve	No change.	No change.
3	12	Improve	Inclusion of: Sheet piling (toe protection) and offshore reef.	No change. Both of these measures would not provide any clear benefits compared to the existing short list in this location.
	13	Improve	No change.	No change.
		Managed Realignment	Removal of: Beach recycling.	No change. Keep this measure on shortlist.
4	14	Improve	No change.	No change.
		Managed Realignment	No change.	No change.

SMZ	ODU	Strategic option	Main changes to short list when cost excluded from appraisal	Proposed change to short list following sensitivity test
5	15	Improve	Inclusion of: groynes, seawall, rock revetment, sheet piling, cliff stabilisation / drainage, offshore reef	No change. None of these additional measures are likely to be economically viable or deliverable.
6	16	Improve	Removal of: Timber groynes, rock revetment.	No change. Keep these measures on shortlist.
		Managed Realignment	Removal of: Beach recycling and rock revetment.	No change. Keep these measures on short list as alternative to beach nourishment is required.
	17	Improve	Removal of: Timber groynes.	No change. Keep this measure on shortlist.
		Managed Realignment	Removal of: Timber groynes.	No change. Keep this measure on shortlist.
	18	Improve	Removal of: Timber groynes.	No change. Keep this measure on shortlist.
		Managed Realignment	Removal of: Timber groynes.	No change. Keep this measure on shortlist.

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