East Devon District Council

Sidmouth Beach Management Scheme

Recommendation

The selected option is known as Option 6 throughout this document. It comprises:

- Main town beach – construction of an offshore breakwater, coupled with beach recharge; Raising of the splash wall to the eastern end and futureproofing of the foundations for a section of the splash wall to the west; Remedial works to the river training wall and improvement to the slipway.
- East Beach – construction of a 120m long groyne and beach recharge.

The scheme will lead to 113 residential and 70 commercial properties being better protected (OM2s) from flood and erosion risk for up to 0.5% AEP events for 100 years benefit period (up to year 2117).

The cost for approval (cash excl. future costs) is £21,322,540

Version Control

Version 1.2, Final for assurance.

Version History

Version 1.2 Updated following LPRG review 06/10/2023

Version 1.1, Final edit from East Devon District Council. 26/04/2023

Version 1.0, (new template) draft, for East Devon District Council review,

Draft Version 1.0, East Devon District Council reviewed (previous template), 02/11/2018

Assurance and Approval Record

RMA reference number:

EA reference number:

Date of submission to EA:

Assurance from Risk Management Authority

I confirm that this Outline Business Case meets our guidelines, quality assurance requirements, environmental obligations and Defra investment appraisal conditions. All internal approvals, including member approval, have been completed. I apply to the Environment Agency for capital grant in the sum of £17,540,069 (Grant Claim Value) and local levy in the sum of £500,000 (cash values).

Name of RMA Project Executive: John Golding

[For administrative use only]

Approval from Risk Management Authority Council

Version approved:

Date:

Endorsement from Environment Agency Area Flood and Coastal Risk Manager

I confirm that the Outline Business Case is ready for assurance.

~~Applications less than £1million - I have consulted with the Area Director and Senior Finance Business Partner External Funding & Grants.~~

~~Applications up to £10million - I have consulted with the Director of Operations and the Deputy Director of Finance.~~

Applications up to £20million - I have consulted with the Executive Director of Operations and the Director of Finance.

~~Applications over £20million - I have consulted with the Executive Director of Operations, the Executive Director of FCRM and the Director of Finance.~~

Name of Area Flood and Coastal Risk Manager:

Date:

[For administrative use only]

Environment Agency Assurance and Technical Approval

I recommend that the application is granted technical approval. The record of assurance is appended to the business case.

Name of AFCRM or Lead Assurance Reviewer:

Date:

[For administrative use only]

Financial Approval

[See Section A4 of the Financial Scheme of Delegation.]

Name of Approving Officer:

Date:

Name of Approving Officer:

Date:

Name of Approving Officer:

Date:

FSoD reference:

Date:

Financial Scheme of Delegation Co-ordinator

Notes

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Contents

1.0 Project Summary

This is the Outline Business Case (OBC) for the Sidmouth Beach Management Scheme. Sidmouth is a prosperous coastal town in East Devon, with approximately 1.250km long coastal front from Connaught Gardens to the west, to East Beach / Pennington Point cliffs in the east (Grid Reference: SY 12633 87194), see Figure 1.

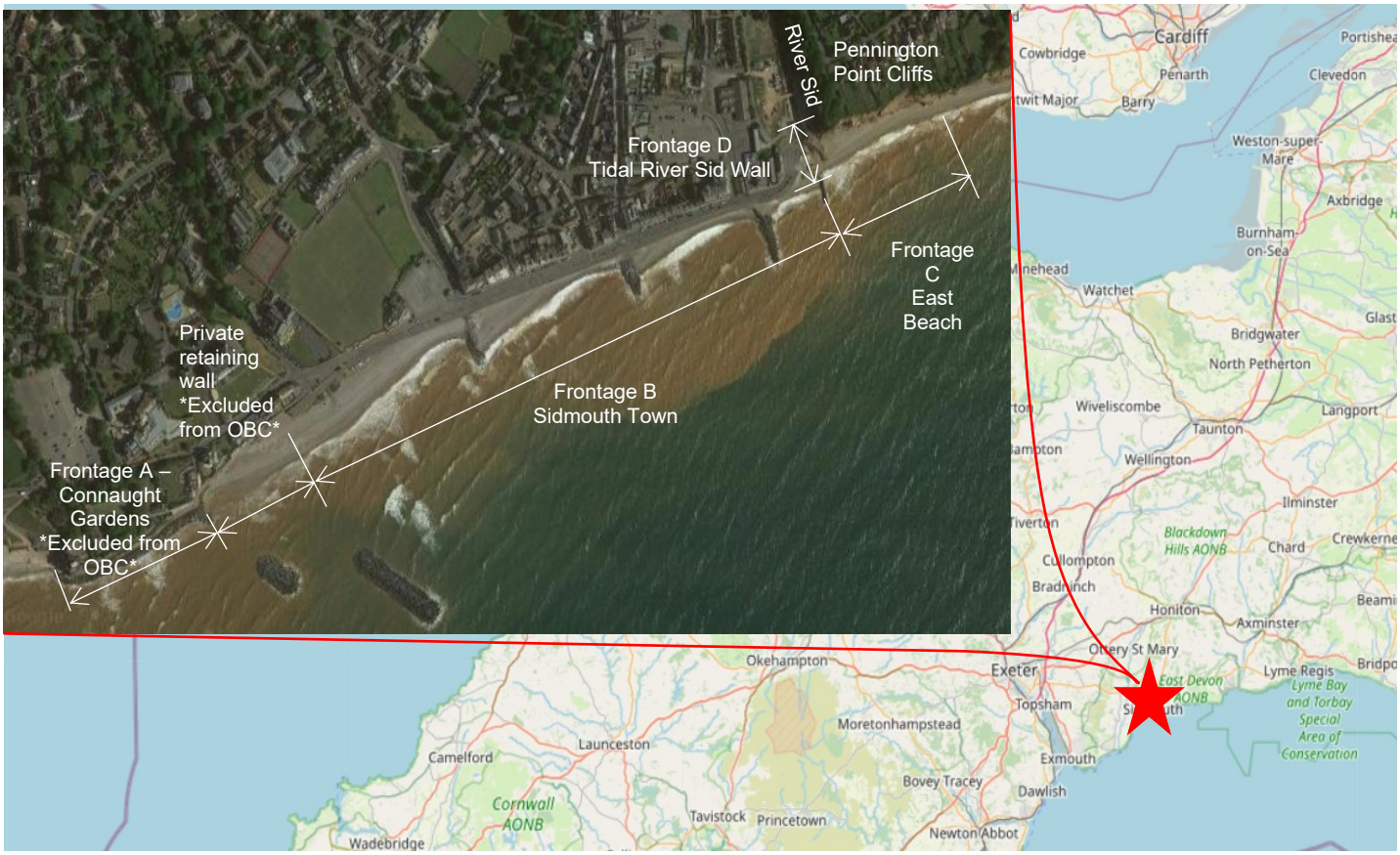


Figure 1: Sidmouth location and frontages

The Sidmouth Town frontage (Frontage A and B), has a long history of construction and maintenance of flood and coastal erosion risk management schemes, dating back to the 18th century. These coastal defences protect a large number of assets, including up to 113 residential and 70 commercial properties at risk of flooding in the low-lying Sidmouth town centre area. The discounted PV of both residential and commercial properties is estimated to be £59,720,950 over 100 years.

Critical infrastructure such as the South West Water Sidmouth sewage pumping station (near to the Alma Bridge to the east), sewage and drainage, electricity sub-stations, Sidmouth Lifeboat station and various amenity facilities including hotels, restaurants, car parks and various entertainment facilities are also at risk in this area. The South West Coast Path also runs along the promenade from west to east and across the Alma Bridge to the top of Pennington Point cliffs and beyond.

The current flood and coastal erosion risk management measures were constructed over many phases between 1991 and 2000, following coastal storms in early 1990s and are actively managed, in with the Hold the Line Shoreline Management Plan (SMP) policy. Key elements of the defences comprise (see Figure 2):

- two offshore breakwaters;
- sea wall along the town frontage with concrete apron and buried rock armour;
- three rock groynes;
- renourished beach; and
- ~300mm set-back splash wall at the back of the promenade

Conversely, flood and erosion risk is not actively managed on East Beach (Frontage C), in line with the Managed Realignment Shoreline Management Plan (SMP) policy and highly environmentally designated areas. However, in early 2000s following a series of cliff failures, political pressure was exerted and a small rock armour placed to the westernmost end of the beach. Since placement of the rock armour, no management has been carried out to this asset.

Figure 2: Sidmouth's existing coastal defence arrangement

Sidmouth town frontage has a long history of coastal flooding and erosion, particularly when beach levels are low. The town was affected by the "great gale" in November 1824, with both coastal erosion and flooding of properties reported at Sidmouth. Between 1981 and 2022, there have been approximately 14 known events whereby wave overtopping has occurred, affecting some residential and

commercial properties along the Esplanade (although exact number is unknown), with extensive waves spray and pebbles being thrown onto the promenade. Most recently, significant wave overtopping has occurred approximately every two to three years, with the most significant events in 2014, 2017, 2020 and 2022.

Due to the local topography, overtopped waters flow from the promenade landwards, towards the low-lying areas of the town, ponding in particular around York Street and Ham (West) Car Park (Figure 3).

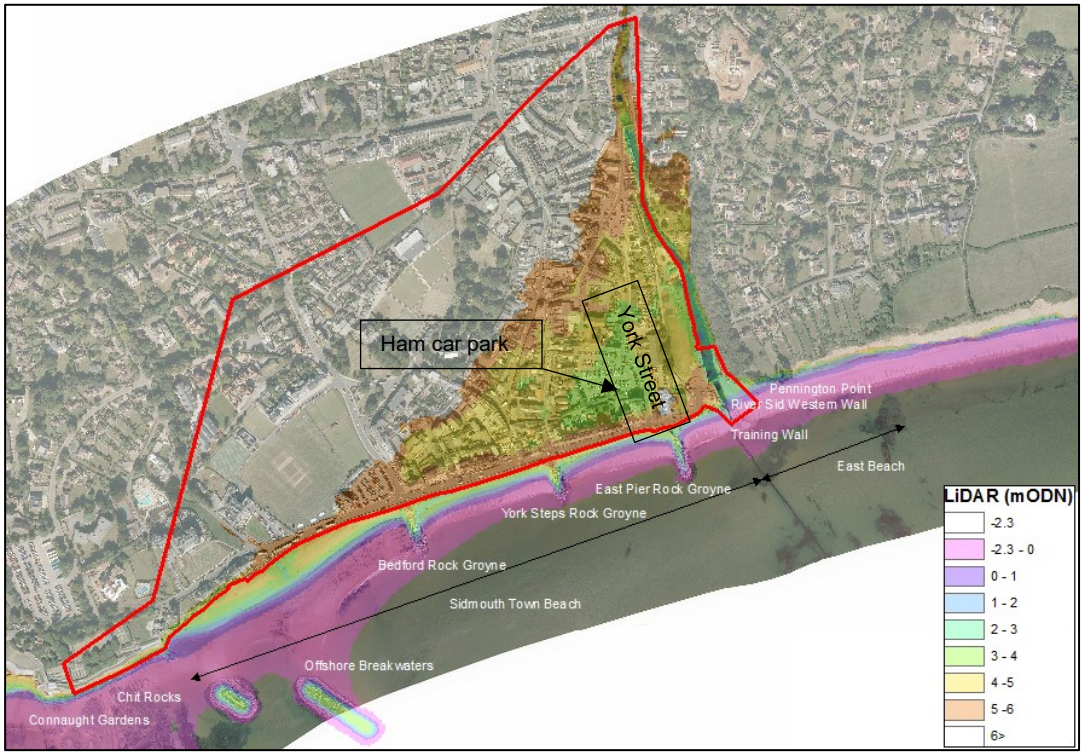


Figure 3: Sidmouth LiDAR data showing low lying areas

During the present-day scenario, 52 residential and 36 commercial properties are shown to be at very significant risk of flooding (events up to the 5% AEP events). These values rise to 123 residential and 76 commercial properties for events up to the 0.5% AEP.

With climate change by 2067, 136 residential properties and 87 commercial properties are at very significant flood risk, and 182 residential and 123 commercial ones are at risk in events up to the 0.5% AEP.

By 2117, 215 residential and 155 commercial properties are at significant risk of flooding. The flood extent and depth for the present day and 2117 5% AEP and 0.5% AEP events from the southwest are shown in Figure 4 and Figure 5.

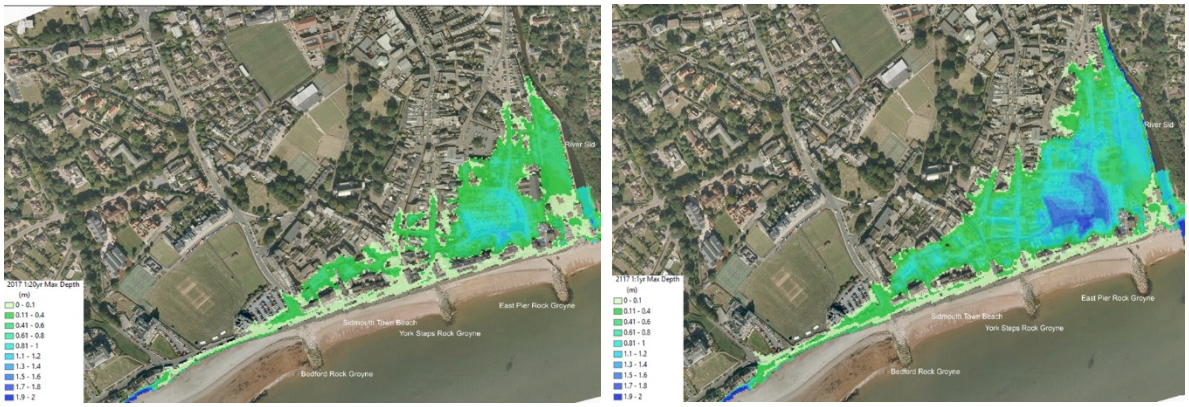


Figure 4: 2017 (left) and 2117 (right) 5% AEP flood extent and depth

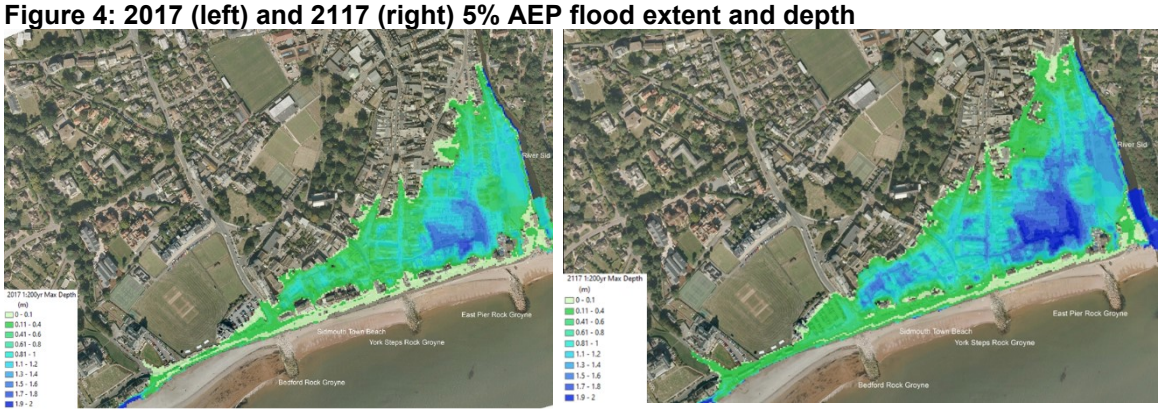


Figure 5: 2017 (left) and 2117 (right) 0.5% AEP flood extent and depth

Historically, in addition to wave overtopping and associated flooding, the town front has also suffered from coastal erosion (Figure 6), causing repetitive failure of the seawall failing at various times. The most recent storm damages in 1989 / 1990 triggered the construction of the existing coastal defence scheme. Without improvement measures, following failure of the existing sea defences, it is estimated that 45 properties, the main access road and buried services along the Esplanade are at risk of erosion in next 75 years.

Figure 6: Sidmouth, The Esplanade – Storms damage 1920s

On Frontage C to the east, the Pennington Point cliffs are eroding due to wave impacts on the cliffs toe and weathering from above. The existing narrow shingle beach at the base of the cliffs forms the main cliff protection from wave action together with a small rock armour (unmanaged) placed to its west in early 2000s,

near the mouth of the River Sid. Beach lowering, partly due to the presence of the hard defences to the west of the River Sid, is exposing increasing sections of the cliffs toe to the destructive wave actions which is contributing to the experienced recent increased rate of erosion (see Figure 7).

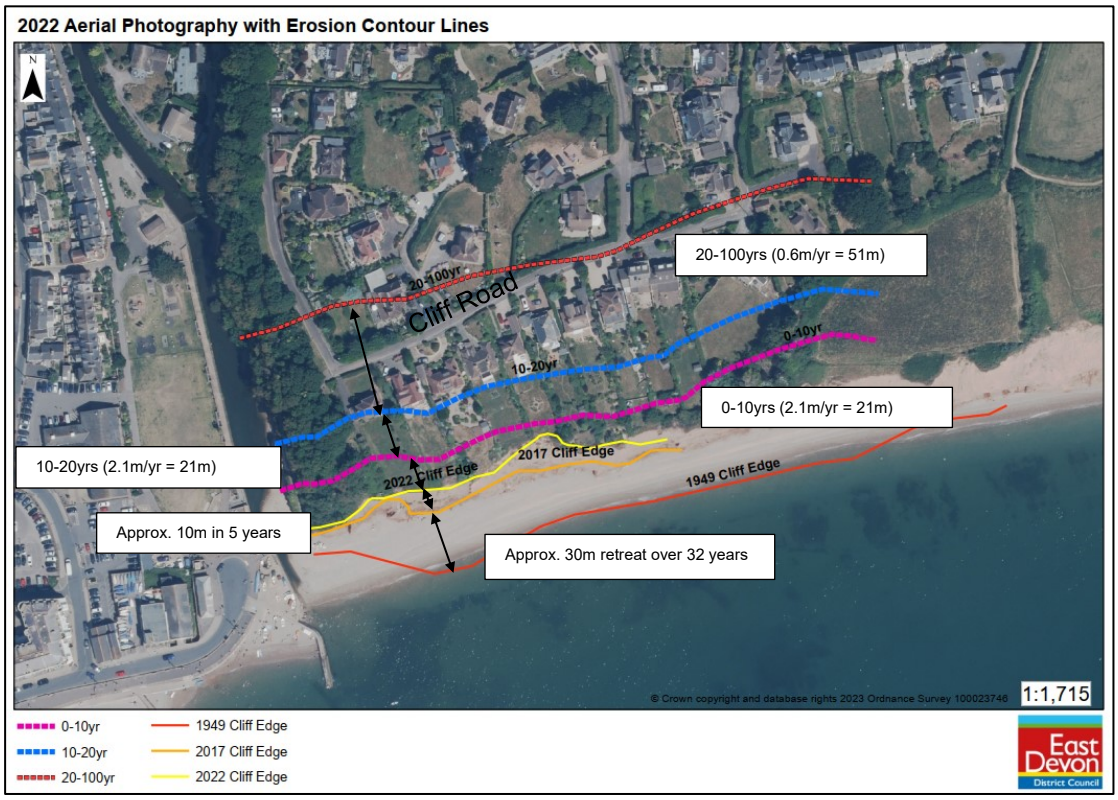


Figure 7: Sidmouth East Beach historic and predicted erosion lines

As shown above, coastal erosion in this area threatens six residential properties on the cliff top in the next 10 - 20 years, and an additional eight in the next 20 to 100 years. The road access and all buried services are also at risk of failure in the next 20 to 100 years. The South West Coast Path, historically running along the cliff edge, has already been relocated once landwards and it now runs along Cliff Road to re-join the original alignment by the Alma Bridge and continuing westwards along the promenade.

Critically, the cliff retreat poses an increased risk of flooding to Sidmouth as an indirect consequence of the Pennington Point cliffs erosion. The retreat of the cliffs exposes the fluvial River Sid Wall to open coast processes with an increased risk of flooding due to outflanking of the main coastal defences by wave overtopping in the next 10 to 20 years from south easterly events. In addition, the fluvial River Sid Wall is more likely to fail due to scour and direct coastal waves impacts, given its construction as fluvial defences and estimated residual life of 15 to 30 years (see Beach Management Plan[1] (BMP) asset condition report, 2017). A breach in the seawall in the next 20 years would increase the risk of flooding to residential and commercial properties during events up to 5% AEP from the southeast.

[1] *Sidmouth and East Beach Management Plan, East Devon District Council – CH2M, 2017*

The BMP undertaken for East Devon District Council (EDDC) in 2017, identified a long-term preferred option to address coastal flooding and erosion on the main town front and East Beach over the next 100 years. The preferred option, fundamentally comprising beach recharging on the main town front and the construction of one or two groynes on East Beach, was preferred to other shortlisted ones which included the provision of offshore breakwaters which were considered superior on technical grounds but unaffordable to constraints at the time on available Grant in Aid funding. In 2018 the BMP preferred option was taken forward to outline design and further refined.

In 2020, following updates in the Environment Agency Flood and Coastal Erosion Risk Management Appraisal Guidance (FCERM-AG) and Partnership Funding Calculator, additional Flood Defence Grant in Aid (FDGiA) was made available to the originally BMP preferred option. This provided the basis for exploring alternative options previously discounted on economic grounds but that comprised more passive defence measures and less future maintenance commitments. Further development identified the current proposed scheme which includes amongst other elements the provision of one offshore breakwater, as the preferred option on technical, economic and environmental grounds. However, it is worth noting that other more technically robust options discounted on economic grounds only could be implemented following further detailed analysis which is not feasible at this stage. Therefore, it is EDDC intention to refine the current option at detailed design stage with the aim to further reduce the current uncertainties and ascertain the possibility to include additional breakwaters and thus reducing further future maintenance commitments.

An Advisory Group was formed to provide an important link between the community, businesses, regulatory bodies and the professional consultants and Local Authority who are developing the scheme (see Table 25 for a list of representatives). This group has been consulted throughout the appraisal and option selection stage to ensure the voice and views of the local community are heard and considered.

The strong support and commitment to provide improved flood and erosion reduction measures at Sidmouth from the local community and businesses alike is also reflected in the above average external contributions provided to breach the FDGiA gap. Overall, £200k has been provided towards the scheme by the Sidmouth Lifeboat, EDDC housing and Road Cliff Action Group.

The recommended scheme has a Present Value benefit of £196,171,374 and will reduce the flood risk to 113 residential properties and 70 commercial properties. In addition, 14 properties on East Beach cliff will be better protected from erosion and 45 along the town frontage.

Total Value of Project £25,512,850 (whole life cash cost incl. sunk and future costs)

Flood risk type: Coastal

Numbers of households at flood and/or erosion risk with no scheme

Households at very significant risk now - 52
Households at significant risk now - 0
Households at intermediate risk now - 70
Households at moderate risk now - 1
Households at very significant risk in 2121 - 215
Households at significant risk in 2121 - 0
Households at intermediate risk in 2121 - 58
Households at moderate risk in 2121 - 37
Households at medium-term loss of erosion – 6
Households at long-term loss of erosion - 53

Critical Infrastructure at risk now and in 2121

Given the local topography with low lying areas in the centre of the town and rapidly rising grounds to the outskirt, the flood extent does not change significantly with climate change (unlike the flood depths which will clearly increase). Therefore, the number of critical infrastructures at risk during the present day and in 2121 does not change.

During the current day and 2121, one South West Water sewage pumping station (near the Alma Bridge to the east), the Sidmouth Lifeboat and six electricity sub-stations are at very significant risk of flooding.

Buried services along the Esplanade are at risk of erosion in the next 75 years. Also, buried services along the Cliff Road on the cliff top are at risk of erosion in the next 20 to 100 years.

Type, condition and residual life of existing defences

Refer to Figure 1 and Figure 2 for frontages and defence location.

Frontage B: Sidmouth Town Frontage

- The shingle beach along the town frontage is managed and held in place by the two nearshore breakwaters and three rock groynes. The condition of the rock groynes is considered ‘good’ to ‘very good’. The condition of the offshore breakwaters is also considered ‘good’. The residual life of these structure is uncertain although they are estimated to continue to perform for many years.
- The beach is backed by a seawall, promenade and low splash wall at the landward side of the promenade. Beach levels have lowered by ~2m since 1995 and are estimated to continue to lower in the next 100 years, albeit at a lower rate. This will expose more of the seawall with consequent. failure of the wall predicted within 75-100 years. Failure of the seawall would not affect flooding but would rapidly progress landwards causing extensive damage to the Esplanade and consequent loss of 45 residential

properties and buried services and potential loss of 45 residential properties to erosion.

Frontage C: East Beach Frontage

- The East Beach frontage consists of Pennington Point cliffs and a narrow shingle beach at their base. A small rock armour exists to the west of the beach, forming the only man-made defence to the toe of the cliffs. The cliffs are eroding and thereby retreating. The rate of erosion is varying over time showing rapid increase in recent years. Estimated rates of ~2m/year are predicted in the short to medium period (0-20 years), with a slower rate of erosion of ~5m/year in the long term (20-100 years). This poses erosion risk to 6 cliff properties on Cliff Road in the next 20 years, increasing to 8 additional properties, the Alma Bridge, coastal path (already been diverted once) between 20 to100 years.
- The retreat of the cliff is posing a risk to the fluvial River Sid Wall as it will become more exposed to open coast processes and thus at increased risk of scour, wave overtopping and failure. Failure of the fluvial wall would cause increased risk of flooding to the town as the main sea defences are outflanked and flood water would propagate from the river Sid via the Ham Car Park.

Frontage D: Mass Concrete River Sid Wall

- The existing wall is thought to be a mass concrete wall. The wall condition is “Fair” - Defects that could reduce the performance of the asset. The best estimate for complete failure of this wall is 15-30 years. As explained above, the consequence of failure is increased risk of flooding to the main town.

Key environmental designations

- Dorset to East Devon Coastal United Nations Educational, Scientific and Cultural Organisation (UNESCO) World Heritage Site (WHS) (the Jurassic Coast). Impact on type of defence measures acceptable on East Beach.
- Sidmouth conservation areas and listed buildings, a registered park and garden, and numerous non-designated archaeological sites. Impact on type / finish of coastal defences on the town front and East Beach.
- Sidmouth to Beer Coast SSSI and Sidmouth to West Bay Special Area of Conservation (SAC), including coastal waters to the MLW mark. Impact on type of defence measures acceptable on East Beach.

Regulators, such as Natural England, have been formally consulted and subject to further consultation during the detailed design and planning stage are tentatively acceptive of the proposed option

How is flood and erosion risk managed?

Frontage B - Town frontage

Currently, the erosion risk on the town front is being managed by a Do Minimum approach, comprising primarily reactive maintenance of the sea defences and opportunistic recycling depending on funding availability.

Since the 1990s scheme, there has been very limited recycling of the beach from the westernmost healthier section to the more depleted areas to the east (Frontage B only). In addition, EDDC are looking to restart annual limited recharge of Frontage B using dredged material from the River Sid at Sidford (upstream).

The remaining flood risk to the town is managed by the following hard engineered elements: offshore breakwaters and rock beach groynes, seawall and set-back splash wall (Figure 2).

To date, the offshore breakwaters have not required maintenance and have been proven effective in retaining beach material to their lee. This has minimised the need to recharge the beach in these areas. The breakwaters protect of Sidmouth Town frontage from the prevailing south westerly. However, these structures offer little flood risk reduction from the most recent increasing southerly to easterly storms events.

Rock groynes along the beach generally require little maintenance and aid maintaining the 1990s beach profile in front of the town and thus reducing wave energy hitting the seawall.

The seawall is the town's primary flood defence and since it was last improved in the 1990s, it is repointed in sections yearly. Despite comprising the main defence against flooding, it is prone to overtopping (namely recent events in 2014, 2017, 2020 and 2022), leaving pebbles and debris on the pedestrian promenade and the Esplanade which needs to be cleared post storms.

Setback from the seawall is a low splash wall, which divides the pedestrianised esplanade to the highway. Its purpose is to prevent overtopped water flowing inland and flooding into town. The maintenance regime comprises concrete repairs when required and repairs / replacements of the multiple flood gates.

River Sid Flood Defence Wall: Environment Agency asset. East Beach Cliffs eroded as they became exposed to the sea and become de-facto Sea Defences. The river wall is an historic masonry wall in fair condition owned by the landowner. Set back from this is a high concrete flood wall built as part of the 1960s fluvial flood scheme which is maintained by the Environment Agency. Although not currently a sea defence wall, over time without intervention, this wall will become increasing exposed to sea storms,

East Beach – Frontage C

Currently, the erosion risk on East Beach is not being managed within the Managed Realignment frontage, due to limitations to what Flood Risk

Management activity can be done within the designated site. However, in early 2000s, political pressure resulted in a small rock armour placement at the western most end of the cliffs which is not maintained. As described above, the cliffs on this frontage are eroding at increased rates and have already retreated beyond the former coastal path (see Figure 7) which has been moved inland to follow Cliff Road down to the Alma Bridge on the River Sid. Whilst this relocation has removed some of the public risk at the top of the cliffs by diverting users of the coastal path, risk to the cliff properties and inhabitants remain in the short term. Although the beach cannot be closed, public access has been discouraged due to public safety concerns from frequent cliff falls.

Summarise the case for change

Sidmouth is at risk of coastal flooding from south westerly and less frequently and to a lesser impact, from south easterly events. The flooding mechanism is overtopping of the coastal defences propagating inland and ponding in low-lying area. Overtopping occurs more frequently when south westerly storms coincide with high tides, particularly in the most exposed eastern areas further away from the protection of the existing offshore breakwaters. However, in recent years, Sidmouth has also experienced increased south easterly events, which hit the exposed seawall and contribute to lowering the already depleted beach.

The current coastal defences at Sidmouth provide an approximate 10% to 5% AEP (1 in 10-year to 1 in 20-year return period) standard of protection with 52 residential and 36 commercial properties in the low-lying areas landwards of the Esplanade at very significant risk from coastal flooding. Overtopped flood water propagates inland ponding in low-lying areas around York Street and Fore Street. Along the western side of the town, flooding is relatively confined to Bedford Square and Chapel Road due to the local topography rising towards the west and north. (

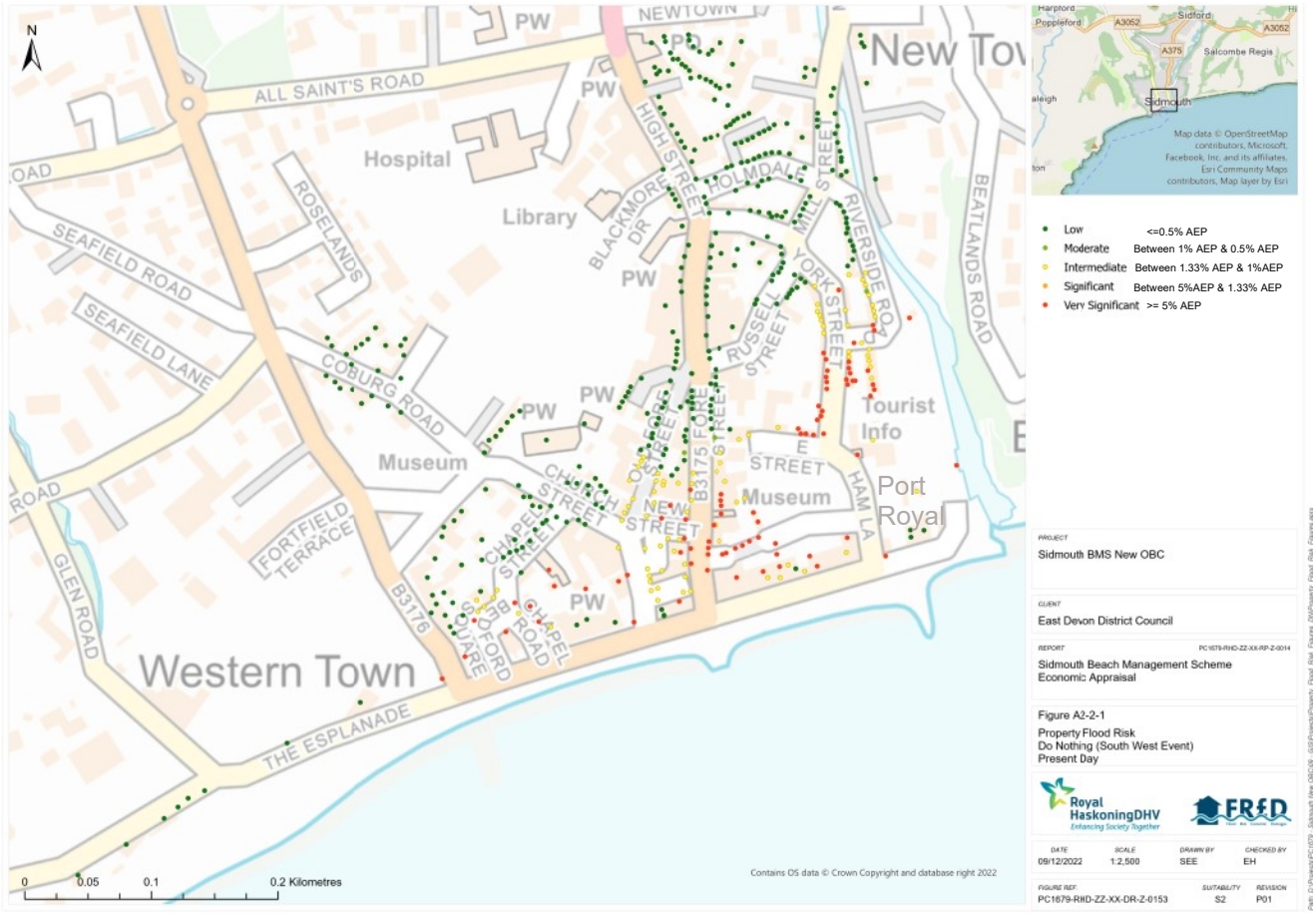


Figure 8).

During more severe events, overtopped water propagates further inland along Old Fore Street and York Street with increasingly greater flood depths whilst remaining relatively contained within the main town centre due to the locally rising ground. During the present day in events up to the 0.5%, 123 residential and 76 commercial properties are at risk of flooding.

In addition to flood risk to properties, the popular pedestrian area of the promenade is inundated almost yearly, especially towards Port Royal to the east.

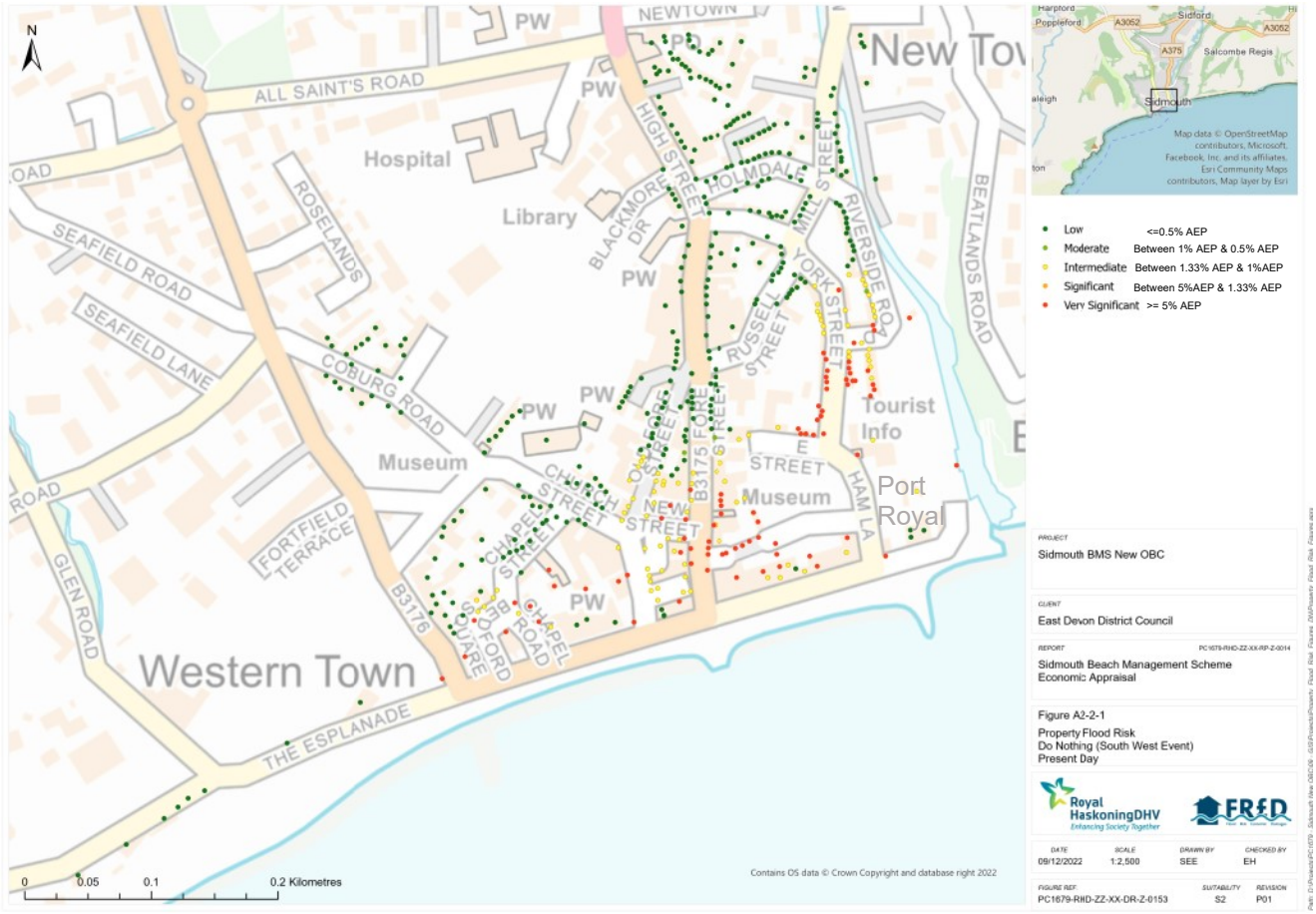


Figure 8 : 2017 properties at risk during south westerly event

Since 1995 (completion of the beach recharge scheme), beach levels on the town front to the east of the existing breakwaters have dropped to lower than the design levels, uncovering the apron of the sea wall in places. As described in the Beach Management Plan[2] (2017), using data from July 2014, an approximate loss of 63,000m^3 of material has been observed, equating to over 50% of recharged material. Beach levels have lowered in places by ~2m, with greater decrease observed to the west of the groynes. The depleted beach absorbs less wave energy thus increasing wave overtopping. Moreover, reflected waves on the now exposed vertical face of the sea wall causes greater wave set-up of the incoming waves with increased risk of overtopping and windblown spray.

Table 1 shows the present day modelled overtopping rates for different severity events from a south westerly direction for a representative profile on the main town front. The table clearly illustrates the worsening effect on the overtopping of a lowered beach profile, with present day 5% AEP events being comparable to 2% AEP events with the original 1990s design beach. This detrimental effect increases significantly for events greater than 2% AEP which predict overtopping values and thus flooding, comparable to events greater than 0.5% AEP with the 1990s design beach.

In addition, the table shows the insufficient height of the existing splash wall in reducing the overtopping rates and thus preventing the propagation in land of

[2] *Sidmouth and East Beach Management Plan, East Devon District Council – CH2M, 2017*

flood water. The estimated overtopping rates on the Esplanade also represent risk to life and road users for events with frequency lower than ~5% AEP.

Table 1: 2017 Sidmouth town front overtopping rates

AEP%	Sidmouth town front – 2017 epoch			
	Current beach profile promenade l/s/m	1990s design beach profile – promenade l/s/m	Current beach profile the Esplanade l/s/m	1990s design beach profile the Esplanade l/s/m
100%	0.87	Not modelled	0.20	Not modelled
10%	3.37	Not modelled	1.17	Not modelled
5%	4.48	Not modelled	1.82	Not modelled
2%	7.01	Not modelled	3.22	Not modelled
1.33%	8.09	3.63	3.95	1.60
1%	8.46	7.99	4.26	2.00
0.5%	8.50	7.85	4.53	3.20

Without active intervention and with climate change, the beach is estimated to continue to lower with consequent worsening of waves overtopping. Based on recent beach surveys (2007-2017), it was estimated that beach levels would lower by ~1m in 2117.

Table 2 below presents the 2117 predicted wave overtopping results with an estimated beach crest lowered by ~1m against the reinstated 1990s beach profile. Results have been extracted landwards of the existing splash wall. The 2117 100% AEP it is comparable with events more severe than the present 2017 0.5% AEP.

Table 2: 2117 Sidmouth town front overtopping rates

AEP%	Sidmouth town front – 2117 epoch			
	Future depleted beach profile – promenade l/s/m	1990s design beach profile – promenade l/s/m	Future depleted beach profile – the Esplanade l/s/m	1990s design beach profile – the Esplanade l/s/m
100%	19.28	Not modelled	8.57	Not modelled
10%	39.52	Not modelled	21.54	Not modelled
5%	40.63	Not modelled	21.89	Not modelled
2%	47.10	20.28	25.97	11.61
1.33%	53.16	24.20	29.84	14.82
1%	53.32	28.13	30.64	16.00
0.5%	64.21	30.24	36.52	19.00

During present day, overtopping rates on the promenade are estimated to be ~1.5-2l/s/m during present day events equal or more severe than 10% AEP events. These rates of overtopping pose safety hazards to users of the promenade, notwithstanding the great number of pebbles and debris which normally accompany the storm events.

With climate change, by 2067, the overtopping rates onto the Esplanade are estimated to increase to ~8.5l/s/m for 10% AEP posing serious risks to life to pedestrians and car users.

The EA has a coastal flood warning service for this area of the coast. However, at present there is no measures to close the pedestrianised promenade nor the Esplanade when flood warnings are issued.

Clearly, as a result of climate change which will result in sea level rising within Sidmouth by ~0.7m over the next 100 years, the risk of coastal flooding in the town area will increase unless adaptation measures are undertaken.

With the current management regime and no active intervention to reinstate the beach profile to the previous design levels on the main town beach, the seawall is predicted to fail in ~75 years. A breach in the seawall would quickly develop inland causing the loss of 45 residential and 15 commercial properties along the Esplanade, the pedestrian promenade and all buried services within the road. An indicator of future scenario without further works on the town beach, is shown in Figure 6, when large holes developed behind the seawall during 1920s storms, causing extensive flooding and damage to the road and services.

On East Beach (Frontage C), with the current unmanaged regime and rates of erosion of ~2m/year for the next 20 years, the cliffs at East Beach will continue to retreat, with six residential properties initially losing further garden space (next 10 years), and eventually being deemed uninhabitable with significant structural damage or collapse by ~2037 (Figure 7).

Moreover, Pennington Point cliffs and narrow beach at East Beach provide flood protection to Sidmouth from south easterly coastal storms by sheltering the river mouth and the fluvial wall further upstream to direct wave actions. However, as the cliffs continue to retreat, the current fluvial River Sid wall would become progressively more exposed to direct wave action. The tidal river frontage is made of old river walls with a setback flood wall. The fluvial walls are in poor condition (see BMP asset condition report) and are expected to fail within the next 15-30 years. With increased exposure to open coastal process and therefore, increased scour and wave impacts, it is estimated that the fluvial defences will breach by 2037 causing extensive flooding during events from the southeast more frequent than 5% AEP, with 119 residential and 73 commercial properties flooded. Obviously, properties affected increases with increase storm severity and time as progressive cliff retreat exposes larger sections of the fluvial wall.

Selected option

The selected option is known as Option 6 throughout this document. It comprises two main areas, which work together to reduce flood and coastal erosion risk.

The main town beach is to gain at least an additional ~70m long offshore breakwater and beach recharging to the original 1990s profile.

From east to the west, a new splash wall, 1.3m high is to be constructed south of the Alma Bridge. New demountable defences to be implemented at the location of the current boat and maintenance access. The existing splash by the Port Royal area is to be raised by ~1m. To the west, the existing splash wall is to have improved foundations to allow for future raising of the wall to 1m high from the level of the Esplanade. The exact time of intervention for raising the splash wall is to be refined at detailed design stage, following additional numerical and physical modelling. However, for the purpose of this OBC, given current uncertainties, it has been assumed that the costs associated with raising the splash wall will occur in the first phase of the construction for the whole frontage.

Additional works are to be carried out to the river training wall which requires shortening by ~8m to allow increased sediment transport between frontages and remedial works to address current structural damage. An improved slipway is to be provided to aid construction of this scheme and future maintenance. Moreover, the upgraded slipway will improve amenity and water safety with shorter times to launch the Sidmouth Lifeboat.

Direct benefits to Sidmouth Town are a reduced risk of flooding from the sea to 113 residential and 70 commercial properties. Also, the risk of breach of the sea wall estimated in the next 75 years and subsequent damages to 45 properties, road access and services due to erosion will decrease.

An important additional benefit is the lesser need of ongoing future recharge and maintenance due to the construction of the proposed offshore breakwater which will hold a healthy beach to its lee. This proposed scheme is more passive and will be more resilient to multiple storms requiring less post-storm and regular interventions compared to the originally proposed BMP option which comprised beach recharge only on the main town front.

Further benefits are the maintained and likely enhanced amenity space, as in the case of the existing breakwaters which are holding a healthy beach to their lee. Recreation and tourism losses have been included in the benefit analysis.

At East Beach, a new 120m long groyne is to be built at the eastern end of the urban boundary, with new beach recharging to its west. The proposed large structure will aid maintaining the recharged material required to slow down the erosion rate. However, as discussed with Natural England (NE) and the World Heritage Site (WHS) and agreed in principle, the groyne will not be directly connected to the base of the cliffs. The cliff erosion will not be completely prevented but only slowed down and therefore, this option will be likely acceptable and assent granted, as not impacting designated features. This compares favourably to other dismissed options which are unlikely to be permitted. The 14 residential properties on the cliff top will directly benefit from a slower erosion rate of the cliffs and so will Sidmouth town as the town will be better protected from southerly and south easterly events.

Following five years of engagement with professional partners, local Advisory Group and public feedback, it has been confirmed the preferred option is the most popular option for the majority of stakeholders, including local residents and

businesses, and is therefore the most likely option to achieve the necessary planning permission.

Table 3: Key elements of proposed Sidmouth flood and coastal erosion scheme

Frontages	New measures	Key benefits	Comments
Frontage B	Beach recharge to 1990s profile ~36,000m^3	Wave energy absorption, reducing wave overtopping and providing protection from scour to the seawall. Indirect amenity value benefit for locals and tourism.	Exact quantity of material to be refined at detailed design stage as it is dependent on recent existing beach profile.
	Construction of at least one ~70m long offshore breakwater.	Wave energy reduction. Stable beach maintained to its lee aiding wave energy absorption and minimising future recharge maintenance costs. Need for raising the publicly contested splash wall to the back of the promenade delayed. Indirect environmental benefit of increased marine environment.	Location, alignment, dimensions and number to be refined at detailed design stage as these require physical and more detailed numerical modelling. The inclusion of additional breakwaters is highly desirable as these are passive flood alleviation measures which minimise maintenance costs and delay the need to raise the highly contentious splash wall at the back of the promenade.
	Improved foundations to existing splash wall for future wall raising and improved flood gates to 1m above the Esplanade. Eastern end of the splash wall to be raised by 1.4m above the Esplanade. New splash wall 1.3m high north of demountable defences.	Set-back flood defence containing overtopped water, reducing overtopping on the Esplanade and propagation of flood waters inland.	Time of intervention and extent of initial wall raising to be refined at detailed design stage as heavily dependent on design of offshore breakwater and modelling results. Costs for raising the splash wall for the whole length of the splash wall assumed to occur in the first phase of the construction.
	Demountable flood defences (slot-in 'stop-log' barriers) to the east by the slipway. ~30m	Provide continuation of the flood alleviation scheme when in place whilst enabling access to the slipway / beach for maintenance and other purposes.	
	Existing training arm wall to be shorten by ~8m and encased.	Improve longshore sediment transport between frontages and improve residual life of training arm wall.	

Frontages	New measures	Key benefits	Comments
	New slipway onto the beach.	Improved access for maintenance and reduced times for launching the Lifeboat.	Sidmouth Lifeboat contributing to the funding of the scheme.
Frontage C	Beach recharge ~26,000m^3	Reduces the rate of Pennington Point cliffs erosion and increase shelter to the River Sid mouth / fluvial defences	
	120m long rock groyne	Ensure containment of recharged beach to its west. Bypassing of material eastwards is not completely obstructed.	

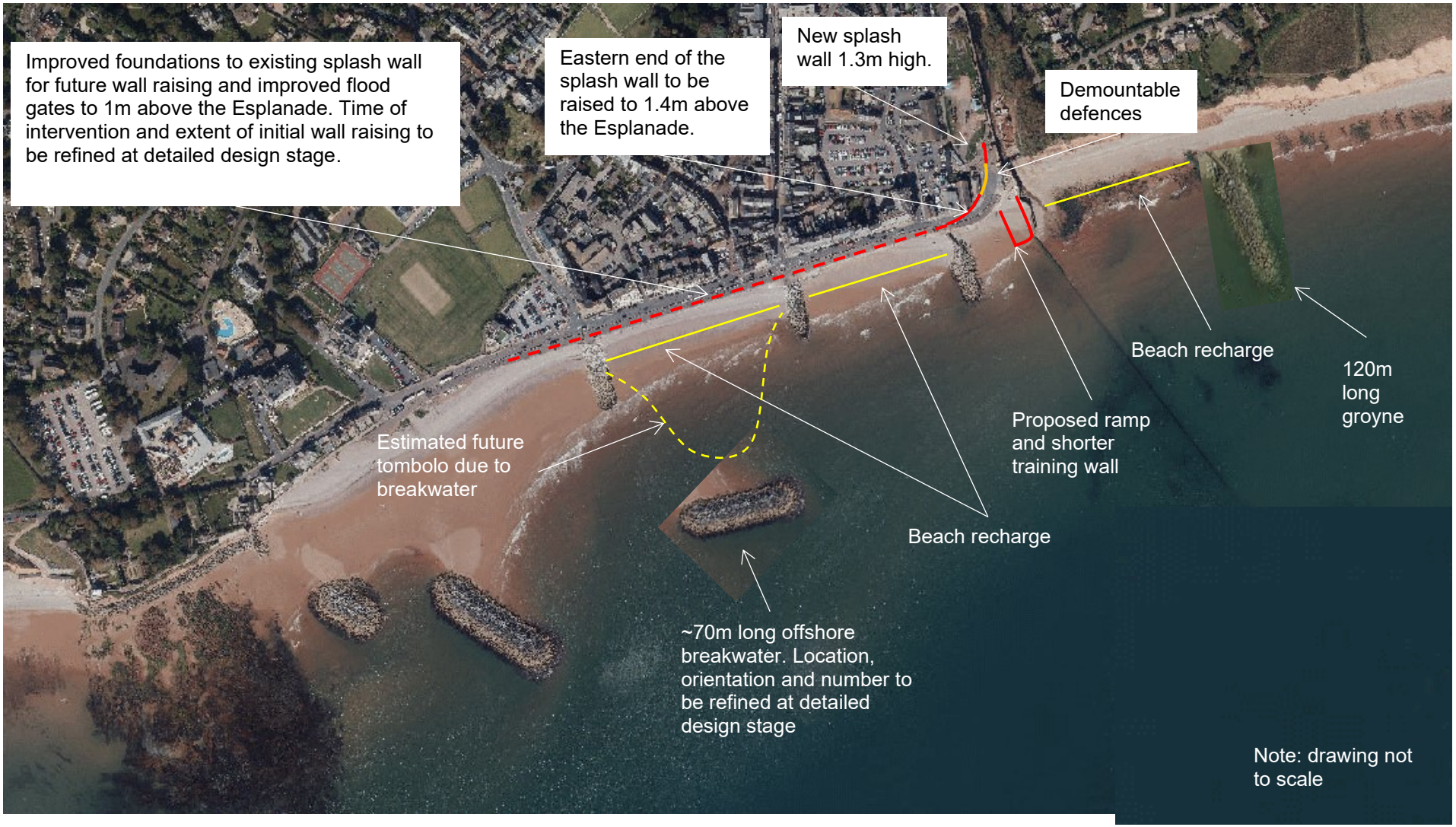


Figure 9: Proposed scheme to address flood and coastal erosion at Sidmouth

It is worth noting that in line with the BMP and HR Wallingford results in 1993, the most recent appraisal also identified that additional breakwaters along the whole frontage would provide a more robust solution. The need for future beach recycling and recharging would be significantly reduced and the requirements for raising the splash wall at the back of the promenade delayed. However, these alternative sub-options were discounted at this stage on economic grounds, without a detailed economic assessment due to significant uncertainties. To further progress these options, lengthy and costly detailed modelling would be required which was not feasible at this stage. It is the intention of EDDC to undertake further modelling at detailed design stage to ascertain whether a more passive solution may be affordable. In the event of a positive response, a Business Case Update Report (BCUR) will be submitted to update the current proposal.

Economic cost and benefit of selected option

Present Value Benefit - £196,171,374

Present Value Cost - £17,606,026

Net Present Value - £178,565,348

Benefit to Cost Ratio 11.14

Incremental Benefit to Cost Ratio N/A

Whole Life Cash Cost - £25,512,850

Affordability of selected option

Raw Partnership Funding score is 84%

Adjusted Partnership Funding score is 101%

Funding from Environment Agency (grant) is £17,540,069 cash value (£16,141,879 PV)

Funding from the Local Levy is £500,000 (cash value)

Funding from East Devon District Council is £2,250,000 (cash value)

Funding from other public sector (Devon County Council) is £500,000 (cash value)

Funding from other public sector (Sidmouth Town Council) is £100,000 (cash value)

Funding from private businesses (Sidmouth Life Boat) £100,000 (cash value)

Funding from private businesses (Cliff Road Action Group) £50,000 (cash value)

Risk

The total contingency amount is £5,125,587 for construction and £918,711 for future costs, and £2,673,536 for inflation (all cash values). Further detail of the risk is included in Appendix L.

Top three residual risks are:

Planning permission
Weather
Health and Safety

Permissions and consents

The planning application process has not commenced but Statutory Consultees have expressed no objections to the proposed option

Outcomes

OM2 - 113
OM3 - 59
OM4a - 0
OM4b - 0

Schedule of critical milestone dates.

2023 August – Submit OBC to Environment Agency for Assurance

2023 November – Tender Consultant for Detailed design phase

2024 March – Appoint Consultant

2024 April – Start Detailed design stage

2025 March – Complete detailed design stage

2025 February/July 2025 – Planning permission stage

2025 August - Tender Contractor

2025 December – Appoint contractor

2026 March - Construction commence

2027 February - Construction complete

2027 March -Ready for Service.

2.0 Strategic Case

2.1 Introduction

The Sidmouth Beach Management Scheme is led by East Devon District Council in close partnership with the Environment Agency.

Sidmouth is an historic coastal town in East Devon, with an approximately 1.250km long coastal frontage from Connaught Gardens in the west, to East Beach / Pennington Point cliffs in the east (Grid Reference: SY 12633 87194), see Figure 10.

Figure 10: Sidmouth location and frontages

Sidmouth beach is very popular with local residents and tourists and is a favourite holiday destination with Bathing Water classified as Excellent in recent years.

The proposed flood and risk management scheme is to improve the level of protection from coastal flooding and erosion in line with the overarching policies to Hold the Line and maintain coastal defences for Sidmouth town, and Managed Realignment for the River Sid and Sidmouth (East) over the next 100 years, as described in the South Devon and Dorset Shoreline Management Plan (SMP, 2011).

The recommended scheme will better protect (OM2s) 113 residential and 70 commercial properties at risk of coastal flooding in the main town for events up to

0.5% AEP over the next 100-year appraisal period. In addition, 45 residential and 15 commercial properties at risk of erosion along the Esplanade in the next 75 years will be better protected.

At East Beach, to the east of the River Sid, 6 residential properties are at risk from erosion in the next 10 to 20 years and 8 residential properties at risk from erosion in the next 20 to 100 years will be better protected.

One South West Water sewage pumping station (near the Alma Bridge to the east), the Sidmouth Lifeboat and six electricity sub-stations at very significant risk of flooding will be better protected with the proposed scheme over the next 100-year appraisal period for events up to 0.5% AEP.

Buried services along the Esplanade at risk of erosion in the next 75 years and along Pennington Point cliffs top in the next 20 to 100 years will be better protected from erosion.

The Flood Defence Grant in Aid (FDGiA) funding being sought is £15,571,812 which includes 34% risk and inflation allowances. In addition, East Devon District Council (EDDC) are contributing £2,200,000 to the scheme, comprising an initial £500k which matches the Devon County Council and Local Levy application value and an additional £1.7m due to the recent years' economic climate, construction costs increase and uncertainties. As this contribution is a significant value in proportion to the rest of the yearly capital budget for a small district authority, it comes with the following provisions:

- Firstly, should the risk budget not be fully utilised, this would be returned to EDCC.
- Secondly, should the PF calculator be adjusted due to further construction inflation being realised, EDDC would seek to reapply for further FDGIA funding within the rules for grant eligibility.

2.2 Strategic context

The scheme frontage lies within the administrative area of East Devon District Council who are the Risk Management Authority. The open coast frontage is owned and managed by East Devon District Council and the River Sid Western Wall is managed by the Environment Agency. South West Water maintains an outfall that extends offshore from a point adjacent to the mouth of the River Sid. Figure 11 illustrates the seaward ownership boundaries within the scheme area.

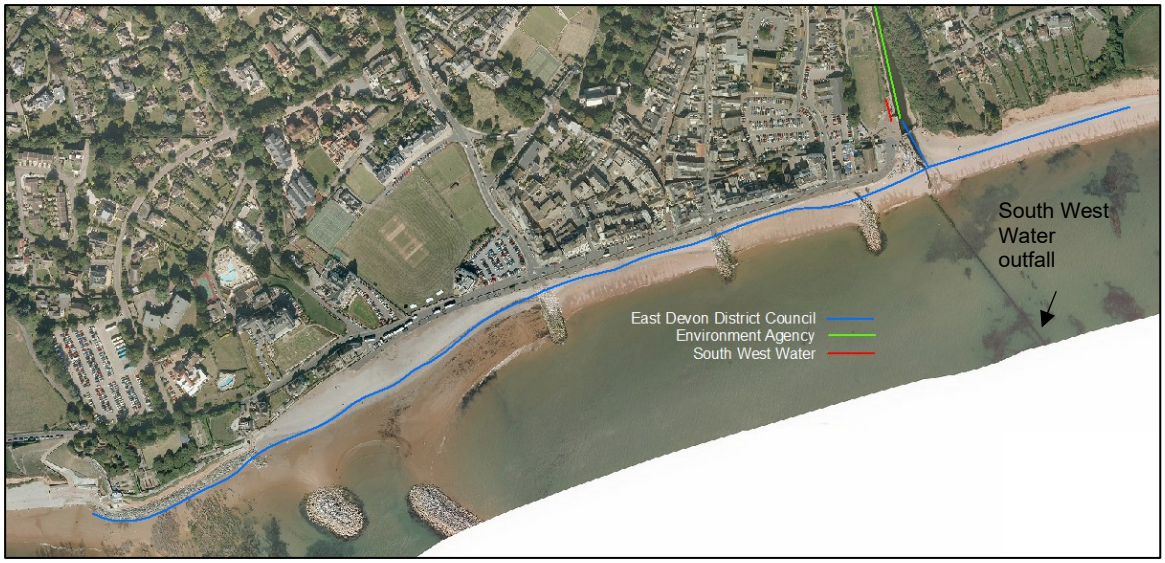


Figure 11: Sidmouth – frontages management responsibilities

2.2.1 Business Strategies

The following section references and summarises the existing strategy and management documents relevant to the scheme frontage.

In terms of flooding and coastal erosion risk management (FCERM) the following has been referenced:

- Durlston Head to Rame Head Shoreline Management Plan 2, 2011.
- Sidmouth to East Beach Management Plan, 2017.

The SMP provides a large-scale assessment of the risks associated with coastal evolution and presents a policy framework to address these risks to people and the developed, historic and natural environment in a sustainable manner. Below this document, sits the Sidmouth and East Beach Management Plan (BMP) which covers the coastline of Sidmouth. The aim of the BMP is to inform, guide and assist East Devon District Council in managing the beach and associated coastal defences, in line with the SMP recommended policy. The BMP also ensures that the risk of coastal flooding and erosion to properties and other assets along its frontage continues to be managed sustainably. This OBC is built upon the recommendations of the 2017 BMP.

Other relevant strategies noted and considered include:

- The East Devon New Local Plan, 2013 – 2031
- UNESCO Dorset and East Devon World Heritage Site Management Plan, 2014 - 2019
- East Devon Catchment Flood Management Plan (CFMP)
- East Devon Area of Outstanding Natural Beauty (AONB) Management Strategy 2014-2019
- Sidmouth to West Bay SAC Site Improvement Plan, 2014
- South Inshore and South Offshore Marine Plans

- South West River Basin Management Plan, 2009

The proposed SBM scheme has been developed in line with the requirements of relevant national and local policies and plans.

Since the production of the BMP, further option appraisal and development has been undertaken which has further refined the preferred option described above and also identified the need to pursue other alternative options that satisfy the concerns of the Advisory Group.

The recommended scheme option supports all the relevant policies summarised below. These will be revised at detailed design stage to ensure no conflicts due to changes in policies adversely impact the chosen scheme.

Durlston Head to Rame Head Shoreline Management Plan, 2011.
The SMP provides a large-scale assessment of the risks associated with coastal evolution and presents a policy framework to address these risks to people and the developed, historic and natural environment in a sustainable manner. The SMP was adopted in June 2011. The SMP policy recommended for the Sidmouth coastline is defined by Policy Unit 6a35, 6a36 and 6a37. Table 4 summarises the SMP policies which cover the Sidmouth Beach Management Scheme and Figure 12 presents the extent of each policy unit.

The recent SMP Refresh (2022) hasn't changed these policies.

Table 4: SMP Policies adopted in June 2011.

Policy Unit	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
6a35 – River Sid and Sidmouth (east)	Undertake **Managed Realignment** through beach management.	Undertake **Managed Realignment** through beach management.	Undertake **Managed Realignment** through beach management.
6a36 – Sidmouth	Continue to maintain existing defences under a **Hold the Line** policy.	Continue to maintain existing defences under a **Hold the Line** policy.	Continue to maintain existing defences under a **Hold the Line** policy.
6a37 – Chit Rocks to Picket Rock	Allow natural coastal evolution to continue through to **No Active Intervention**.	Allow natural coastal evolution to continue through to **No Active Intervention**.	Allow natural coastal evolution to continue through to **No Active Intervention**.

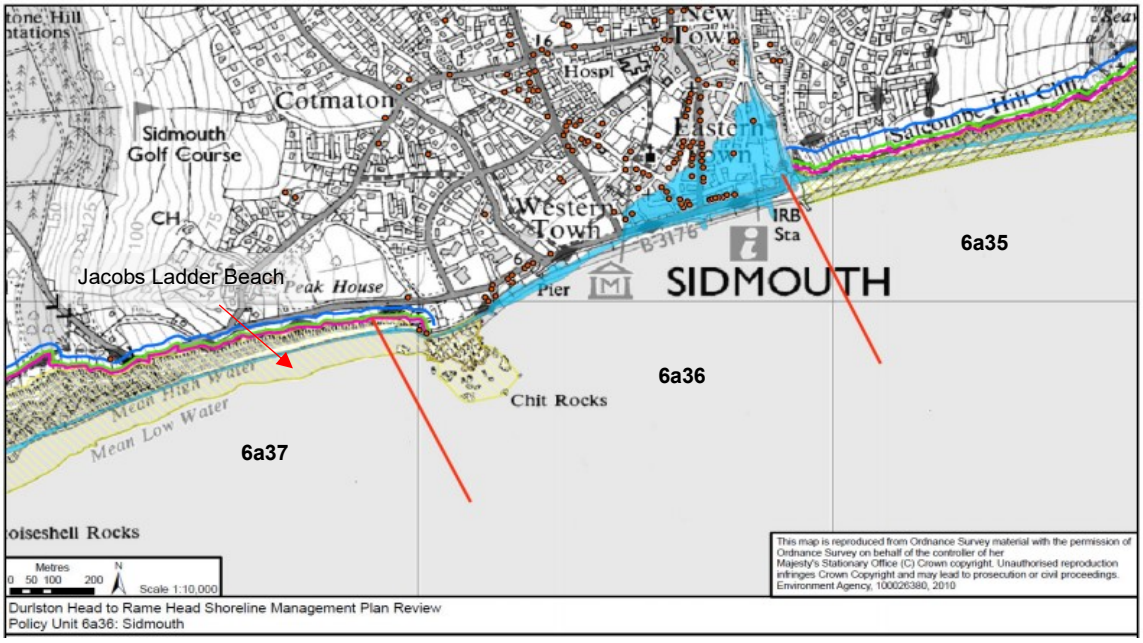


Figure 12: Durlston Head to Rame Head SMP, Sidmouth Frontage Policy Units

Sidmouth and East Beach Management Plan, 2017

The Sidmouth and East BMP sits below the SMP. The BMP covers Sidmouth's coastline, from Jacob's Ladder Beach in the west to East Beach in the east, as well as the western bank of the River Sid up to the weir. The BMP informs, guides and assists the responsible authorities and organisations in managing the beach and associated hard coastal defences. It ensures that the risks of coastal flooding and erosion to properties and other assets continues to be managed sustainably, whilst recognising and managing the environmental and amenity implications of doing so.

The key objective of the BMP is to manage the risk of coastal flooding and erosion to property and other assets along the Sidmouth frontage in the long term, by ensuring that adequate beach is maintained along the BMP frontage, supported by (and in support of) adequate maintenance of the existing hard defences and control structures, and any future structures.

The BMP sets out a plan for monitoring and intervention to maintain the beach and associated hard coastal defences to ensure they continue to provide adequate coastal flood and erosion risk management to Sidmouth.

The preferred long-term management option proposed within the BMP is described as follows:

> *'to seek to construct one or two new rock groynes along East Beach over a distance of up to 200m east of the River Sid, whilst modifying the length of the seaward end of the River Sid training wall and East Pier rock groyne to improve sediment transport between Sidmouth Town beach and East Beach. This will also enable access for future beach management at East Beach. This is to be supported by repairs to the seaward end of the training wall as well as ongoing recycling of sediment along Sidmouth Town beach and maintenance of the existing defences at Jacob's Ladder Beach and Connaught Gardens (around Chit Rocks). This option was*

selected as it provided the best balance between technical viability, environmental acceptability and economic case'.

The East Devon New Local Plan, 2013 – 2031

The current East Devon Local Plan was adopted on 28th January 2016. The Plan guides where development in East Devon will occur and how the great natural asset of the coastline and surroundings will be conserved and enhanced. Included within the Plan is a commitment to designate a Coastal Change Management Area (CCMA) at Sidmouth to manage the impact of future coastal change, though no timescale for CCMA designation is stated.

Jurassic Coast Partnership Plan 2020-2025 (Management Framework for the Dorset and East Devon Coast World Heritage site)

The Jurassic Coast Partnership Plan 2020-2025 is a formal requirement of both UNESCO and the UK Government for managing the World Heritage Site. It is a public document which outlines the aims, policies and priority objectives for managing the Site over the coming years. It also explains the reasons for the Site's World Heritage designation and how it is protected and managed. This Plan is the central tool of the partnership that looks after the Jurassic Coast as it helps to facilitate collaboration and provides a strategic context for investment and action. The following key polices are of relevance to the Sidmouth Beach Management Scheme:

- **Policy R1:** The Outstanding Universal Value (OUV) of the WHS is protected by preventing developments that might impede natural processes, or obscure the exposed geology, as set out in the GCR / SSSI details, now and in the future.
- **Policy R2:** Any development resulting in a negative impact to the OUV of the WHS will only be acceptable if it is both essential and unavoidable. In these circumstances mitigation measures will be undertaken.
- **Policy R3:** New developments in the WHS's setting that may warrant a future need for coastal defences are opposed.
- **Policy R4:** Those elements of landscape character, seascape, seabedscape, natural beauty, biodiversity and cultural heritage that constitute the WHS's functional or experiential setting are protected from inappropriate development.
- **Policy CSS1:** The conditions of GCR sites and SSSIs will be maintained and / or improved, when appropriate and possible, in ways that are consistent with or build on natural processes, taking account of other conservation objectives.

East Devon Catchment Flood Management Plan (CFMP)
The CFMP acknowledges sources of flooding from rivers in the East Devon Catchment. It describes significant tidal flooding in Sidmouth with risks to people, property and infrastructure. The plan highlights preferred risk management policies for East Devon with a recommended 'sustain the current scale of flood risk' for Sidmouth.

East Devon Area of Outstanding Natural Beauty (AONB) Partnership Plan 2019 –2024
The East Devon AONB Partnership Plan focuses primarily on conserving and enhancing the quality of the AONB landscape, in particular its natural beauty. In particular the Plan formulates East Devon District Council and Devon County Council local authority policy and action in relation to the management of the East Devon AONB as required under Part IV, Section 89 of the Countryside and Rights of Way Act 2000. The following key polices are of relevance to the Sidmouth Beach Management Scheme:

- **Policy L1:** Support the development and delivery of environmental schemes and projects aimed at maintaining and improving the landscape character, historic environment and local distinctiveness of the AONB.
- **Policy P1:** Encourage the development of guidelines to support high quality sustainable development which complements and respects the AONB landscape and historic character.

Sidmouth to West Bay SAC Site Improvement Plan, 2014
Site Improvement Plans (SIPs) have been developed by Natural England for each Natura 2000 site in England as part of the Improvement Programme for England's Natura 2000 sites (IPENS). Natura 2000 sites is the combined term for sites designated as Special Areas of Conservation (SAC) and Special Protected Areas (SPA).

The SIP covering the Sidmouth to West Bay SAC was published in 2014 (Natural England, 2014) and provides a high-level overview of the issues (both current and predicted) affecting the condition of the Natura 2000 features on the site(s) and outlines the priority measures required to improve the condition of the features.

It does not cover issues where remedial actions are already in place or ongoing management activities which are required for maintenance. This includes actions regarding inappropriate coastal management with relation to vegetated sea cliffs habitat.

South Inshore and South Offshore Marine Plan, 2018
The overall vision for the south marine plan area states the area's iconic and unique qualities, and that its characteristics and culture will be conserved, promoted and where needed enhanced, through good management of its marine space, looking forward to 2038. The vision for the plan will be achieved through a series of 12 high level objectives which have associated policies (53 in total) which have been specifically drafted (if legislation doesn't already exist to meet a particular objective). Each policy is situated within the objective it is most related

to; and the policies can be applied to the whole of the plan area, or just the inshore or offshore or to defined areas.

South West River Basin Management Plan, 2015
The South West River Basin Management Plan (Environment Agency, 2015) was prepared under the Water Framework Directive (WFD). It contains actions to improve the ecological status of water bodies in river basin catchments, including coastal waters out to 1 nautical mile. The Sidmouth Beach Management Scheme lies within one such WFD Coastal Water Body (Lyme Bay West: GB650806420000) and so activities need to comply with the requirements of this plan.

2.3 Environmental and other considerations

The scheme frontage contains the following environmental and conservation designations:

- Sidmouth to West Bay Area of Conservation (SAC).
- Lyme Bay to Torbay SAC.
- Dorset to East Devon Coastal United Nations Educational, Scientific and Cultural Organisation (UNESCO) World Heritage Site (the Jurassic Coast).
- Sidmouth the Beer Coast Site of Special Scientific Interest (SSSI).
- Ladram Bay to Sidmouth SSSI.

The impacts of the proposed scheme on the designated areas have been considered when developing the scheme option, with many having legislative requirements to ensure they are not adversely impacted. In addition, the scheme (or study) area is designated for its landscape setting and character with both the eastern and western ends of the scheme being within the East Devon Area of Outstanding Natural Beauty (AONB). The town of Sidmouth itself also includes several conservation areas as well as many listed buildings, a registered park and garden, and numerous non-designated archaeological sites.

The proposed scheme has been developed ensuring minimal impacts upon the environmental receptors and further details can be found in the Preliminary Environmental Information Report (PEIR), Appendix N.

Geology and Geomorphology
The geological importance of the region is recognised by the SSSI and the UNESCO Dorset and East Devon World Heritage Site. The Sidmouth to Beer Coast SSSI is designated for its geological and biological interest. The scheme also contains two Geological Conservation Review (GCR) sites, Ladram Bay to Sidmouth (GCR 3215) and Sidmouth (GCR 814). The description of these sites underpins the SSSI and World Heritage site designations. Chit Rocks to the west of the scheme area forms part of GCR 814, yielding fossilised remains of internationally rare Middle Triassic fossil fish, amphibians and reptiles. The same GCR includes the cliffs and foreshore of Pennington Point, which also yields these rare fossils. The cliffs on both sides of the town lie within the UNESCO

Dorset and East Devon World Heritage Site ('Jurassic Coast') designated by for their geological importance.

The scheme area comprises a section of very dynamic coast. Sediments are reported to input into this area from contemporary terrestrial sources. There are also sediment inputs from the western end of the frontage. However, these are limited by Chit Rocks and the promontory of Connaught Gardens. This headland prevents the movement of shingle from west to east although finer grained sediment will still pass this boundary.

Water Quality

The Sidmouth Town water sampling point has been monitored since 1988 in line with the Bathing Water Directive, (1976) and also with the Water Framework Directive, (2003) after 2006. In 2021 the results of the water sampling at "Sidmouth Town" and "Sidmouth Jacobs Ladder" recorded a measure of Excellent based on samples taken from 2017 through to 2021; and as such, the bathing waters of Sidmouth currently meet the 2006 Bathing Water Directive standards.

Ecology

The following nature conservation designations and their qualifying interest features are all within or lie in close proximity to the scheme area:

- Sidmouth to West Bay SAC (designated for Vegetated sea cliff of Atlantic and Baltic coasts and *Tilio-Acerion* forests of slopes, screes and ravines).
- Lyme Bay and Torbay SAC (designated for the Lyme Bay Reefs and sea caves).
- Sidmouth to Beer Coast SSSI (designated for species rich chalk grassland, broadleaved woodland and invertebrate fauna).

Fish Ecology

Cefas's Spawning and Nursery grounds of selected fish species in UK water (Ellis, J.R, et al, 2012) reported the following species that utilised the coastal water of Sidmouth for either spawning or nursing:

- Spurdog *Spulaus acanthias* – Low intensity nursery area
- Thornback ray *Raja clavata* - Low intensity nursery area
- Spotted ray *Raja montagui*- Low intensity nursery area
- Anglerfish *Lophius piscatorus* - Low intensity nursery area
- Sandeels *Ammodytidae* – Low intensity spawning area
- Mackeral *Scomber scombru* – High intensity nursery area
- Sole *Solea solea* - Low intensity spawning area

The River Sid has been classed as a 'recovering salmon river' by the Environment Agency. There is therefore an overall objective to ensure that the river recovers and stocks of Atlantic salmon *Salmo salar* improve.

Fisheries

The scheme area is within the Southern Inshore Fisheries and Conservation Authority's (IFCA) district. There are a number of commercial fisheries working from small vessels which are launched from the beach at Sidmouth. Sidmouth also attracts recreational fishing from the beach.

There are no Shellfish protected areas within the scheme area.

Landscape
The importance of landscape to the Sidmouth area is recognised by the following:

- East Devon AONB: characterised by vast areas of heathland, small wooded combes, fertile river valleys and outstanding cliffs and hilltops, form the protection setting for the Devon and East Devon UNESCO World Heritage Site.
- The East Devon Heritage Coast: comprises vivid red sandstone cliffs that are broken by the white chalk headland at Beer and fronted by pebble beaches.
- The Sidmouth Town Centre Conservation Area: designated by East Devon District Council under the Listed Buildings and Conservation Areas Act 1990. The area includes the Esplanade from the River Sid to Connaught Gardens which contains features of historical and special architectural interest.

Archaeology and cultural heritage
The landscape of Sidmouth is of primary importance due to its distinctive steep red cliffs that as well as being geologically important, attract and maintain high levels of tourism. The scheme area is included within several character areas which include the Blackdown National Character Area, the Sidmouth and Lyme Bay Coastal Plateau Devon Character Area, and the Sidmouth Town Conservation Area. There are no Scheduled Monuments within the scheme area, although Connaught Gardens, located near Chit Rocks, is a Registered Parks and Gardens. There are over 100 listed buildings and structures within the town of Sidmouth, along the Esplanade and near to Chit Rocks.

2.4 The case for change

2.4.1 History of Flood and Coastal Erosion Risk Management

Sidmouth has a long history of coastal flooding and erosion dating back to the 18th century which has resulted in a number of defence schemes over the years (see BMP for further details and Figure 14).

Pre-1990s FCERM measures:

- Timber groynes and breastwork was constructed in 1825, followed by the first seawall along the town frontage in 1835.
- By the early 1980s, the River Sid training wall was replaced with a structure that acted as a partial terminal groyne in an attempt to retain the beach.
- 1957 the seawall and promenade were constructed along Connaught Gardens.

Post-1990s FCERM measures:
Following the storms of 1989 and 1990, the Sidmouth Town frontage experienced substantial damage to existing defences and large volumes of shingle were lost to the east. This damage triggered the need for upgraded coastal flood and erosion risk management measures. Further storms in 1993 and 1994 triggered the need for additional works, as beach lowering exposed greater sections of the main seawall (Figure 13).

Timber groyne damage in 1990 | Beach lowering in 1993 | Seawall damage and erosion in 1994

Figure 13: Past storm damage along the Sidmouth Beach Management Scheme Frontage
The existing scheme was constructed over many phases during the 1990s and early 2000, broadly summarised below. Further details can be found in the BMP document.

- Sidmouth Coast Protection Scheme Phase I in 1991: encasement of the exposed sections of the existing seawalls; low-level rock apron along Clifton Beach; removal of timber groynes, securing the East Pier at its present length and encasement of the seaward end of the West Pier.
- Emergency Works in 1993: construction of a low-level rock revetment at the foot of the seawall between West Pier and York Steps; construction of concrete access steps and repairs to the seawall.
- Sidmouth Coast Protection Scheme Phase II in 1995: installation of flood gates on the promenade; construction of two large offshore breakwaters; reinforced concrete encasement of the seawall between East Pier and the river training wall; construction of two rock groynes at East Pier and York Steps and beach recharge.
- Sidmouth Coast Protection Scheme Phase III in 2000: construction of a rock groyne at Bedford Steps; beach recycling along the town front.

Figure 14: Sidmouth existing defences and frontages

2.4.2 Current Problem and Impacts of Climate Change

Different flooding and erosion mechanisms affect sections of the coastline at Sidmouth. This section summarises the current flooding and erosion problem and the impacts of climate change under the current scenario.

Sidmouth town frontage has a long history of coastal flooding and erosion, particularly when beach levels are low. The town was affected by the “great gale” in November 1824, with both coastal erosion and flooding of properties reported at Sidmouth. Between 1981 and 2022, there have been approximately 14 known events whereby wave overtopping has occurred, affecting some residential and commercial properties along The Esplanade (although exact number is unknown), with extensive waves spray and pebbles being thrown onto the promenade. Most recently, significant wave overtopping has occurred approximately every two to three years, with the most significant events in 2014, 2017, 2020 and 2022.

The town is exposed to the prevailing south westerly winds with partial sheltering from this direction offered by the two offshore breakwaters to the west. Storms conditions from the south and southeast, although less frequent and intense, also impact the town. As there is an equal chance of occurrence of events coming from either the southwest or the southeast, these events have been treated independently from each other and the risk to properties combined, whilst ensuring no double counting occurred. However, events from the southwest were determined to cause most coastal flooding and therefore they have been mostly shown in figures and tables.

Due to the local topography, the key mechanism of flooding is waves overtopping the main seawall and propagating landwards towards the low-lying areas of the town, ponding around York Street and Ham Car Park. Along the western side of the town, flooding is relatively confined to Bedford Square and Chapel Road due to the local topography rising towards the west and north. See Figure 15 and Figure 16.

Overtopping of the coastal defences occurs more frequently when south westerly storms coincide with high tides, particularly in the most exposed eastern areas further away from the protection of the existing offshore breakwaters. However, in recent years, Sidmouth has also experienced increased south easterly events, which hit the exposed seawall and contribute to lowering the already depleted beach.

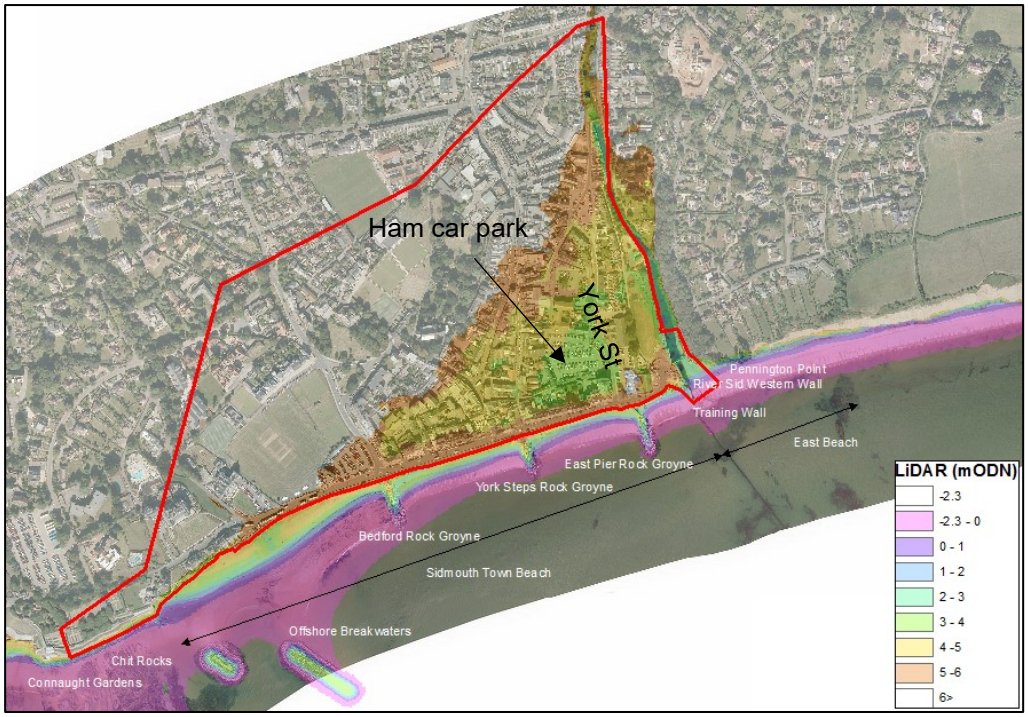


Figure 15: Sidmouth LiDAR data showing low lying areas

The current coastal defences at Sidmouth provide an approximate 10% to 5% AEP (1 in 10 to 1 in 20 years return period) standard of protection with 52 residential and 36 commercial properties at very significant risk from coastal flooding.

During more severe events, flood waters propagate further inland along Old Fore Street and York Street with increasingly greater flood depths whilst remaining relatively contained within the main town centre due to the locally rising ground. During the present day in events up to the 0.5% AEP, 123 residential and 76 commercial properties are at risk of flooding.

In addition to flood risk to properties, the popular pedestrian area of the promenade is inundated almost yearly, especially towards Port Royal to the east.

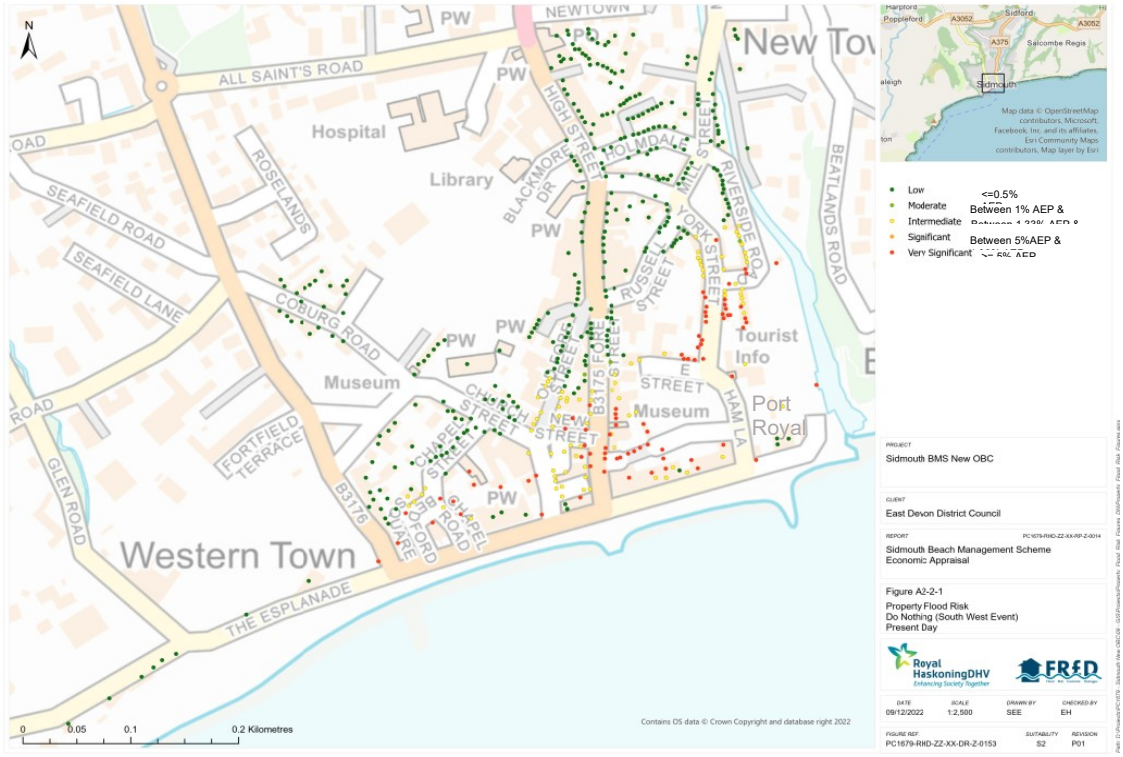


Figure 16 : 2017 properties at risk during south westerly event

Since 1995 (completion of the beach recharge scheme), beach levels on the town front to the east of the existing breakwaters have dropped to lower than the design levels, uncovering the apron of the sea wall in places. As described in the Beach Management Plan[3] (2017), using data from July 2014, an approximate loss of 63,000m^3 of material has been observed, equating to over 50% of recharged material. Beach levels have lowered in places by ~2m, with greater decrease observed to the west of the groynes. The depleted beach absorbs less wave energy thus increasing wave overtopping. Moreover, reflected waves on the now exposed vertical face of the sea wall causes greater wave set-up of the incoming waves with increased risk of overtopping and windblown spray.

Table 1 shows the present day modelled overtopping rates for different severity events from a south westerly direction for two representative profiles on the main town front (Figure 17). The table clearly illustrates the worsening effect on the overtopping rates from beach lowering, with present day 5% AEP events causing greater overtopping than equivalent 1.33% AEP events with the 1990s design beach.

[3] *Sidmouth and East Beach Management Plan, East Devon District Council – CH2M, 2017*

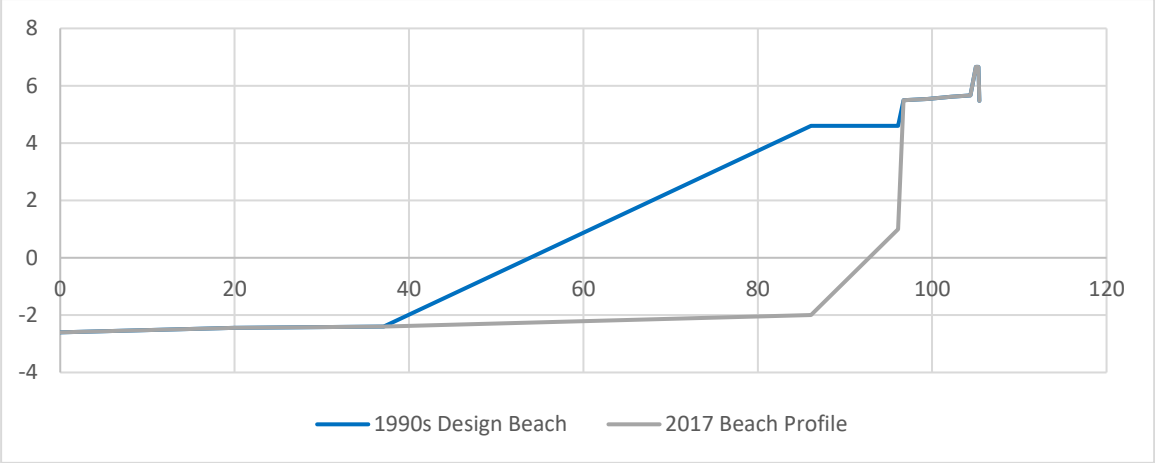


Figure 17: Representative profiles at the town centre (elevation in m OD)

In addition, the table illustrates how the existing splash wall height is insufficient in containing overtopping and preventing flooding. EurOtop Second Edition guidance indicates a safe limit of 0.3 l/m/s for people at seawall (splash wall)/ dike crest with a clear view of the sea and a limit of <5 l/m/s for Cars on seawall (splash wall) / dike crest, or railway close behind crest. Therefore, the estimated overtopping rates on the Esplanade also highlight the current risk to life and road users even for high frequency events.

Table 5: 2017 Sidmouth town front overtopping rates

AEP%	Sidmouth town front – 2017 epoch			
	Current beach profile promenade l/s/m	1990s design beach profile – promenade l/s/m	Current beach profile the Esplanade l/s/m	1990s design beach profile the Esplanade l/s/m
100%	0.87	Not modelled	0.20	Not modelled
10%	3.37	Not modelled	1.17	Not modelled
5%	4.48	Not modelled	1.82	Not modelled
2%	7.01	Not modelled	3.22	Not modelled
1.33%	8.09	3.63	3.95	1.60
1%	8.46	7.99	4.26	2.00
0.5%	8.50	7.85	4.53	3.20

Without active intervention and with climate change, the beach is estimated to continue to lower with consequent worsening of waves overtopping. Based on recent beach surveys (2007-2017), it is estimated that beach levels will lower by a further ~1m from their already heavily depleted levels by 2117. Beach depletion will decrease its efficacy in wave absorption causing greater volumes of wave overtopping. This in turn will contribute to beach drawdown and increased potential for waves to overtop the defences and damage of the seawall.

Table 2 below presents the 2117 predicted wave overtopping results (accounting for future sea level rise) with an estimated beach crest lowered by ~1m against the reinstated 1990s beach profile with no depletion in level. Results have been

extracted landwards of the existing splash wall. The 2117 100% AEP it is comparable with events more severe than the present 2017 0.5% AEP. Without measures to contain overtopping or restrict the use of the promenade and the Esplanade, these overtopping rates would pose unacceptable risks to life and road users.

Table 6: 2117 Sidmouth town front overtopping rates

AEP%	Sidmouth town front – 2117 epoch			
	Future depleted beach profile – promenade l/s/m	1990s design beach profile – promenade l/s/m	Future depleted beach profile – the Esplanade l/s/m	1990s design beach profile – the Esplanade l/s/m
100%	19.28	Not modelled	8.57	Not modelled
10%	39.52	Not modelled	21.54	Not modelled
5%	40.63	Not modelled	21.89	Not modelled
2%	47.10	20.28	25.97	11.61
1.33%	53.16	24.20	29.84	14.82
1%	53.32	28.13	30.64	16.00
0.5%	64.21	30.24	36.52	19.00

During present day, overtopping rates on the promenade are estimated to be >3.0 l/s/m during present day events equal or more severe than 10% AEP events. These rates of overtopping pose safety hazards to users of the promenade, notwithstanding the great volumes of pebbles and debris which normally accompany the storm events.

With climate change, by 2117, the overtopping rates onto the Esplanade are estimated to increase to over 21 l/s/m for 10% AEP posing serious risks to life to pedestrians and car users.

The Environment Agency has a coastal flood warning service for this area of the coast which activates the closure of the current splash wall flood gates, but which doesn't prevent the risk to local pedestrians or cars from excessive overtopping.

Beach levels have lowered by ~2m since 1995, causing exposure of the seawall aprons in places, and are estimated to continue to lower over the next 100 years, albeit at a lower rate (a further ~1m by 2117). This will expose more of the seawall with consequent failure of the wall predicted within the next 75-100 years. Failure of the seawall would not directly affect flooding, compared to the pre-breach scenario, but the collapse would rapidly progress inland, causing the loss of 45 residential and 15 commercial properties along the Esplanade, the pedestrian promenade and all buried services within the road. An indicator of future scenario without further works on the town beach, is shown in

Figure 18, when large holes developed behind the seawall during 1920s storms, causing extensive flooding and damage to the road and services.

Figure 18: Sidmouth, The Esplanade – Storms damage 1920s

The increased risk due to lowering beach levels and drawdown has already been noticeable over the past 10 years, namely during the Valentine's Day storm in February 2014, Storm Brian in 2017 and Storm Eunice in 2022 (Figure 19). Several properties were flooded during these events. The increased risk of wave overtopping highlights the current and future threat to the town and the importance of ensuring beach levels are managed and maintained against the seawall. Moreover, these recent events highlight the critical role of the splash

wall in containing overtopped water on the promenade. The 1990s design beach alone is unlikely to sufficiently dissipate wave energy to prevent overtopping onto the promenade.

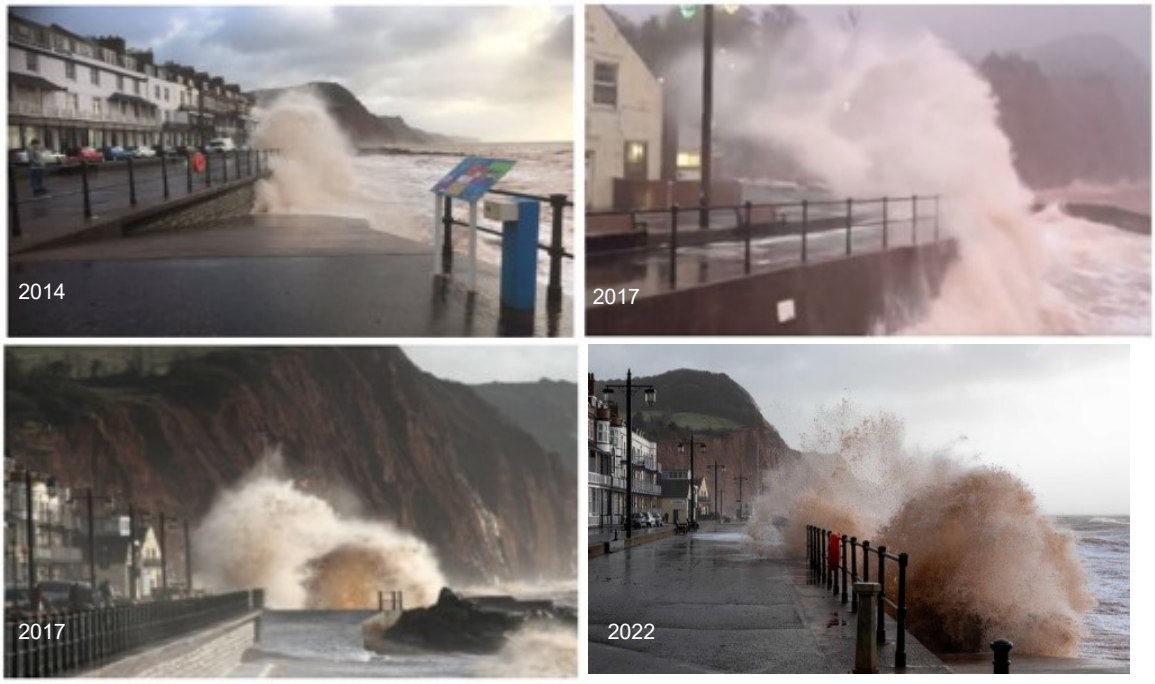


Figure 19: Sidmouth Storm Event in February 2014 (left), Storm Brian 2017 (centre and right) and Storm Eunice (2022 bottom right)

With climate change, by 2067, 136 residential properties and 87 commercial properties are at very significant flood risk, and 182 residential and 123 commercial ones are at risk in events up to the 0.5% AEP.

By 2117, with approximately 0.7m of sea level rise predicted, 215 residential and 155 commercial properties are at significant risk of flooding. The flood extent and depth for the present day and 2117 5% AEP and 0.5% AEP events from the southwest are shown in Figure 26 and Figure 27.

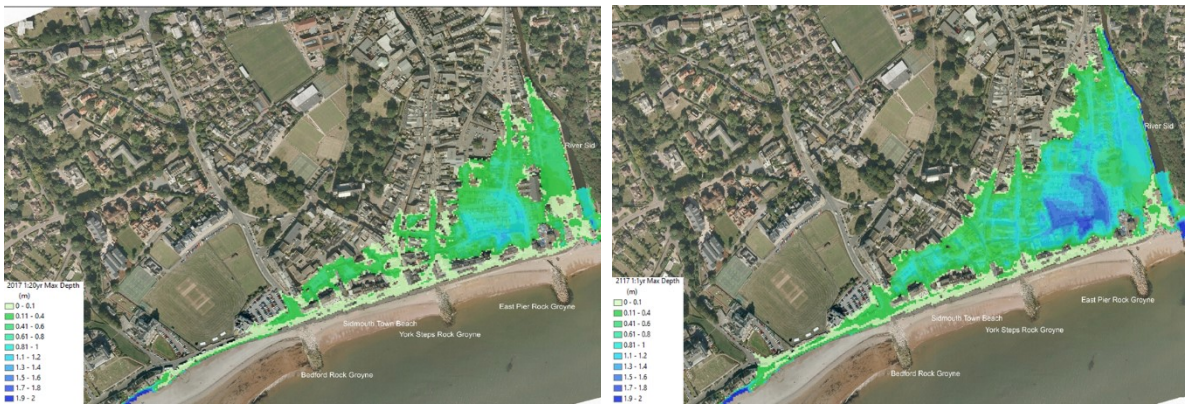


Figure 20: 2017 (left) and 2117 (right) 5% AEP flood extent and depth

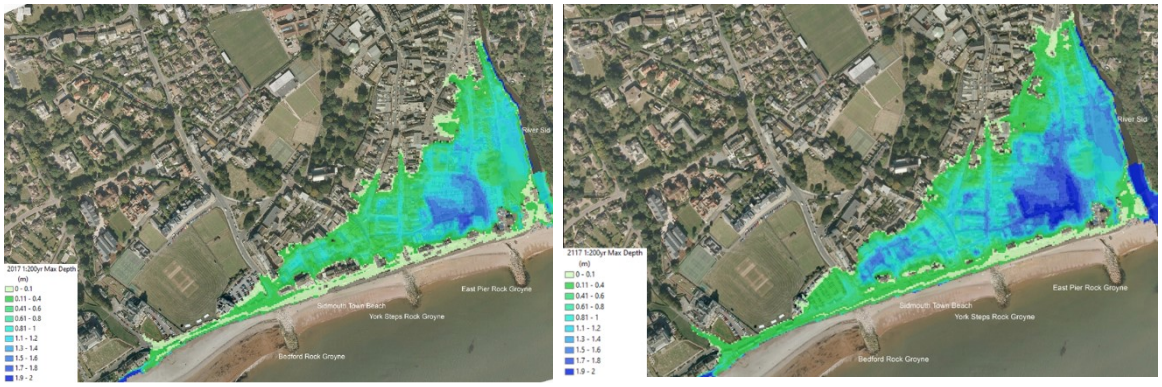


Figure 21: 2017 (left) and 2117 (right) 0.5% AEP flood extent and depth

On East Beach, the Pennington Point cliffs are eroding and thereby retreating. The erosion is due to wave impacts on the cliffs toe and weathering from above. The existing narrow shingle beach at the base of the cliffs forms the main cliff protection from wave action together with a small amount of rock armour (unmanaged) placed to its west in early 2000s, near the mouth of the River Sid. Beach lowering, partly due to the presence of the hard defences to the west of the River Sid, is exposing increasing sections of the cliffs toe to the destructive wave actions which is contributing to the experienced recent increased rate of erosion.

The rate of erosion is varying over time showing rapid increase in recent years (Figure 22). Estimated rates of ~2m/year are predicted in the short to medium period (0-20 years) which threatens six residential properties on the cliff top.

A slower rate of erosion of ~0.5m/year is predicted in the long term (20-100 years) which threatens an additional eight residential properties and buried services on Cliff Road.

Figure 22: East Beach current arrangement and recent cliff falls

In addition to the residential properties at risk, recession of the cliff also threatens the Alma Bridge and the South West Coast Path in the next 20 to 100 years. Historically running along the cliff edge, the Coast Path has already been relocated once landwards and it now flows Cliff Road to re-join the original

alignment by the Alma Bridge and continuing westwards along the promenade. Figure 23 highlights the historic and predicted erosion rates.

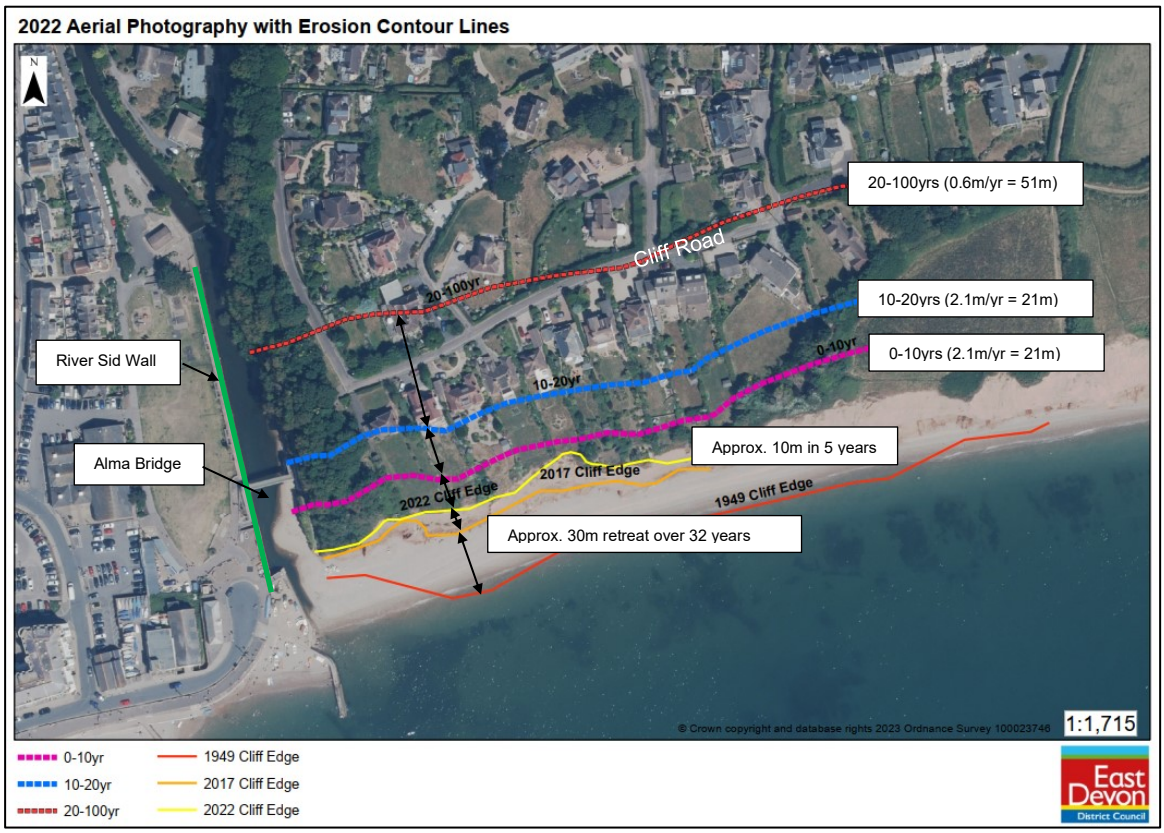


Figure 23: Sidmouth East Beach historic and predicted erosion lines

Critically, the cliff retreat poses an increased risk of flooding to Sidmouth as an indirect consequence of the Pennington Point cliffs erosion. The retreat of the cliffs exposes the fluvial River Sid Wall to open coast processes with an increased risk of flooding due to outflanking of the main coastal defences by wave overtopping in the next 10 to 20 years from south easterly events. In addition, the fluvial River Sid Wall is more likely to fail due to scour and direct coastal waves impacts, given its construction as fluvial defences and estimated residual life of 15 to 30 years (see Beach Management Plan[4] (BMP) asset condition report, 2017). A breach in the seawall in the next 20 years would increase the risk of flooding to residential and commercial properties during events up to 5% AEP from the southeast.

Clearly, as a result of climate change which will result in sea level rising within Sidmouth by ~0.7m over the next 100 years, the risk of coastal flooding in the town area and coastal erosion will increase unless measures are undertaken.

2.5 Objectives

The key investment objectives are summarised below:

[4] *Sidmouth and East Beach Management Plan, East Devon District Council – CH2M, 2017*

- To build upon the recommended option(s) from the Sidmouth Town and East Beach BMP.
- To ensure that full environmental consideration is given to the scheme and minimal impact on the environment is achieved.
- To manage the risk of coastal flooding and erosion to property and other assets along the Sidmouth frontage in the short to long term by ensuring that an adequate beach is maintained along the scheme frontage.
- To manage the risk of coastal flood and erosion to property and other assets along the Sidmouth frontage by ensuring there is adequate maintenance of the existing hard defence / control structures and any future structures.
- To develop a scheme which is acceptable to the local community and has minimal impact on the public realm.
- Develop and implement sustainable long-term solutions to the management of the issues and risk posed by potential outflanking of the Sidmouth Town coastal defences as a result of ongoing erosion of the cliffs at East Beach.
- Seek all sources of available external funding to maximise the opportunity for scheme delivery.
- Integrate wider initiatives such as regeneration and broader outcomes.

2.6 Current arrangements

Frontage B - Town frontage

Currently, the erosion risk on the town front is being managed by a Do Minimum approach, comprising primarily reactive maintenance of the sea defences and opportunistic recycling depending on funding availability.

Since the 1990s scheme, there has been very limited recycling of the beach from the westernmost healthier section to the more depleted areas to the east (Frontage B only). In addition, EDDC are looking to restart annual limited recharge of Frontage B using dredged material from the River Sid at Sidford (upstream) which would contribute to diminish somewhat the volumes of future recharging.

The remaining flood risk to the town is managed by the following hard engineered elements: offshore breakwaters and rock beach groynes, seawall and set-back splash wall (Figure 2).

To date, the offshore breakwaters have not required maintenance and have been proven effective in retaining beach material to their lee. This has minimised the need to recharge the beach in these areas. The breakwaters protect Sidmouth Town frontage from the prevailing south westerly. However, these structures offer

little flood risk reduction from the most recent increasing southerly to easterly storms events.

Rock groynes along the beach generally require little maintenance and aid maintaining the 1990s beach profile in front of the town and thus reducing wave energy hitting the seawall.

The seawall is the town's primary flood defence and since it was last improved in the 1990s, it is repointed in sections yearly. Despite comprising the main defence against flooding, it is prone to overtopping (recent events in 2014, 2017, 2020 and 2022), leaving pebbles and debris on the pedestrian promenade and the Esplanade which needs to be cleared post storms.

The seawall is inspected yearly, and has an average £50k worth of repairs on it per year. The splash wall and flood gates have around £10k a year spent on them through maintenance.

Setback from the seawall is a low splash wall, which divides the pedestrianised esplanade to the highway. Its purpose is to reducing overtopping waters propagating inland and flooding the low-lying town. The maintenance regime comprises concrete repairs when required and repairs / replacements of the multiple flood gates.

The town beach frontage has had only ad-hoc recycling and expenditure for this activity is not available.

The beach used to be recharged annually with river gravels taken from the River Sid at Sidford to reduce fluvial flood risk at this location (by the Environment Agency). Due to additional administration from the MMO and Waste Transfer licencing, the recycling of this material has not happened for the last 10 years, although this is hoped to restart in summer 2023, and anticipating a £5k annual cost.

East Beach – Frontage C

Currently, the erosion risk on East Beach is not being actively managed within the Managed Realignment frontage, due to limitations to what Flood Risk Management activity can be done within the designated site. However, in early 2000s, political pressure resulted in a small amount of rock armour being placed at the western most end of the cliffs, which is not maintained.

As described above, the cliffs on this frontage are eroding at increased rates and have already retreated beyond the former coastal path (see Figure 23) which has been moved inland to follow Cliff Road down to the Alma Bridge on the River Sid. Whilst this relocation has removed some of the public risk at the top of the cliffs by diverting users of the coastal path, risk to the cliff properties and inhabitants remain in the short term. Although the beach cannot be closed, public access has been discouraged due to public safety concerns from frequent cliff falls.

Due to its environmental designations, no maintenance occurs on East Beach. However, the cliffs are inspected and surveyed regularly. This is typically £20k a year.

2.7 Main benefits

2.7.1 Scheme benefits

The implementation of the scheme will better protect (OM2s) 113 residential properties for events up to 0.5% AEP over the next 100 years and provide better erosion protection (OM3s) to 59 residential properties for the same period.

Further details on the methodology used to assess the economic analysis and flood bands can be found in Section 3.5.

During the present day Do Nothing scenario, 52 residential and 36 commercial properties are shown to be at very significant risk of flooding (events up to the 5% AEP events). These values rise to 123 residential and 76 commercial for events up to 0.5% AEP (Table 7).

Properties at risk during present day south westerly events are illustrated in

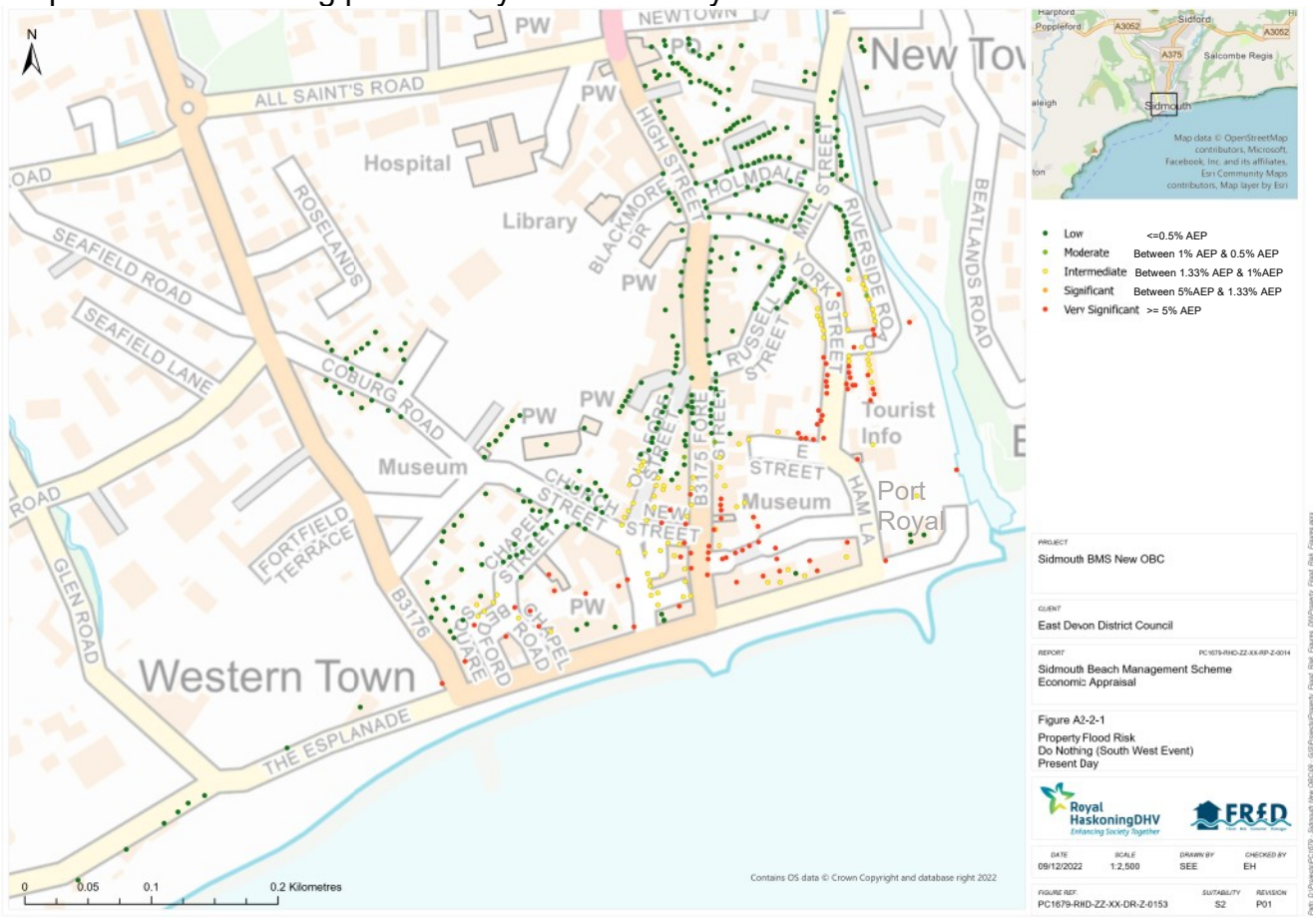


Figure 8.

Table 7: 2017 Do Nothing scenario properties at risk

Residential

Risk Band	Low	Moderate	Intermediate	Significant	Very Significant	Total
20% most deprived	0	0	0	0	0	0
21-40% deprived	0	0	0	0	0	0
60% least deprived	438	1	70	0	52	561
	438	1	70	0	52	561

Non-Residential

Risk Band	Low	Moderate	Intermediate	Significant	Very Significant	Total
20% most deprived	0	0	0	0	0	0
21-40% deprived	0	0	0	0	0	0
60% least deprived	170	2	38	0	36	246
	170	2	38	0	36	246

With climate change by 2117, 215 residential and 155 commercial properties are at significant risk of flooding. In events up to the 0.5% AEP, 310 residential and 186 commercial properties are shown at risk of flooding (Table 8).

Table 8: 2117 Do Nothing scenario properties at risk

Residential

Risk Band	Low	Moderate	Interme-diate	Significant	Very Significant	Total
20% most deprived	0	0	0	0	0	0
21-40% deprived	0	0	0	0	0	0
60% least deprived	251	37	58	0	215	561
	251	37	58	0	215	561

Non-Residential

Risk Band	Low	Moderate	Interme-diate	Significant	Very Sig-nificant	Total
20% most deprived	0	0	0	0	0	0
21-40% deprived	0	0	0	0	0	0
60% least deprived	60	4	27	0	155	246
	60	4	27	0	155	246

With a scheme in place and considering climate change by 2117, 0 residential and 0 commercial properties are at significant risk of flooding. 61 residential and 37 commercial properties remain at intermediate risk, and in events up to the 0.5% AEP, 99 residential and 52 commercial properties are shown at risk of flooding (Table 9).

Table 9: 2117 Do Something scenario properties at risk

Residential

Risk Band	Low	Moderate	Interme-diate	Significant	Very Significant	Total
20% most deprived	0	0	0	0	0	0
21-40% deprived	0	0	0	0	0	0

60% least deprived	462	38	61	0	0	561
	462	38	61	0	0	561

Non-Residential

Risk Band	Low	Moderate	Interme-diate	Significant	Very Sig-nificant	Total
20% most deprived	0	0	0	0	0	0
21-40% deprived	0	0	0	0	0	0
60% least deprived	194	15	37	0	0	246
						246

Following the implementation of the scheme, 113 residential properties will be better protected (OM2s) with an onset of flooding occurring for events of lesser frequency. Notably, 52 properties at very significant risk today will be at Intermediate (51) or Moderate / low risk (1) by 2117. Table 10 summarises properties at risk today that are better protected against flood risk with the proposed scheme.

Table 10: Residential properties better protected

At risk today – without scheme

Risk Band	Low	Moderate	Intermediate	Significant	Very Significant	Total
20% most deprived		0	0	0	0	0
21-40% deprived		0	0	0	0	0
60% least deprived		1	60	0	52	113
		1	60	0	52	113

At risk after duration of benefits – with scheme

Risk Band	Low	Moderate	Intermediate	Significant	Very Significant	Total
20% most deprived	0	0	0	0	0	0
21-40% deprived	0	0	0	0	0	0
60% least deprived	24	38	51	0	0	113
	24	38	51	0	0	113

Note: properties better protected are those which move risk bands in line with the definition for the Partnership Funding Calculator. These numbers are therefore not directly comparable with the tables showing the numbers of properties at risk, as some properties may have reduced flooding but do not move risk band and therefore are not included in this table, and properties better protected also compare across scenario and climate change epochs i.e. Do Nothing present day vs. with scheme 2117.

The proposed scheme will also increase the level of protection to 70 commercial properties, including South West Water Pumping Station (at very significant risk today), Sidmouth Lifeboat and local business. Notably, 36 non-residential properties at very significant risk today will be at intermediate (31) and at moderate / low (5) risk by 2117.

Broader benefits not directly accounted for in the economic analysis also include the increased protection to the River Sid wall and to six electricity sub-stations.

Table 11 summarises the non-residential properties better protected following the implementation of the scheme.

Table 11: Non-residential properties better protected

At risk today – without scheme

Risk Band	Low	Moderate	Intermediate	Significant	Very Significant	Total
20% most deprived		0	0	0	0	0
21-40% deprived		0	0	0	0	0
60% least deprived		2	32	0	36	70
		2	32	0	36	70

At risk after duration of benefits – with scheme

Risk Band	Low	Moderate	Intermediate	Significant	Very Signifi-cant	Total
20% most deprived	0	0	0	0	0	0
21-40% deprived	0	0	0	0	0	0
60% least deprived	24	15	31	0	0	70
	24	15	31	0	0	70

2.7.2 Scheme wider benefits

The scheme will also provide the following wider benefits:

Landscape

- Public access to the Sidmouth town frontage and to the beach is highly valued by the local residents, visitors and recreational users. Maintaining access to the coastline and retaining a beach will help towards sustaining and improving recreation / amenity within the town.
- Potential to improve the landscape and public realm of The Esplanade and promenade.
- The South West Coastal Path is present through the entire scheme area. It follows the promenade and crosses the River Sid at Alma Bridge providing an important link between residences east of the River Sid and the main town. Walkers regularly visit Sidmouth town via this route. Therefore, it is important to maintain access across the footpath.
- Sidmouth seafront is also part of the National Cycle Route No.2. Therefore, it is important to maintain access to the seafront.
- Sidmouth is home to a large concentration of 100 listed buildings which are at risk of damage through flooding.

Environment

- Protecting East Beach cliffs will reduce the loss of terrestrial species currently growing on the cliffs.

- The introduction of the long groyne and breakwater have the potential to create artificial reef habitats for fish, such as bass; and could be further enhanced through making the structures ‘living structures’ through the implementation of sea wall panels to encourage smaller marine species to colonise the breakwater and groyne.
- The above could be incorporated into an educational resource for local school projects and community monitoring initiatives of the local marine environment.
- Following completion of construction, a new launch ramp will be opened for use by the local community.
- Amenity improvements as a result of the upgrade to the splash wall.
- The existing two breakwaters have increased amenity behind them, with calmer waters and a sandy beach attracting the highest concentration of beach goers and water users

Broader Outcomes

- Potential re-development of the East Devon District Council owned land and buildings at Port Royal (behind East Pier rock groyne and along the River Sid).
- Improved access to the beach between East Pier Groyne and the River Sid training wall for boat users.
- Improved safety along The Esplanade through construction of a splash wall with improved access to the promenade through formal flood gates.

2.7.3 Highways Benefits

Devon County Council are contributing £500k towards the scheme to ensure benefits to the local highways network.

Through reducing risk of overtopping and erosion the damages avoided to the highway are £23.4m over the scheme duration.

2.8 Strategic risks, assumptions, constraints and dependencies

The sections below illustrate key strategic risks and how these have shaped the direction of the project.

2.8.1 Main risks and assumptions

Failure to secure funding: The project will require external contributions in addition to the FDGiA. External stakeholder engagement has secured a percentage of the contribution. East Devon District Council will provide the remaining funding. Early Contractor Involvement (ECI) has been applied to identify efficiencies.

Securing Planning Permission and assent - Adverse reaction from the local residents and interest groups: The proposed scheme provides a solution to an evidence-based problem and meets FCERM requirements. However, residual concern remains within sections of community associated with the height of splash wall that needs to carefully managed. Risk of not achieving Planning Permission and assents has been reduced through ongoing community and stakeholder liaison through the Advisory Group that support the preferred approach. This is also true of the statutory consultees for the designated sites who have been consulted with, and there is an agreeable way forward, but a risk remains that assent is not achieved.

Change in legislation or regulations: This project commenced in 2017 and several significant changes in legislation and regulations have occurred which caused delays in the delivery of the scheme. We continue to monitor all future changes which may affect the scheme. Grant funding rules changed increasing eligibility (positive) but caused delay re-assessing options, so urgency now increased as erosion and flood risk increased accordingly.

Cost certainty: The costs have been prepared with the assistance of an experienced contractor. A risk workshop has been undertaken to assess all significant risks. Optimism bias, Monte Carlo analysis and Inflation have been added to the cost. There has been significant inflation in the economy generally, and in particular in the construction sector over recent years due to external factors. There is a risk that ongoing inflation will make the scheme unaffordable. However, the project has attempted to mitigate this risk by using 2022 Environment Agency guidance for current inflation values.

Hydraulic and sediment transport modelling inaccuracy: Industry standard numerical models have been used to model shoreline evolution / sediment transport, wave overtopping and flood inundation (flood, depth and hazard). Previous physical modelling results (HR Wallingford physical model, 1993) have been used to validate the results. Model results have been verified against anecdotal evidence (inc. photos and videos). Sensitivity tests have been undertaken on recycling and nourishment rates, the length of the groyne and design beach to inform uncertainties (see Numerical Modelling report, Appendix D). Recent analysis confirms initial recommendation from HR Wallingford 1993 physical model of requiring additional offshore breakwaters. Further detailed numerical and physical modelling is to be undertaken at detailed design stage to refine the results of the proposed scheme.

Weather: The works will take place on the foreshore in a tidal area and offshore. The works will need to be programmed outside the winter months due to severe and unpredictable wave and weather conditions. This may involve 24hour

working for a short period during summer months to make best use of weather, tides and equipment.

Health and Safety – Cliff stability: The proposed works include the construction of a groyne and beach recharge on East Beach, requiring machinery to work close to the cliff. Due to concerns about the stability of the cliff, it is uncertain whether work will be undertaken from land. However, at this stage of the project, it is assumed that access will be limited to the foreshore at low tides, maintaining a safe distance from the cliff toe. This methodology will need to be revisited at detailed design stage. A significant proportion of the allocated risk allowance relates to this item in the eventuality that access needs to be provided exclusively from the sea with specialised machinery. –

Public Safety – Permanent structures: All new structures will have an effect on local conditions, and potentially sea safety such as unexpected rip currents. All structures will be designed to minimise dangerous rip currents.

2.8.2 Main constraints

There are a number of key constraints that needed to be considered in the appraisal, as summarised below.

Technical: Limitation of modelling accuracy to inform the preferred option. This has been mitigated by calibration and validation, sensitivity analysis, and risk contingency.

Environment: The area falls within designated areas that force constraints on the design and licencing and consenting required.

- Sidmouth to West Bay Area of Conservation (SAC).
- Lyme Bay to Torbay SAC.
- Dorset to East Devon Coastal United Nations Educational, Scientific and Cultural Organisation (UNESCO) World Heritage Site (the Jurassic Coast). The scheme options must not fully prevent erosion of East Beach cliffs. However, the BMP recognised that erosion must be slowed down to prevent early failure of the Western River Sid Wall and outflanking of the Sidmouth Town coastal defences.
- Sidmouth the Beer Coast Site of Special Scientific Interest (SSSI).

Landscape: The views and character of the local area which are part of the East Devon Area of Outstanding Natural Beauty AONB are important to residents, along with heritage setting of Sidmouth.

2.8.3 Main dependencies

The key delivery dependencies are as follows:

Funding: Contributions above FDGiA are to be required for the scheme to fully progress to construction. This had been outlined during the development of the Sidmouth Town and East Beach BMP.

Licencing and Consenting: There will be a number of statutory consultations which need to take place to assure the scheme implementation. For example, a marine licence will likely be required as construction works will fall within the jurisdiction of the Marine Management Organisation and planning permission for the construction of the raised splash wall and other elements.
A number of assessments will be required during detailed design stage:

- Environmental Impact Assessment (EIA) screening and scoping letter will be prepared and sent to EDDC and the Marine Management Organisation (MMO) to seek their opinion on the requirements of an EIA under the Town and Country Planning (EIA) Regulations 2017.
- A detailed Habitat Regulation Assessment will be required
- An updated Water Framework Directive (WFD) Compliance Assessment
- A Landscape Visual Impact Assessment (LVIA) may be required

3.0 Economic Case

To inform the baseline Do Nothing scenario and appraisal of options, a 2D hydraulic model was developed in 2018. The model was used to assess the flood extent / depth, taking into consideration the impacts of sea level rise and residential and commercial properties at risk (Appendix D).

For this appraisal, the scheme has been divided into three sub-frontages (B, C and D), as presented in Figure 24. Each sub-frontage has distinct physical characteristics and constraints. Solutions that may suit one sub-frontage may not be relevant to others. In appraising the 'Do Something' options, comparison is made to the baseline 'Do Nothing' option and impacts on adjacent sub-frontages.

Figure 24: Sidmouth Beach Management Scheme Extent

Options to reduce flood and coastal erosion risk management have been considered in accordance with the latest FCERM-Appraisal Guidance and Treasury Green Book rules.

As part of the 2017 BMP, a long list of all possible options was considered and assessed against technical, environmental and economic criteria. 'Non-starter' and unviable options were screened out to provide a list of potential options to assess in greater detail. A preferred option was then selected and developed further in 2018. This option is described in more details in Section 3.2.

In 2020, following the publication of the updated Partnership Funding Calculator for Flood and Coastal Risk Management (FCRM) projects by the Environment Agency, additional Flood Defence Grant in Aid (FDGiA) was released for the originally proposed flood defence scheme in 2017.

Following the update, the PV whole life benefits increased from ~£150m to ~£200m, which increased the amount of potentially available FDGiA by ~£7m. This provided the basis for revisiting the previous BMP preferred options discounted on economic grounds which were identified as preferred with the community. East Devon District Council, in collaboration with an elected Advisory Group, requested a high-level assessment of additional flood defence options including, but not limited to, options that were previously discounted during the development of the BMP for the main town (Frontage B) and East Beach (Frontage C). In particular, the previously discounted BMP offshore breakwaters option (further described below), more costly but preferrable on technical grounds and to the community, became potentially viable and was further assessed. Reference should be made to the Technical Note in Appendix A of the Numerical Modelling report for further details of the alternative options considered.

3.1 Critical success factors (CSF)

CSFs were established for the project based on the objectives from the BMP and scheme. The CSFs are aligned with the five standard CSFs as presented in the HM Treasury Green Book for this scheme are as follows:

- **Strategic fit and meets business needs - Cliff Erosion:** to slow down the rate of erosion to Pennington Point cliffs, East Beach.
- **Potential Value for Money - Overtopping and Inundation:** to implement a scheme that can retain a beach in front of Sidmouth town and reduce the risk of wave overtopping onto the promenade and coastal flood inundation to the town of Sidmouth.
- **Potential affordability - Maintenance costs:** to implement a scheme with minimal future maintenance costs.
- **Strategic fit and meets business needs - Landscape:** a scheme that maintains the views and character of the local area.
- **Potential achievability - Acceptance:** to implement a scheme that is acceptable to key stakeholders, the Advisory Group and regulators.
- **Potential affordability - Affordable:** to implement a scheme that is affordable within grant eligibility and contributions for the benefit period of the scheme.
- **Supplier capacity and capability - Contractor interest:** to adopt a scheme that retains interest from competent and experienced contractors.

The critical success factors provided a means of assessing the level of success of the short-listed options. The appraisal process has been recorded using the Appraisal Summary Tables which can be found in Appendix F ‘Sidmouth Beach Management Scheme Appraisal Summary Table’.

3.1.1 Measurement Criteria of the CSF

- To slow down the rate of erosion to Pennington Point cliffs, East Beach. This will be measured by future cliff surveys
- To implement a scheme that can retain a beach in front of Sidmouth town and reduce the risk of wave overtopping onto the promenade and coastal flood inundation to the town of Sidmouth. This will be measured by future beach surveys
- To implement a scheme with minimal future maintenance costs. This will be measured by future maintenance costs
- A scheme that maintains the views and character of the local area. This will be judged a success when the scheme obtains planning permission.
- To implement a scheme that is acceptable to key stakeholders and regulators. This will be judged a success when the scheme obtains the necessary permissions and consents.
- To implement a scheme that is affordable. This will be measured by being affordable on the budget set out.

3.2 Longlist of Options

The BMP developed a long list of potential options and appraised these against technical, economic and environmental criteria. The preferred strategic management option was ‘Do Something’ by sustaining the existing standard of protection over the next 100 years.

Other options rejected as unviable were screened out early on to provide a refined longlist of potential options to assess in greater detail. The following sections provide a summary of the refined long list taken from the BMP. All options meet SMP policy objectives.

3.2.1 Option Do Nothing. Shortlisted

Baseline option only. Under this option, no maintenance or improvement of existing defences are undertaken. The coastal flood risk increases over time.

As explained in Section 2.4.1, the seawalls along the town front are estimated to breach in year 75-80. Whilst this would not significantly change the risk of flooding from overtopping, it will initiate an erosion process which will quickly affect the Esplanade and the services running beneath it. Properties along the sea front will be deemed uninhabitable with potential wider impacts caused by the disruption of services.

With no remedial works, the cliffs at Pennington Point, East Beach will continue to erode causing increased exposure of the river Sid wall to sea storm conditions. Therefore, the risk of outflanking / breach of the fluvial wall will increase. Moreover, properties on top of the cliff will be lost over the medium to long term.

3.2.2 Option Do Minimum. Rejected

The strategic management option of 'Do Minimum', comprising emergency repairs and minimal maintenance only was discounted at the start of the appraisal process. This option did not achieve the following Critical Success Factors:

- Cliff erosion: a Do Minimum approach will not slow down the rate of erosion at Pennington Point cliffs, East Beach. There is no incident response nor maintenance regime of the existing beach that could be undertaken which would reduce the wave action contributing to the cliff's collapse.
- Overtopping and inundation: given the loss of beach material at the town front and the low height of the existing splash wall at the back of the promenade, simply maintaining the status quo by implementing a Do Minimum approach would not be sufficient to reduce the risk of overtopping and coastal flood inundation over the next 100 years (refer to Table 1 and Table 2 in Section 1). The beach profile requires substantial additional material which cannot be sourced in the adjacent areas. The existing coastal flood defence height alone is inadequate to reduce wave overtopping and would require extensive works to be upgraded. In order to contain flood water, the splash wall at the back of the promenade requires raising which involves the construction of new foundations.
- Maintenance costs: by year 60-65 defects in the existing defences would render the structures beyond economic structural repair and major capital interventions would be required (BMP asset condition report). Incremental maintenance costs would be required whilst the benefits would reduce.
- Acceptance: for the reasons above, a Do Minimum approach will not be accepted by key stakeholders, the Advisory Group and regulators.
- Affordability: a Do Minimum approach will require annual maintenance costs to East Devon District Council with no real benefits. Moreover, by year 60-65 repairs will become economically unviable and major capital intervention works would be required.

3.2.3 Option Do Something S1. Shortlisted

Figure 25 illustrates key elements of option S1.

Description

- Frontage B:
    - Maintain existing defences.
    - Repair and shorten the length of both the current freestanding section of training wall and East Pier rock groyne.
    - Immediate repairs to the River Sid training wall.

    - Raise the splash wall along the entire frontage length to help contain the increase in wave overtopping onto the promenade in the future.
    - Undertake periodic beach recharge / recycle to maintain beach volumes to the level of the design beach.
- Frontage C:
    - Construct 1 or 2 new groynes 150-200m east of the River Sid to aid beach levels.
    - Supporting periodic beach recycling from East Beach to Frontage B. Future maintenance is high to medium.
- Frontage D: Maintenance for as long as economically viable followed by replacement.

Reason for shortlisting

- Frontage B: Ensures standard of protection is provided to the seafront. Beach levels are maintained.
- Frontage C: Cliff erosion slowed down as beach levels are maintained.
- Frontage D: Ensures continued effectiveness of wall.
- Awareness that public protests have already been organised against a full raising of the splash wall, and feedback is negative from consultation, meaning planning permission may be hard to obtain.

Figure 25: Option S1 showing one new groyne on East Beach

3.2.4 Option Do Something S2. Rejected

Figure 26 illustrates Option S2.

Description

This option is the same as Option S1 with the following additional activities:

- Frontage B:
    - Modify existing Bedford Steps, York Steps and East Pier rock groynes to make ‘T-head’ type groynes to retain sediment in small stable bays between each groyne bay and shortening East Pier groyne in the process. This change will contribute to maintaining beach levels to provide a consistent standard of protection is provided to the seafront.
    - Support with periodic beach recycling and / or recharge to retain volume to give required design beach.

Reason for rejection

- Frontage B: This option requires additional upfront investment compared to S1 which is considered not justifiable. Compared to S1, the benefits remain unchanged but future maintenance costs are the same, as modifying the rock groynes to hold the beach in place will still require future beach management / maintenance though likely requiring smaller volumes or lesser frequently.
- Frontage C: cliff erosion slowed down as beach levels are maintained.
- Frontage D: ensures continued effectiveness of wall.
- Public protests have already been organised against a full raising of the splash wall, and feedback is negative from consultation, meaning planning permission may be hard to obtain.

Figure 26: Option S2 showing T-head groynes and additional groyne on East Beach

3.2.5 Option Do Something S3. Rejected

Figure 27 illustrates Option S3.

Description

This option is the same as Option S2 with the following additional activities:

- Frontage B:
    - Remove East Pier rock groyne and training wall and place rock-armour around seawall where it curves into the River Sid. This ensures the required Standard of Protection (SoP) is provided to seafront. Beach levels are maintained. Allows for more transition of shingle between Frontage B and C.

Reason for rejection

- Frontage B: This option requires additional investment compared to S1 with no increased benefits. The maintenance / management costs are as high as for Option S1. Raise the splash wall along a short length either side of the area of influence by the breakwater to help contain the increase in wave overtopping onto the promenade in the future.
- Frontage C: Cliff erosion reduced as beach levels are maintained.
- Frontage D: Ensures continued effectiveness of wall.
- Public protests have already been organised against a full raising of the splash wall, and feedback is negative from consultation, meaning planning permission may be hard to obtain.

Figure 27: Option S3 comprising T-head groynes, removal of East Pier groyne and new groyne on East Beach

3.2.6 Option Do Something S4. Shortlisted

Figure 28 illustrates Option S4.

Description

- Frontage B:
    - Remove existing beach structures (Bedford Steps, York Steps and East Pier rock groynes) and construct new offshore breakwaters.

    - Immediate repairs to the River Sid training wall.
- Frontage C: Construction of new offshore breakwaters tapering towards the eastern end of the study areas.
- Frontage D: Maintenance for as long as economically viable followed by replacement.

Reason for shortlisting

- Frontage B: Ensures SoP is provided to seafront. Beach levels are maintained. Allows for more transition of shingle between Frontage B and C although there is more uncertainty on design and performance compared to other options. The offshore breakwaters would maintain beach levels and thus future maintenance costs would be greatly reduced. Support from local residents and Advisory Group.
- Frontage C: Cliff erosion reduced as beach levels are maintained. Allows for more transition of shingle between Frontage B and C. However, there are some increased uncertainties on design and performance compared to other options. Reduces the amount of future beach management / maintenance required.
- Frontage D: Ensures continued effectiveness of wall.

Figure 28: Option S4 comprising four new offshore breakwaters

3.3 Technical appraisal

A full technical appraisal was undertaken on each of the short-listed options and is summarised below. Full details of this can be found in Appendix F ‘Sidmouth Beach Management Scheme Appraisal Summary Table’ and Appendix D ‘Sidmouth Beach Management Scheme – Numerical Modelling’.

For options 1 to 5 (S1.1a to S1.1e), each sub-option comprises the same proposed works for frontages B and D and therefore the technical appraisal has

focused on the different groyne combinations for Frontage C together with the required beach maintenance regimes

For Option 6 (S4.4a) (offshore breakwater), the same solution as per Option 3 (S1.1c) is proposed for frontages C and D. For Frontage B, in addition to beach recharge and raised splash wall, 1no. offshore breakwater is introduced. This will reduce future beach management requirements as the presence of the offshore structure will maintain the replenished beach to its lee. Moreover, the need to raise the splash wall on the promenade in line with the breakwater is likely to be delayed or not be required within the lifetime of the scheme. This is critical for local acceptance and support for the scheme.

As describe in Section 3.2, the preferred option presented will be further refined at detailed design stage to assess whether additional breakwaters can be included to implement a more passive solution. If future detailed assessment proves that a more passive scheme is economically affordable, a Business Case Update Report (BCUR) will be submitted.

Note: identifying the time of intervention for raising the splash wall for Frontage B requires detailed modelling. Therefore, to provide a conservative estimate of construction costs, the splash wall is estimated to be raised at the same time along the whole promenade without a staged approach. This will be refined at the next stage of the project.

Table 12 below summarise the key aspects of the technical appraisal.

Table 12: technical appraisal summary

Shortlist option No.	Frontage B	Frontage C
Option 1 – S1.1a	This option comprises: • Sufficient beach material to provide protection to the seawall and reduce overtopping of the seawall. • The raised splash wall along the whole frontage will contain overtopped sea water. • Beach recharge will be required over the whole frontage every 10 years. • Beach recharge every one to five years required from Frontage C, depending on the proposed length / combination of groynes on Frontage C.	This option will: • Hold sufficient beach material to provide protection to cliff toe. • The beach will be at very high risk of drawdown / erosion under sea storm conditions. • Annual recycle from Frontage C to Frontage B required to decrease the risk of losing material eastwards and maintain healthier beach levels. • Recharge of Frontage C required every 10 years.
Option 2 – S1.1b		This option will: • Hold sufficient beach material to provide protection to cliff toe. • Beach will be at high risk of drawdown / erosion under sea storm conditions. • Annual recycle from Frontage C to Frontage B required to decrease the risk of losing material eastwards and maintain healthier beach levels. • Recharge of Frontage C required every 10 years.
Option 3 – S1.1c		This option will: • Hold sufficient beach material to provide protection to cliff toe. • Beach will be at some risk of drawdown / erosion under sea storm conditions. • Beach recycle from Frontage C to Frontage B required every five years, as less material likely to bypass the long groyne. • No beach recharge of Frontage C required.
Option 4 – S1.1d		This option will: • Hold sufficient beach material to provide protection to cliff toe. • Beach will be at low risk of drawdown / erosion under sea storm conditions. • Beach recycle from Frontage C to Frontage B required every five years, as less material likely to bypass the long groyne. • No beach recharge of Frontage C required. • Increased construction costs compared to Option 3 due to building an additional groyne outweighing the relatively small savings in reduced maintenance costs.
Option 5 – S1.1e		This option will: • Hold sufficient beach material to provide protection to cliff toe. • Beach will be at very low risk of drawdown / erosion under sea storm conditions. • Beach recycle from Frontage C to Frontage B required every five years, as less material likely to bypass the long groyne. • No beach recharge of Frontage C required. • Increased construction costs due to building an additional long groyne in addition to increased maintenance costs.
Option 6 – S4.4a	As per Sub-Options S1 with the addition that this option will hold beach material in the lee of the breakwater in the long run and thus reducing maintenance. • The presence of the offshore breakwater will likely reduce the requirements for a raised splash wall on the promenade within the same envelope where the breakwater is built. • Moreover, as in the case of the existing offshore breakwaters further to the west, a stable tombolo feature will form landwards of the breakwater increasing beach effectiveness in reducing wave energy. Note: additional offshore breakwaters, discounted on economic grounds only, would be technically more preferable as these would aid reducing wave energy and maintaining a healthy beach to their lee. This would have the additional benefit of reducing the need for recycling / recharging and therefore future maintenance costs. However, further refinement of this option is not achievable at this stage without lengthy and costly detailed modelling which will be undertaken during detailed design stage.	This option will: • Hold sufficient beach material to provide protection to cliff toe. • Beach will be at some risk of drawdown / erosion under sea storm conditions. • Beach recycle from Frontage C to section of Frontage B without breakwater required every five years, as less material likely to bypass the long groyne. • No beach recharge of Frontage C required.

3.2.4 Short listed options

Overview
After review of technical, environmental and economic appraisal, the 2017 BMP identified the preferred option as Option S4. This option required significant contributions over and above available FDGiA, and efforts to secure these contributions were not progressed due to the lengthy timescales and the anticipated very low chances of success. Option S1 therefore progressed to outline design stage due to greater affordability (still requiring funding above available FDGiA) while meeting the project objectives.

In accordance with the recommendations of the BMP, sub-options of options S1 were developed and appraised and are summarised in Table 13.

Overtopping analysis highlighted the need to include a raised splash wall to ~1m high from ground level at the back of the promenade along the whole town frontage. Public consultation identified significant concerns over the inclusion of the splash wall and further concerns were raised regarding the reliance on a healthy beach fronting the defences to provide the required standard of protection. Maintaining such a beach would commit EDDC to an intense (and very costly) future maintenance regime. This aspect of the scheme greatly concerned EDDC and the local community which feared future budgetary constraints would undermine essential maintenance and therefore reduce the effectiveness of the scheme.

In 2020, the updated Partnership Funding Calculator increased the amount of potentially available FDGiA by ~£7m additional FDGiA. This triggered a renewed interest in the BMP originally preferred option, Option S4, which relies on more passive measures (offshore breakwaters) to reduce wave energy and maintain beach levels along the town frontage.

Analysis was undertaken to assess additional flood defence options, including ones that were previously discounted during the development of the BMP. These have been summarised in Appendix A of the Numerical Modelling report. Option S4 was still confirmed as the technically preferred option. Sub-options were assessed at high-level, including different numbers and dimensions of breakwaters and their relative distance from the shore.

The appraisal process identified only one economically affordable option (Option 6 – S4.4a in Table 13 and 29), comprising the construction of one offshore breakwater, in addition to beach recharge and other measures. This option has been progressed to this OBC, recognising that further development at detailed design will consider the number of offshore breakwaters required.

It is worth noting that in line with the BMP and HR Wallingford results in 1993, the recent assessment also identified that additional breakwaters along the whole frontage would provide a more robust solution. The need for future beach recycling and recharging would be significantly reduced and the requirements for raising the splash wall at the back of the promenade delayed. However, these alternative sub-options were discounted at this stage on economic grounds, without a detailed economic assessment due to significant uncertainties. To

further progress these options, lengthy and costly detailed modelling would be required which was not feasible at this stage. It is the intention of EDDC to undertake further modelling at detailed design stage to ascertain whether a more passive solution may be affordable. In the event of a positive response, a Business Case Update Report (BCUR) will be submitted to update the current proposal.

Table 13: Shortlist of options

Shortlist option No.	Description		
	Frontage B	**Frontage C**	**Frontage D**
Option 1 – S1.1a	Maintain existing defences. Repair and shorten length of the current freestanding section of training wall. Undertake beach recharge to reinstate 1990s design beach levels. Undertake periodic beach recharge, and recycling from frontage C to frontage B to maintain design beach levels. Immediate repairs to the River Sid training wall. Raise existing splash wall and install higher flood gates. Construction of new maintenance ramp.	Construct 1no. rock groyne ~80m in length east of the River Sid. This will control beach levels and will be supported by periodic beach recharge.	Maintenance for as long as economically viable followed by replacement.
Option 2 – S1.1b		Construct 2no. rock groynes ~80m in length east of the Frontage D River Sid. This will control beach levels and will be supported by periodic beach recharge.	
Option 3 – S1.1c		Construct 1no. rock groyne ~120m in length east of the Frontage D River Sid. This will control beach levels without the need for periodic recharge.	
Option 4 – S1.1d		Construct 1no. rock groyne ~80m in length and 1no. rock groyne ~120m in length east of the Frontage D River Sid. This will control beach levels without the need for periodic recharge	
Option 5 – S1.1e		Construct 2no. rock groynes ~120m in length east of the River Sid. This will control beach levels without the need for periodic recharge.	
Option 6 – S4.4a	As per Options S1 with the construction of offshore breakwater.	Construct 1no. rock groyne ~120m in length east of the Frontage D River Sid. This will control beach levels without the need for periodic recharge.	Maintenance for as long as economically viable followed by replacement.

3.4 Environmental appraisal

A Preliminary Environmental Information Report (PEIR) has been prepared and reference should be made to the report (see Appendix N). The PEIR report identifies and describes the environmental issues, constraints, and opportunities relating to the preferred option for the Sidmouth Beach Management Scheme. It recommends where possible, actions required to further assess or manage any environmental impacts during subsequent phases of.

A high-level assessment of all shortlist options has been summarised in Appendix F. An extract of the appraisal related to the environmental receptors is presented below in Table 14.

Table 14: High-level Environmental Appraisal

Environmental Impacts								
Option	Frontages	Baseline - Do Nothing	Option 1 - S1.1a	Option 2 - S1.1b	Option 3 - S1.1c	Option 4 - S1.1d	Option 5 - S1.1e	Option 6 - S4.4a
Landscape	Frontage B – Sidmouth town	As defences fail there will be significant changes to the landscape.	Maintaining/repairing the training wall and recharging the beach are unlikely to change the landscape setting. Raising the existing splash wall and installing flood gates may change the landscape setting, impacting views and the townscape. Negligible or slight impact.					Maintaining/repairing the training wall and recharging the beach are unlikely to change the landscape setting. Raising the existing splash wall, installing flood gates may change the landscape setting, impacting views and the townscape. Negligible or slight impact. Constructing a new offshore breakwater will change the landscape setting, impacting views and the townscape. Impact considered minor - moderate.
	Frontage C – East Beach and Pennington Point Cliff	East Beach cliff continue to erode back changing the landscape naturally.	Introducing one short groyne is likely to result in the smallest change to the setting of the landscape and seascape character in one discreet area, including the AONB and the World Heritage Site (WHS). Impact considered minor.	Introducing two short groynes is likely to result in a change to the setting of the landscape and seascape character in two areas, including the AONB and the World Heritage Site (WHS). The change is likely to be larger than expected for one groyne as more than one location will be impacted. Impact considered minor - moderate with localised substantial visual effects.	Introducing one long groyne is likely to result in a larger change to the setting of the landscape and seascape character in one discreet area when compared to one shorter groyne, including the AONB and the World Heritage Site (WHS). The change is likely to be smaller than if two short groynes were installed as it will be contained to one location. Impact considered minor - moderate. Impact considered minor - moderate with localised substantial visual effects.	Introducing two groynes (one short one long) is likely to result in a change to the setting of the landscape and seascape character in two areas, including the AONB and the World Heritage Site (WHS). The change is likely to be larger than expected for one groyne as more than one location will be impacted. Impact considered minor - moderate. Impact considered minor - moderate with localised substantial visual effects.	Introducing two long groynes is likely to result in a change to the setting of the landscape and seascape character in two areas, including the AONB and the World Heritage Site (WHS). The change is likely to be larger than expected for one groyne as more than one location will be impacted and also more than for options 2 and 4 with two groynes due to their length. Impact considered minor - moderate with localised substantial visual effects.	Introducing one long groyne is likely to result in a larger change to the setting of the landscape and seascape character in one discreet area when compared to one shorter groyne, including the AONB and the World Heritage Site (WHS). The change is likely to be smaller than if two short groynes were installed as it will be contained to one location. Impact considered minor - moderate. Impact considered minor - moderate with localised substantial visual effects.
	Frontage D – River Sid Western Wall	As defences fail there will be significant changes to the landscape.	No likely change in landscape.	No likely change in landscape.	No likely change in landscape.	No likely change in landscape.	No likely change in landscape.	No likely change in landscape.
Coastal Geomorphology	Frontage B – Sidmouth town	No impacts. Coast allowed to naturally function.	Baseline conditions remain the same. No impact on UNESCO World Heritage Site and nationally designed geological sites.					
	Frontage C – East Beach and Pennington Point Cliff	Coast allowed to naturally function so will continue to erode the cliff with potential to change the sediment deposition regime in a natural manner.	Small adverse impacts on UNESCO World Heritage Site and nationally designated geological sites. Key to designation is that the coast will be allowed to naturally function though at a reduced rate exposing the cliff slower as a result of erosion.					
	Frontage D – River Sid Western Wall	No impacts. Coast allowed to naturally function.	Baseline conditions remain the same. No impact on UNESCO World Heritage Site and nationally designed geological sites.					

Environmental Impacts								
Option	Frontages	Baseline - Do Nothing	Option 1 - S1.1a	Option 2 - S1.1b	Option 3 - S1.1c	Option 4 - S1.1d	Option 5 - S1.1e	Option 6 - S4.4a
Coastal Processes	Frontage B – Sidmouth town	Positive impact on UNESCO World Heritage Site and nationally designated geological sites by allowing natural processes of erosion to enhance features.	No impact, coastal processes would continue as present with the current defences continuing to influence nearshore transport.					No impact, coastal processes would continue as present with the current defences continuing to influence nearshore transport. The construction of the offshore breakwater likely to have minimal or no impact on sediment transport.
	Frontage C – East Beach and Pennington Point Cliff	Positive impact on UNESCO World Heritage Site and nationally designated geological sites by allowing natural processes of erosion to enhance features.	Option will help to stabilise upper beach. Natural movement of beach material along this frontage will be significantly affected. Beaches to the east are generally healthy, therefore impacts updrift are likely to be minimal.					
	Frontage D – River Sid Western Wall	Positive impact on UNESCO World Heritage Site and nationally designated geological sites by allowing natural processes of erosion to enhance features.	Possible construction impacts to UNESCO World Heritage Site and nationally designated geological sites. Baseline conditions likely to remain at same level subject to external driving forces.					

Environmental Impacts								
Option	Frontages	Baseline - Do Nothing	Option 1 - S1.1a	Option 2 - S1.1b	Option 3 - S1.1c	Option 4 - S1.1d	Option 5 - S1.1e	Option 6 - S4.4a
Marine Ecology	Frontage B – Sidmouth town	Impact from infrastructure erosion debris causing possible temporary damage/ smothering of BAP habitat/reef habitat and inshore nursery and fish spawning grounds. The marine ecology would in the long term return to a natural state though there would be undefinable impacts from infrastructure becoming part of the marine environment.	There is likely to be a temporary increase in suspended sediment concentrations during beach recharge and recycling, this impact will be the same regardless of the selected option. These impacts are not anticipated to be significant and will only last for a short period of time. No other changes to the current condition are anticipated.					As per Option S1 with the addition of permanent loss of habitat due to the construction of the breakwater. Considered a negligible adverse / beneficial impact creating artificial reef habitat for fish.
	Frontage C – East Beach and Pennington Point Cliff	No impact as cliff erosion would continue in a natural manner.	Small loss of habitat within the footprint of the structures (smallest to largest - 1a, 1c, 1b, 1d, 1e). This will not affect any Priority Habitats or species of conservation importance. There is also likely to be a temporary increase in suspended sediment concentrations during construction with the impact slightly larger depending on the selected option (smallest to largest - 1a, 1c, 1b, 1d, 1e). The same impact can be expected during beach recharge and recycling though this impact will be the same regardless of the selected option. These impacts are not anticipated to be significant and will only last for a short period of time. A potential positive impact may occur from additional structures providing surfaces and crevices (e.g. for brown crab) that can be colonised by marine species resulting in an increase in the diversity of habitats found in this location. Potential for small impacts from vehicular movements along the beach and vessels moored on the beach or nearshore during the construction phase, this is not considered likely to result in any significant effects on the ecology. A Construction Environmental Management Plan (CEMP) will mitigate for spills, leaks etc.					
	Frontage D – River Sid Western Wall	Potential for infrastructure to block the river Sid impeding fish migration.	No impact compared to present.					
Water Quality	Frontage B – Sidmouth town	No change to current conditions.	There is the possibility that the proposed beach management activities and construction could impact on water quality if undertaken within or from the water. However impacts will be managed with the implementation of a CEMP with a particular focus on reducing the risk of accidental spills and disturbance to the marine environment as far as possible.					
	Frontage C – East Beach and Pennington Point Cliff	No change to current conditions.	There is the possibility that the proposed beach management activities and construction could impact on water quality if undertaken within or from the water. However impacts will be managed with the implementation of a CEMP with a particular focus on reducing the risk of accidental spills and disturbance to the marine environment as far as possible. It follows that the potential for an unmitigated impact would be larger, the larger the scale of the works (smallest to largest - 1a, 1c, 1b, 1d, 1e).					
	Frontage D – River Sid Western Wall	No change to current conditions.	There is the possibility that the proposed beach management activities and construction could impact on water quality if undertaken within or from the water. However impacts will be managed with the implementation of a CEMP with a particular focus on reducing the risk of accidental spills and disturbance to the marine environment as far as possible.					

Environmental Impacts								
Option	Frontages	Baseline - Do Nothing	Option 1 - S1.1a	Option 2 - S1.1b	Option 3 - S1.1c	Option 4 - S1.1d	Option 5 - S1.1e	Option 6 - S4.4a
Terrestrial Ecology	Frontage B – Sidmouth town	No change to current conditions.	No change to current conditions. The man-made sea defence structures currently do not provide much habitat for terrestrial ecology and maintaining/repairing the sea defence will not change this, nor will raising the existing splash wall.					
	Frontage C – East Beach and Pennington Point Cliff	No change to current conditions.	The rate of erosion on the vegetated cliff will continue though it will be reduced by the introduction of the groynes.					
	Frontage D – River Sid Western Wall	No change to current conditions.	No change to current conditions. The wall will be maintained.					
Archaeology & Cultural Heritage	Frontage B – Sidmouth town	As defences fail there will be significant changes to the Sidmouth Town Conservation Area with the potential for the listed buildings and structures within the town of Sidmouth located along the Esplanade and near to Chit Rocks to be lost.	The historic conservation area will potentially be negatively impacted by the new splash wall. During the detailed design phase the splash wall will need to be developed ensuring it is in keeping with the conservation area.					
	Frontage C – East Beach and Pennington Point Cliff	The cliff will continue to erode, with erosion rates likely to increase over time as the current defences fail.	Erosion of the cliff is a key issue. It is a feature of the designation that cliff erosion continues. At the same time the properties located at the top of the cliff would like the cliff to be maintained to safeguard their properties. The rate of cliff erosion depends on the option selected with the largest amount likely to be if Option 1 were selected followed by Option 3, Option 2, Option 4 and with the least amount of erosion taking place for Option 5.					
	Frontage D – River Sid Western Wall	No change to current conditions.	No change to current conditions.					

3.5 Economic appraisal

3.5.1 Assessment of benefits

The economic benefits have been calculated in accordance with the Flood Hazard Research Centre Flood and Coastal Erosion Risk Management: A Manual for Economic Appraisal (known as the Multi-Coloured Manual or MCM), the Environment Agency Flood and Coastal Erosion Risk Management Appraisal Guidance (FCERM-AG) and the HM Treasury Green Book: Appraisal and Evaluation in Central Government.

The economic analysis takes into account both coastal erosion and tidal flood risk, and where properties are at risk from both the relative timescales of write-off have been taken into account to avoid double-counting property benefits. The damage types which have been quantified include property damage (residential and commercial), vehicle damage, emergency service costs, evacuation costs, health (social and mental), risk to life, direct road surface damages, indirect car park losses, and amenity benefits.

The amenity benefits are based on the assessment carried out in the previously approved Sidmouth and East BMP.

The appraisal period for this scheme is 100 years and has a base date of 31st July 2020. Further to the assessment undertaken in 2020 the damage values have been uplifted to the Outline Business Case (OBC) date of 2022 using the *GDP deflator indices*. The assessment takes into account the impacts of climate change looking at four epochs across the appraisal period (2020s, 2050s, 2080s, and 2100s), following the Environment Agency guidance for coastal flooding. Damages have been discounted across the appraisal period in accordance with the recommendations of the HM Treasury Green Book to provide present value (PV) damages, using the standard and health discount rates as appropriate for each damage category.

Damages have been calculated for both a Do Nothing and Do Something option and compared to provide the benefits for the scheme.

All of the Do Something options will achieve the same economic benefits. Therefore, the option selection is based on whole life cost, achieving the Critical Success Factors (outlined in Section 3.2), and residual option uncertainty.

Full details on the methodology used in the economic appraisal can be found in Appendix I ‘Sidmouth Beach Management Scheme Flood Risk Damage Methodology’

3.5.2 Assessment of costs

Options cost estimates were developed as part of the appraisal process. Cost estimates took into consideration staff costs, external fees, construction and site costs, environmental considerations, optimism bias, risks and maintenance costs over the 100-year appraisal period.

Prices were developed in consultation with a competent coastal contractor to ensure robustness in the appraisal process. An initial optimism bias of 40% was used at the option appraisal stage, following assessment of the risk of change and consideration of the key elements of the construction (note the costs including the risk allowances have been developed further for the preferred option, and therefore values presented in Table 15 below do not match the developed cost numbers in Section 5 Financial Case). The 40% optimism bias was applied to all costs including future maintenance.

Key elements for this assessment were:

- The large proportion of the capital costs are associated with the construction of rock groynes, offshore breakwater, beach re-nourishment or recycling.
- As this is an extension to an existing groyne field, offshore breakwaters and beach management scheme, the existing scheme performance and drawing details gave increased confidence to:
    - The sizing and performance of the proposed groyne structures.
    - The sizing and performance of the proposed beach.
    - The sizing and performance of the proposed offshore breakwater

The proposed raising of the splash wall is being constructed in a landward zone, outside of the intertidal zone, which comparatively is a very controlled working environment with reduced risk of weather delay and increased confidence in construction output.

The majority of risks lie in the instability of the cliff at East Beach and the works to construct the offshore breakwater.

Table 15 shows the results of the economic appraisal presented as present value (discounted in line with HM Treasury Green Book guidance). The PV costs include all costs and risk allowances over the 100-year appraisal period (including maintenance). Table 16 splits the present value maintenance costs out from the total PV costs (which are presented in Table 15).

Option 3 is the most economic option, however it does not meet the objectives and CSFs of the project. See Section 3.8 for discussion on selection of preferred option.

Table 15: results of the economic appraisal (present value)

Option	PVc (WLC) (£k)	PVb (£k)	BCR	iBCR	Rank
	£k	£k			
0 - Do Nothing	£-	NA	NA	NA	7
1 – S1.1a	£17,866	£196,171	10.98	NA	3
2 - S1.1b	£18,430	£196,171	10.964	NA	4

Option	PVc (WLC) (£k)	PVb (£k)	BCR	iBCR	Rank
3 - S1.1c	£17,081	£196,171	11.48	NA	1
4 - S1.1d	£17,368	£196,171	11.29	NA	2
5 - S1.1e	£18,460	£196,171	10.63	NA	5
6 - S4.4a	£18,784	£196,171	10.44	NA	6

Table 16: Present value future costs (including 40% optimism bias)

Shortlist option No.	Estimated Present Value (PV) future maintenance and operational costs (£k)	Ranking
Option 1 – S1.1a	£5,240	5
Option 2 – S1.1b	£5,436	6
Option 3 – S1.1c	£3,354	3
Option 4 – S1.1d	£3,272	2
Option 5 – S1.1e	£3,519	4
Option 6 – S4.4a	£1,058	1

3.5.3 Economic sensitivity

To ensure that the business case presents a robust economically justified preferred option, a number of sensitivity tests have been undertaken as outlined in Table 17.

Table 17: Sensitivity Analysis

Sensitivity Test		Raw Partnership Funding Score	BCR	BCR > 1
0	Baseline	84%	9.7	Yes
1	Sensitivity 1 - Change in PV Whole Life Cost (25% increase)	67%	7.7	Yes
2	Sensitivity 2 – Change in OM2 – 50% of households in Very Significant (before) risk already in Significant Risk band	84%	9.7	Yes
3	Sensitivity 3 – Change in OM3 – Reduce OM3 at medium risk by 50% and increase OM3 at long term risk by 50%	84%	9.7	Yes
4	Sensitivity 4 – Reduced duration of benefits by 25%	84%	9.7	Yes

Sensitivity Test		Raw Partnership Funding Score	BCR	BCR > 1
5	Sensitivity 5 – Benefits reduced by 25%	71%	7.3	Yes

In addition, economic sensitivity analysis has been undertaken by assessing the effects on the breakwater's dimensions (and therefore construction costs) of lowering the SoP from the current 1 in 200, to 1 in 100 and 1 in 75. As described in more details in Appendix I, there is no opportunity to optimise costs by reducing the SoP of the scheme.

3.6 Carbon appraisal

This OBC has a long history, dating back in 2017 when carbon considerations were not at the forefront in decision making. The options have not been selected based on their carbon impact nor a full detailed carbon appraisal undertaken. Nevertheless, the EA Carbon modelling tool has been used to determine the carbon impact of each options. However, the offshore breakwater asset is not included within the tool, nor beach recycle. Moreover, assumptions had to be made to allow for different recharge regimes. Therefore, the results of the carbon appraisal may not be representative of the real impact of each option. Further refinement will be required at detailed design stage.

Going forward, the carbon impact of the proposed works and ways to mitigate and reduce it will be fully incorporated in the design. This is in line with EDDC Climate Change strategy. Link to Council Strategy - East Devon

Table 18 shows the results of the carbon appraisal.

Table 18: Carbon appraisal

Stage	Option 1 – S1.1a	Option 2 – S1.1b	Option 3 – S1.1c	Option 4 – S1.1d	Option 5 – S1.1e	Option 6– S4.4a
Capital carbon (A1-A5) (tCO2e)	11,743	11,780	8,851	8,818	9,873	9,475
Operational carbon (B1-B3) (tCO2e)	5,205	5,240	5,237	5,271	5,305	5,236
Replacement carbon (B4) (tCO2e)	676	1,344	1,344	2,012	2,680	1,344
Refurbishment carbon (B5) (tCO2e)	4	4	4	4	4	4
Demolition carbon (C) (tCO2e)	569	602	662	694	726	662
Residual carbon (D) (tCO2e)	188	377	377	566	755	377

Whole Life carbon (tCO2e)	120,300	141,722	82,653	86,148	79,558	78,128
Rank	**5**	**6**	**3**	**4**	**2**	**1**

3.7 Other appraisal(s)

3.7.1 Sidmouth and East Beach Advisory Group.

Since the production of the BMP and now the OBC, EDDC has hosted meetings with an Advisory Group which comprises local stakeholders (see Table 25 for list of representative). Some of these groups are contributing to the finances of the project and therefore have strong views and direct interest in the development of the options. Whilst the current Option 6 (S4.4a) option has the support of the contributors, previous proposed ones do not. In the absence of support from the contributors, funding contributions could be substantially reduced rendering the project economically not feasible.

These groups represent the views of the local residents which are diverse, ranging from do-nothing options to even larger than the proposed civil engineering ones. Although the Advisory Group has no decisional power, it provides advice on the preferred way forward, including voting different proposals, with advice passed to cabinet to inform decision making.

During the development of the OBC options, it was advised that the group would support Option 6 with voting taken against previous options.

Moreover, there is significant local opposition to raising the splash wall over the full length of the Esplanade. The current splash wall is low, and does not affect the sea views from homes and businesses. The raised concrete splash wall built in Seaton, a town further to the east, as part of its flood defence scheme is often taken as a bad example of what the local community does not wish to see in Sidmouth.

3.7.2 EDDC Cabinet Approval

The work going into the OBC has been approved with various cabinet reports to cabinet. The draft OBC was approved in cabinet February 2023. This approval also included the additional funding requirement.

3.8 Option Selection

Table 19 below brings together the results of the appraisal process.

Table 19: Summary of appraisal process

Criteria	Do Nothing	Option 1 - S1.1a	Option 2 - S1.1b	Option 3 - S1.1c	Option 4 - S1.1d	Option 5 -S1.e	Option 6 - S4.4a
Meets Project Objectives	No	Partial	Partial	Partial	Partial	Partial	Yes
Meets CSFs	No	No	No	No	No	No	Yes
Technical	NA	6	5	2	4	3	1
Environmental	NA	6	5	2	4	3	1
Initial Investment	NA	3	4	1	2	5	6
Other appraisal	NA	NA	NA	NA	NA	NA	NA
Maintenance regime / costs	NA	5	6	3	2	4	1
Local preference	NA	6	5	2	4	3	1
Conclusion and selection	**No**	**No**	**No**	**No**	**No**	**No**	**Yes**

Option 6 is the only option which meets the project objectives and CSFs and therefore is the only option which is capable of delivering its intended output and expected benefits. The preferred option selected is Option 6 - S4.4a for the reasons highlighted below. A visualisation of this option is illustrated in Figure 29.

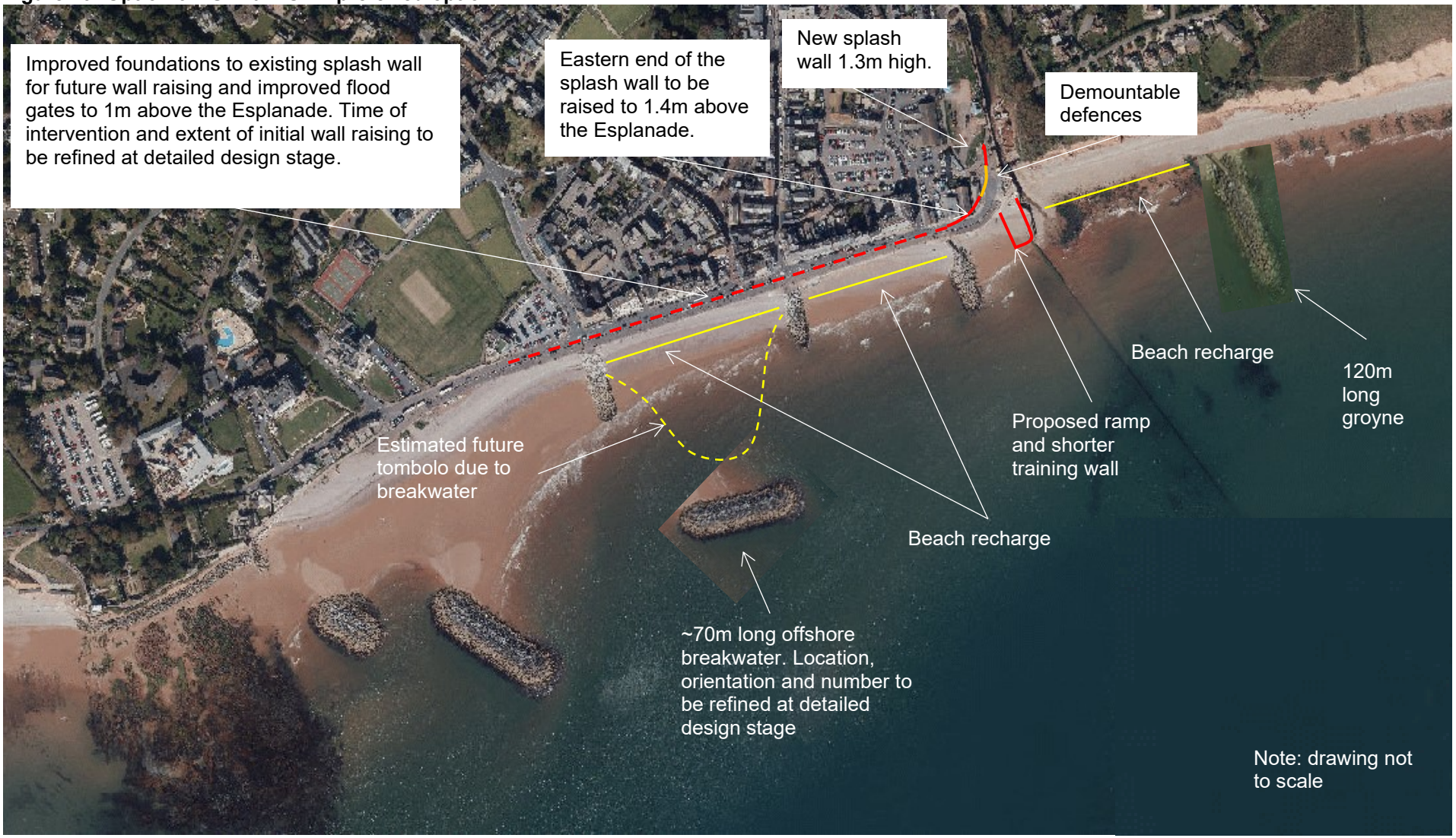
- **Project CSFs**: all Do Something options meet the requirement to slow down the rate of erosion to Pennington Point cliffs, East Beach. Do Something options are largely able to retain a beach on front of the existing seawall, however Option 6 provides the greatest certainty of this, through reduction in wave energy at the beach and reducing the reliance on future capital recharge activities. Many of the Do Something options fail to meet the CSF of minimising future maintenance costs. Option 6 does meet this CSF by alleviating the need for future beach recharge and recycling. Option 6 is the only option that limits the impact on views from town and retains acceptability to key stakeholders, the Advisory Group and regulators. All Do Something schemes are affordable.

- **Technical**: all shortlisted options are feasible on technical ground. However, whilst Option 6 presents more construction challenges due to building an offshore breakwater, it is also the most passive shortlisted option as it does not rely on recycling material to the lee of the breakwater. Options that depend on active maintenance are less favourable than options that can rely on passive, less maintenance intense measures. Options 1 to 5 require maintaining the design beach profile along the whole town frontage for their success and therefore depend on significant future capital intervention with periodic recharge and recycle being carried out during the benefit period. Moreover, technical challenges exist during recharging activities and therefore, Option 6 which minimises these activities is preferred over the others. In addition, due to the cliff instability at East Beach, the option that minimises construction on Frontage C (one groyne) and the recycling material needed is preferred on technical ground.
- **Environmental**: all options have negligible to small adverse impact with some localised substantial impact with the construction of two groynes on East Beach. However, the presence of the breakwater may have a beneficial impact as it may improve marine life by creating an artificial reef and a 'live' structure. Option 6 is preferred on environmental grounds.
- **Carbon**: There are limitations to the carbon assessment at this stage due to the lack of availability of appropriate information. Refinement of the assessment will be undertaken at detailed design stage. Opportunities to mitigate the carbon impact and reduce the total carbon cost of the design will be progressed, in line with EDDC Climate Change strategy.
- **Initial investment**: based on the cost benefit ration, Option 3 is the preferred option. However, maintenance costs are higher for this option and relies more heavily on active measures than Option 6. Minimising maintenance costs for East Devon District Council is one of the Critical Success Factors for this project.
- **Maintenance regime and costs**: Option 6 minimises the maintenance regime and costs over the next 100 years compared to the other options. This reduces the technical challenges over the life of the scheme. The presence in Option 6 of one or more breakwaters ensure that a more stable beach is maintained to its lee requiring less ongoing maintenance. This has been corroborated by the 1993 HR Wallingford physical modelling and can be seen in the healthy beach and tombolo formed in the lee of the existing breakwaters. Reduced maintenance costs puts less financial pressure on East Devon District Council and increases confidence in the local community and Advisory Group that the scheme will be maintained in the long term.
- **Local Preference**: A raised splash wall along the town frontage is not fully supported by the local residents and businesses, and by the Advisory

Group as it is perceived as a barrier which will reduce the views out to sea from the hotels and houses along the promenade. It is worth noting that to reduce visual impact, the option of using glass splash wall panels was considered. Due to the shingle beach and the risk of damage during storms, a glass splash wall panel was tested in situ. However, this was vandalised and was not universally popular. Therefore, the trial was not considered a success and the glass panel option has been paused for the time being. The proposed offshore breakwater will reduce the length of wall that needs to be raised and therefore, this option is more likely to meet the Stakeholders' requirements and be supported during the planning application process. The council has already experienced protests and 'bad press' due to the raising of the splash wall along the full length of the town frontage. Moreover, given the success of the existing breakwaters in maintaining a healthy beach to their lee, greatly enjoyed by the local residents and tourists, the local residents are supporting the construction of a new breakwaters as this will increase the amenity value of the town front and benefit tourism. In addition, the local residents and Advisory Group oppose to the high maintenance regimes required for all other options as they fear that the financial pressure on East Devon District Council would be unsustainable in the long run, causing the scheme to fail. Also, the local residents raised concerns over the sustainability of high recycling regimes and therefore favour Option 6 which minimise these activities.

- **Successive storm resilience:** Without a structure to build and hold a healthy beach, such as a breakwater, we would not be able to recycle or recharge the full extent of the beach between winter storms, so the standard of protection would drop after each successive storm.
- **Long Term Sustainable Management:** Option 6 provides the best way to manage the unknowns related to climate change. Building the offshore breakwater now within the current financial conditions allows for future improvement, such as raising the splash wall. Delaying raising the splash wall into the future means more accuracy in the design as most up-to-date predictions can be used. Moreover, it is likely that the current predictions in sea level rise will have become reality and the need for a raised wall more tangible. Therefore, local support for a raised splash wall will be likely to be higher.
- **Making use of existing local site knowledge**: The two existing offshore breakwaters have been successful in building and sustaining a healthy beach in their lee. The structures have been successful in reducing overtopping on the west sections of the splash wall from south-westerly storms. Therefore, there is benefit in using existing local knowledge to progress with the direction of the scheme.

Figure 29: Option 6 – S4.4a – OBC preferred option



4.0 Commercial Case

4.1 Procurement strategy and timescales

The commercial case details the procurement strategy for the project, together with details of risk allocation and project efficiencies. It demonstrates that the preferred option for coastal defence improvements has a viable route for procurement and that a structured plan is in place for delivery.

This case sets out the approach for planning and managing the procurement of services. It also demonstrates the lead financial authorities proposed route for competitive procurement is in accordance with UK legislation and World Trade Organisation (WTO) rules and the current regulations in place for public sector procurements.

Key drivers for the procurement of the scheme have been identified as follows:

- Quality: Defences are sensitive to the existing setting and the local area. Experienced suppliers with proven ability on similar schemes and ability to demonstrate added value through experience to date.
- Cost certainty: to support working within fixed budgets from contributions and FDGiA.
- Environmental constraints: the outline design sits with many environmental designations. Continuous engagement with stakeholders is required to ensure the final scheme does not cause unacceptable impacts.
- Value for money: to achieve value for money, identify and focus on efficient delivery supporting DEFRA's target for efficiency savings.

The contracting approaches to deliver the scheme have been reviewed. The contracting approaches considered included procuring separate commissions for the design and construction or a single design and build commission. Based on previous experience and discussions EDDC will take the approach of procuring separate design and construction commissions.

This contracting approach involves the commission of a design supplier to undertake detailed design, planning and marine licenses etc. independently and in advance of the commission of a construction supplier. An independent ECC PM providing ECC contract administration will be appointed by EDDC.

Key decision factors for this approach are as follows:

- Enables technical options to be kept under review during detailed design/physical modelling and maintains the opportunity to revisit the business case should an alternative preferred option emerge
- A full design will be completed before the construction tender is issued to ensure the quality requirements are understood by the contractors.

- Enables assurance of the projects financial case to be made prior to a contractual commitment
- There will be certainty of detailed design, which will provide greater cost certainty.
- EDDC will maintain design control. This is important as there are heavy environmental designations which may pose restrictions on working methods.

Design services

Although not formally confirmed by EDDC, it is highly likely that EDDC will appoint the Environment Agency's framework designer under the Collaboration Delivery Framework (CDF). EDDC are already signed up to and using the CDF on another FDGIA funded project, and its felt detailed design period could start swiftly due to a significantly reduced procurement period.

If however EDDC do not use the CDF, due to procurement rules, EDDC cannot directly appoint a designer outside of a framework. An invited tender procedure will be used to ensure that the most suitable supplier is appointed, providing a best value, high quality product. The designer scope of works will include for Early Supplier Engagement to ensure specialist construction support is maintained during the detailed design.

Procurement would be undertaken with the support of Devon County Council's Procurement Team in accordance the relevant UK legislation.

Construction services

If EDDC use the CDF from the outset, Early Contractor Input (ECI) from the framework contractor will be used, with the implication that the framework contractor would be appointed for the main construction works.

However, if the CDF is not used, or only used for pre-construction work, EDDC would seek to tender the construction via an open market tender.

Appointment of the construction contract after detailed design is complete ensures quality and scope certainty during the construction tender process. Additionally, the client-controlled scope ensures design certainty early in the process. Experience on recent schemes and lessons learned through delivery and utilising different routes to market has demonstrated a strong and experienced range of regional construction suppliers. Access through open tender has demonstrated a clear and competitive route to market. Utilising this regional experience, it is felt the route to market for construction services that represents best value for this scheme will be through open tender under OJEU, ensuring the quality-based supplier status questionnaire prevents unsuitable candidates from pricing.

Key contractual terms and risk allocation

The lead contracting and financial authority for the scheme is East Devon District Council. As a basic principle, risk will be contractually allocated to the party best

placed to manage each risk. Risk allocation will be assessed at the point each contract is prepared between East Devon District Council and each supplier to ensure the most appropriate allocation of risk.

Form of contract - Design supplier: The design services will be undertaken under an NEC4 Professional services Contract. An Option C contract will be used (Target cost contract with activity schedule).

Form of contract – Construction supplier: the construction services will be delivered under the terms of NEC4 Engineering and Construction Contract.

The preferred option for the construction services is to use an ECC Option C (Target cost contract with activity schedule).

4.2 Efficiencies and commercial arrangements

The procurement strategy selected allows for the most efficient delivery programme. It also places risks with those parties best able to manage them effectively and efficiently.

To provide better value for money during the life of the scheme the project team will actively manage and record any efficiencies identified. The process of managing the efficiencies will form part of the day-to-day management of the project and become an integral element of the scheme.

There is a target for Risk Management Authorities to achieve efficiencies in all schemes funded by FCRM FDGiA. In accordance with current guidance, these efficiencies are managed using the Combined Efficiency and Recording Tool (CERT) and this process has been adopted at this early stage of the project. Alongside this, EDDC will actively look for opportunities to work with adjacent coastal schemes and coastal authorities by way of delivering the scheme more efficiently. For example, during the importation of rock.

5.0 Financial Case

5.1 Summary of financial appraisal

All aspects of the costs for the preferred option have been reviewed and updated as appropriate following the option appraisal. Therefore, the numbers presented in the Financial Case do not necessarily match the numbers presented in Section 3.5.2 for the option comparison.

Construction costs have been costed in early 2022 by cost consultant and Early Contractor Involvement (ECI), using the outline drawings with typical construction details and their recent experience of large coastal works. Other contractors have been engaged on various elements over the development so there is high confidence in the scheme costing. The construction cost is made up of the following key items:

- Splash wall & demountable defences - £2,373K
- Offshore breakwater - £3,008k
- Beach recharge - £1,926k
- Rock groyne - £3,352k
- Repair River Sid training wall - £443k
- Contractor costs & prelims - £1,006k
- Total = £12,109k

A risk workshop was undertaken to identify all significant risk and the 95%ile from the Monte Carlo analysis has been applied to the construction risks, which is equivalent to £3,060k. In addition, as per 2003 Defra supplementary guidance[5], an adjusted 15.6% optimism bias has also been included, which is equivalent to £2,066k. This gives a total risk budget of £5,126k (cash value).

An additional 30% Optimism bias has been applied to future maintenance costs, equivalent to £919k (cash value). The future maintenance costs of £3,062k (cash value) consist of:

- Maintenance to gates at 10 year intervals
- Maintenance of demountable defences at 10 year intervals
- Replacement of demountable defences at Year 50
- Annual training for operation of demountable defences
- Beach recharge
- Repairs to the River Sid river wall at 30 year intervals

Inflation has been included in line with the latest Environment guidance with an allowance of 7% per year. Construction is anticipated in 2026/27, therefore three

[5] *Flood and Coastal Defence Project Appraisal Guidance - FCDPAG3 Economic Appraisal Supplementary Note to Operating Authorities, March 2003*

years inflation has been allowed on the construction costs. The pre-construction costs have been inflated according to year they are incurred. The total inflation allowance is £2,674k (cash value), with £2,611k being the construction inflation.

Table 20 shows the Whole Life Cash Cost for the project.

Table 20: Whole Life Cash Cost

Cost Heading	Whole-life cash cost (£
Cost up to OBC	491,700
Salary costs	50,000
Cost of Professional Advice	395,000
Site investigation and survey	375,000
Construction	12,108,570
Supervision	267,375
Environmental mitigation	-
Land purchase & compensation	45,000
Other	-
Risk or Optimism Bias	5,125,587
Future cost (construction + maintenance)	3,062,370
Optimism Bias on future cost.	918,711
Inflation	2,673,536
Total	25,512,850

Table 21 shows the Total Value of the Project which excludes sunk costs and future costs, these are shown as cash costs. When discounted to be present value costs, these are the costs which go into the Partnership Funding Calculator, along with the future costs.

Table 21: Total Value of the Project (cash cost)

Cost Heading	Total value of project (For approval)
Cost up to OBC	282,472
Salary costs	50,000
Cost of Professional Advice	395,000
Site investigation and survey	375,000
Construction	12,108,570
Supervision	267,375
Environmental mitigation	-
Land purchase & compensation	45,000
Other	-
Risk or Optimism Bias	5,125,587
Inflation	2,673,536
Total	21,322,540
Total excl. cost to OBC	21,040,069

5.2 Funding sources

Table 22 outlines the funding sources identified and secured at the OBC stage. EDDC contributions are to be provided in two stages. An initial up-front contribution will support the anticipated scheme costs, while a second contribution to the risk contingency for the project. Outside of Local Levy, and EDDC's contribution, the project has successfully secured significant third-party funding from multiple local organisations, totalling £800k.

In total contributions of £3,500k have been secured (cash value). From the Partnership Funding Calculator the Grant in Aid available for the scheme is £15,722k in present value (discounted) terms. When this is converted to cash value, the Grant in Aid funding is equivalent to £17,111k. The adjusted Partnership Funding score taking into account the contributions (in PV terms) is 103%.

Table 22: Sources of Funding (cash values).

Source of Funding	£k
EA contribution (Grant in Aid)	17,540
Local Levy	500
Contributions 1 - East Devon District Council Risk Budget Contribution	1,700
Contributions 2 – East Devon District Council Up front contribution	500
Contributions 3 – Devon County Council	500
Contributions 4 – Sidmouth Town Council (1)	100
Contributions 5 – Sidmouth Life Boat (2)	100
Contributions 6 – Cliff Road Action Group (CRAG) (3)	50
Contributions 7 – EDDC Housing	50
Total funding	21,040

Notes:
1. Funding reliant on Town Council supporting preferred option (they support preferred option)
2. Funding reliant on construction of improved slipway (for construction and maintenance, which the Lifeboat will utilise)
3. Funding reliant on works to East Beach to reduce rate of erosion.

It is worth noting that since the production of the BMP in 2017, efforts were made to secure external funding to support the preferred option taken forward. Strong support has been shown by the local community and businesses with above average £200k being secured towards the scheme by the Sidmouth Lifeboat, the EDDC Housing Association and Cliff Road Action Group.

South West Water who are aware of benefits of scheme to their infrastructure have not offered contribution, despite formal requests to the company. Other utility companies were also approached, but have declined to contribute, despite the risk of damage to their networks.

Table 23: Partnership Funding Score

Source of Funding	%
Raw Partnership Funding score	84

Source of Funding	%
Adjusted Partnership Funding score	101

It is noted that if total project costs increase, and the project is not eligible for further FDGiA funding, East Devon District Council will cover the additional costs in excess of the target.

5.3 Expenditure and income profile

Table 24 indicates the anticipated cost expenditure and funding for implementation of the project in cash values. This excludes sunk costs, costs to OBC, and future costs.

Table 24: Income and Expenditure Profile in cash values (£k)

Income and Expenditure streams £k	23/24	24/25	25/26	26/27	Total
Cost less contingency	13	753	105	15,044	15,914
Contingency	5	272	35	4,813	5,126
Total cost	**17**	**1,025**	**140**	**19,857**	**21,040**
Grant in aid	0	542	140	16,857	17,540
Local Levy				500	500
Contribution 1 – EDDC Risk				1,700	1,700
Contribution 2 – EDDC Upfront	17	483			500
Contribution 3 - DCC				500	500
Contribution 4 - STC				100	100
Contribution 5 – Sidmouth Lifeboat				100	100
Contribution 6 - CRAG				50	50
Contribution 7 – EDDC Housing				50	50
Total income	**17**	**1,025**	**140**	**19,857**	**21,040**

6.0 Management Case

6.1 Project management

Project structure and governance

The Sidmouth Beach Management Scheme is being managed by East Devon District Council. The project will be managed in accordance with the PRINCE2 project management principles and methodology. Governance and assurance arrangements are already in place for the project and the project Governance structure is presented in Figure 30.

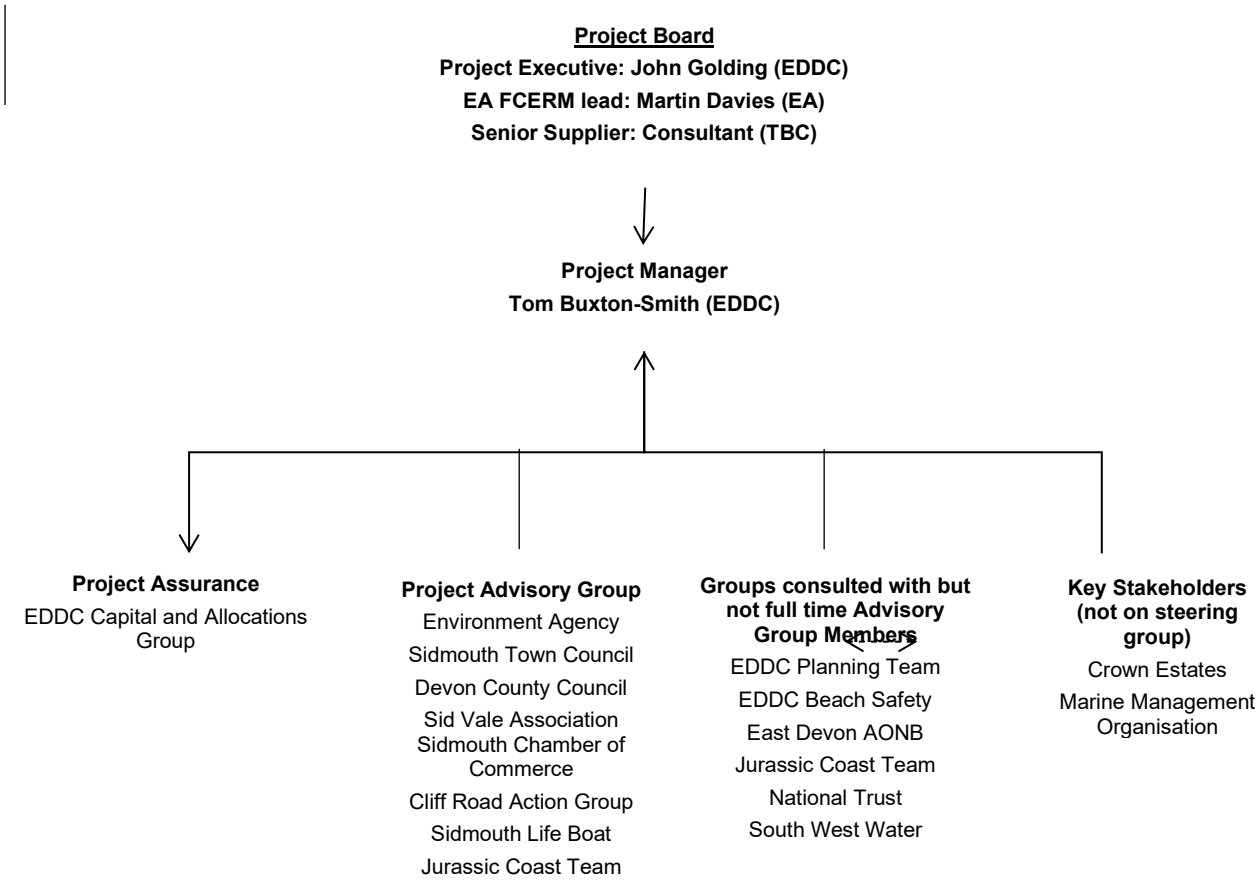


Figure 30: Project Governance structure

Project roles and responsibilities

Table 25: Roles and responsibilities

Role	Responsibility	Undertaken by
Oversight	Provide strategic direction to the project team.	Project Board
Project Executive	Chairs the Project Board and is accountable for project delivery.	John Golding (EDDC)
Project Manager	Responsible for implementing the project.	Tom Buxton-Smith (EDDC)
Project Assurance	Responsible for strategic oversight of East Devon's Capital Projects	EDDC Capital Strategy and Allocation Group
Project Advisory Group	Work in partnership with the project team to guide the development of technical, economical and environment sustainable options. The Project Advisory Group consists of the following: • EDDC Planning Team • Environment Agency • Sidmouth Town Council • Devon County Council • Sid Vale Association • East Devon AONB • Jurassic Coast Team • National Trust • South West Water	
Key Stakeholders	Work in partnership with the project team to guide the development of technical, economical and environment sustainable options. The Key Stakeholders consists of: **Statutory Consultees/ Primary Advisors** • EDDC Planning Team • Marine Management Organisation (MMO) • Natural England • Environment Agency • Cefas • Relevant Local Authorities i.e. Devon County Council, Sidmouth Town Council • East Devon Area of Outstanding Natural Beauty (AONB) • EDDC Landscape Architect • EDDC Heritage Officer • Jurassic Coast Team (World Heritage Site) • Devon Wildlife Trust **Landowners** • National Trust • South West Water	

Role	Responsibility	Undertaken by
	• Private landowners (mostly represented on the Advisory Group, see below) **Advisory Group (not already included)** • Cliff Road Action Group • Sidmouth Chamber of Commerce • Vision Group for Sidmouth • Sid Vale Association • Sidmouth Sailing Club and Sea Anglers • Sidmouth Lifeboat • Local Fishermen **Other specific interest parties and site users** • East Devon Alliance (EDA) • RSPB • Local Sidmouth community (residents) • Wider public community (visitors) • Other water and beach users • Local MPs	

6.2 Schedule

Project plan

The project is working through a traditional sequence of outline design followed by detailed design and construction. The key stages are outlined in the table below.

Table 26: Sidmouth Beach Management Scheme Project Plan

Activity	Date
Detailed design	Apr 2024 – March 2025
Planning permission and all other relevant consents including Marine License received	July 2025
Tender contractor	Aug – Nov 2025
Work to be started on site	March 2026
Work substantially completed by	February 2027
Post scheme monitoring	2027 onwards

6.3 Outcomes

EDDC will own and maintain any assets built. EDDC does not have any additional metrics to assess success apart from budget and project programme.

Table 27; Outcome Measures delivered by the project

Guidance Ref	Outcome Measures	Value
4.1	OM 1 - Ratio of whole-life benefits to whole life costs over the duration of benefits period.	9.7
4.2	OM 1A – Qualifying benefits over the appraisal period (PVb taken from table 2)	£196,171,374
4.4	OM 1B - benefits to people that are not associated with avoiding household damages, eg, less stress/risk to life.	£32,781,547
4.5	Duration of benefit period (not the appraisal period)	100 years
5.2	OM 2A – Households at risk of flooding before the investment and which are going to benefit from a reduction in flood risk at the end of the duration of benefits period (households at risk today)	113
5.3	OM2B – Additional households that are at risk from the impacts of climate change before 2040	3
6.1.1	OM 3 – Households at risk of loss in the medium term	6
6.1.1	OM 3 – Households at risk of loss in the longer term	53
7.2	OM 4A – Habitat created or improved (ha)	-
7.3	OM 4B – Rivers enhanced – river habitats and natural processes restored and enhanced (km)	-

6.4 Risk, assumptions, issues and dependencies management

A risk register has been developed during the OBC phase and is included in Appendix L. A schedule of the most significant construction risks is described below (Table 28).

Table 28: Main risks from risk register.

Risk	Owner	Mitigation	Assumptions
Weather - offshore activities - events greater than 1 in 10 - delay to seek safe harbour / unsafe conditions	Contractor	"Marine works to be undertaken in summer months. Experienced marine contractor will be well-versed in managing weather risk "	Costs based on best conditions. Offshore activities assumed based on 24/7 tidal conditions only. No allowance for restricted working time due to environmental constraints
Suitability of material, e.g. need to sieve material to reduce fines, increasing cost (potentially an additional £2million)	EDDC	Design of grading to consider source availability.	N/A
Availability of beach material from dredged source - need to obtain from further afield	EDDC	Design of grading to consider source availability.	N/A
Availability of rock	EDDC	Early contractor involvement during detailed design and procurement phases.	Based on current available information
Beach levels lower than assumed - more beach material required to be imported and/ or change in methodology required to ensure it is buildable	EDDC	Continued monitoring of beach levels through Regional Monitoring Programme.	Beach levels based on average recent years - beach reached quasi-equilibrium
Cliff stability preventing working from the beach, may also need to amend design to ensure	EDDC	"Drone survey to detect new / increased cracks on cliff tops. Monitoring exercise to detect	Work on East Beach costed allowing working from the beach - new safe method

Risk	Owner	Mitigation	Assumptions
construction can take place safely		potential trend following weather pattern. Design to consider buildability. Further information to be provided on risk.	of working to be produced and works costed.
Construction protest	EDDC	EDDC to liaise closely with stakeholders, Advisory Group and the public throughout scheme development.	Ongoing public consultation
Uncertainties of beach design	EDDC	Uncertainties to be addressed during detailed design.	Based on 1990 scheme and historic beach levels survey - comprehensive recent years survey by PCO
Consultant change - remodelling - change of assumptions - change of design	EDDC	Closely liaise with consultant to ensure smooth handover and minimise design changes	Change of consultant during detailed design
Uncertainties of Offshore Breakwater design - size and alignment of offshore breakwater both due to available funding and limited analysis to date.	EDDC	Uncertainties to be addressed during detailed design. Experienced advisors used to date.	Experienced staff and design standards used
Uncertainties of splash wall height - further modelling at detailed design stage only - current height as a compromise - required height in long term epochs could be higher than current design	EDDC	Uncertainties to be addressed during detailed design. Experienced advisors used to date.	Experienced staff and design standards used

Residual Uncertainty

The preferred solution is a conservative option. Value engineering during the detailed design phase will seek to remove the need for raising the splash wall, and the need for future recharge may be mitigated through the introduction of an additional breakwater. These changes will require additional modelling to demonstrate performance and economic benefit. A BCUR will be submitted if the Preferred option changes as a result of this additional work.

6.5 Assurance

LPRG will review the project Outline Business Case as it completed the Outline Design Stage and ahead of the detailed design and construction. The project manager will continue to produce highlight reports (which will include progress, finance, risk and key issues) to the Project Board at frequent intervals (currently bimonthly). Any matters outside of the Change Authority (see Change Management section above) will need to be authorised by a member of the Project Board.

Where necessary, and as agreed with the Project Board, impartial Project Assurance will be provided by EDDCs Finance, Legal, Audit and Procurement teams. In accordance with EDDC's Constitution procurement may, subject to its contract value, be subject to separate Procurement Gateway(s). These Gateways ensure that any procurement is fair and in accordance with EU Procurement Law.

As part of the Project Assurance 'team' an independent cost consultant and/or quantity surveyor may be employed. This role will review contractor, sub-contractor and third-party estimates/costs.

EDDC assurance will ensure the project is being run by EDDC's project management principles with monthly monitoring and reporting. Once the design is finalised, this will be shared with the Advisory Group, and taken to cabinet to approve before the project progresses to construction

6.6 Engagement with Stakeholders and compliance with eh Equality Act 2010

RMA officer roles

EDDC Role	Comment
EDDC Engineering Project Manager	All officers are in support of the proposal for option 6. This is evidenced by the cabinet report Printed minutes 01st-Feb-2023 18.00 Cabinet.pdf (eastdevon.gov.uk) with the officer's recommendation to support. This recommendation is supported by the Senior
EDDC Service Lead (Assistant Director level)	
EDDC Strategic Lead - Housing & Environment, Housing, Health & Environment (Director Level)	
EDDC Planning lead	

	Management Team, made up of senior officers.

RMA Councillor Roles

Position	Comment
EDDC Portfolio Holder Coast, Country and Environment	Support. Please see minutes from cabinet meeting XXX showing the proposal for option 6 is supported.
EDDC Cabinet Members	

Voting Members of the Advisory Group

Organisation	Comment
Sidmouth Town Council	Voted to recommend that EDDC proceeds with Option 6 (then known as Hybrid Option) Please see minutes of Advisory Group Meeting see Printed minutes 08th-Mar-2023 14.00 Sidmouth and East Beach BMP Project Advisory Group.pdf (eastdevon.gov.uk)
Cliff Road Action Group (CRAG)	
Sidmouth Chamber of Commerce	
Sid Vale Group	
Vision Group of Sidmouth	
Sidmouth Hoteliers Representative	
Sidmouth Lifeboat	
Water users* not part of group when vote to recommend was carried out	

Non-voting members of the Advisory Group

Environment Agency	Can Martin Comment
Devon County Council	No comment
Natural England	See Appendix P for joint statement
Jurassic Coast	
South West Water	Have not attended advisory group meetings since 2020 as unable to contribute

A Stakeholder Engagement Plan has been prepared for this project. This can be found in Appendix M. This is a working document which is kept updated and managed by the Project Teams dedicated communications lead.

Continued engagement with the project Steering Group and Stakeholders has been undertake throughout the project at key stages. Communication and consultation have primarily been through meetings and associated communications. A number of public exhibitions were also held to directly engage with the wider stakeholder community.

A stakeholder mapping exercise was undertaken at the start of the project. Four groups were identified and each group was targeted in slightly different ways in recognition of their level of influence and interest with the main differences being related to:

- The means of communication with each stakeholder;
- The frequency, nature and duration of communication;
- The supporting media; and
- The relevant feedback mechanism.

Regardless of the approach used, the information being shared was meaningful and accessible. Coastal management is a complex process with highly technical design processes and assessment methods. The use of plain English, non-technical language and succinct delivery was important.

The four groups identified were as follows:

- Group 1: Statutory Consultees and Primary Advisors.
- Group 2: Advisory Group.
- Group 3: Other Interest Parties.
- Group 4: Wider Public Community

There has also been further informal public engagement: During the development of the BMP and OBC various press or events have been held, where public feedback has been taken. For example, the glass splash wall trail had a sign to invite comments, and many were taken both on the glass splash wall and the wider scheme proposals

Equality Act 2010 compliance:

During the development of the BMP, EDDC has been in compliance with the Equalities act. To date the process has had little construction completed (save from the trial glass splash wall) so all the documentation produced to date has been in compliance with the act. Looking forward, although the proposed scheme has a large impact on Sidmouth, the majority of the works will have no impact on Equality, as the structures will not be publicly accessible. The recharged beach will have a similar issue of accessibility as the current beach. The land-based civils will be in the public domain, and will be designed in such a way they will be compliant with actability and the equalities act. We are not introducing new stairs, or blocking of access, and nothing that will affect the 9 protected characteristics protected under the equalities act.

7. List of Appendices

A Integrated Assurance and Approvals Plan – NOT USED

B Partnership Funding Calculator

C Photographs

D Numerical Modelling

E Alternative Options Modelling Report

F Appraisal Summary Table

G Sidmouth Breakwater Optimisation

H Details of Proposed Works

I Economic Appraisal and Sensitivity Analysis

J NOT USED

K Cost Breakdown

L Risk, Assumptions, Issues and Dependencies register

M Communications Plan

N PEIR

O Other Environmental Reports

P Joint Statement