SEATON BEACH MANAGEMENT PLAN

Economics Baseline

Prepared for

East Devon District Council

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Contents

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SECTION 1

Introduction

1.1 Background and Study Area

This report has been prepared for East Devon District Council (EDDC), and their partner, the Environment Agency, as part of the Seaton Beach Management Plan (BMP). The BMP covers the coastline from Seaton Hole, in the west, to Harbour Wall, on the east side of the River Axe, and the Axe River up to the Axe Bridge, as shown in Figure 1-1.

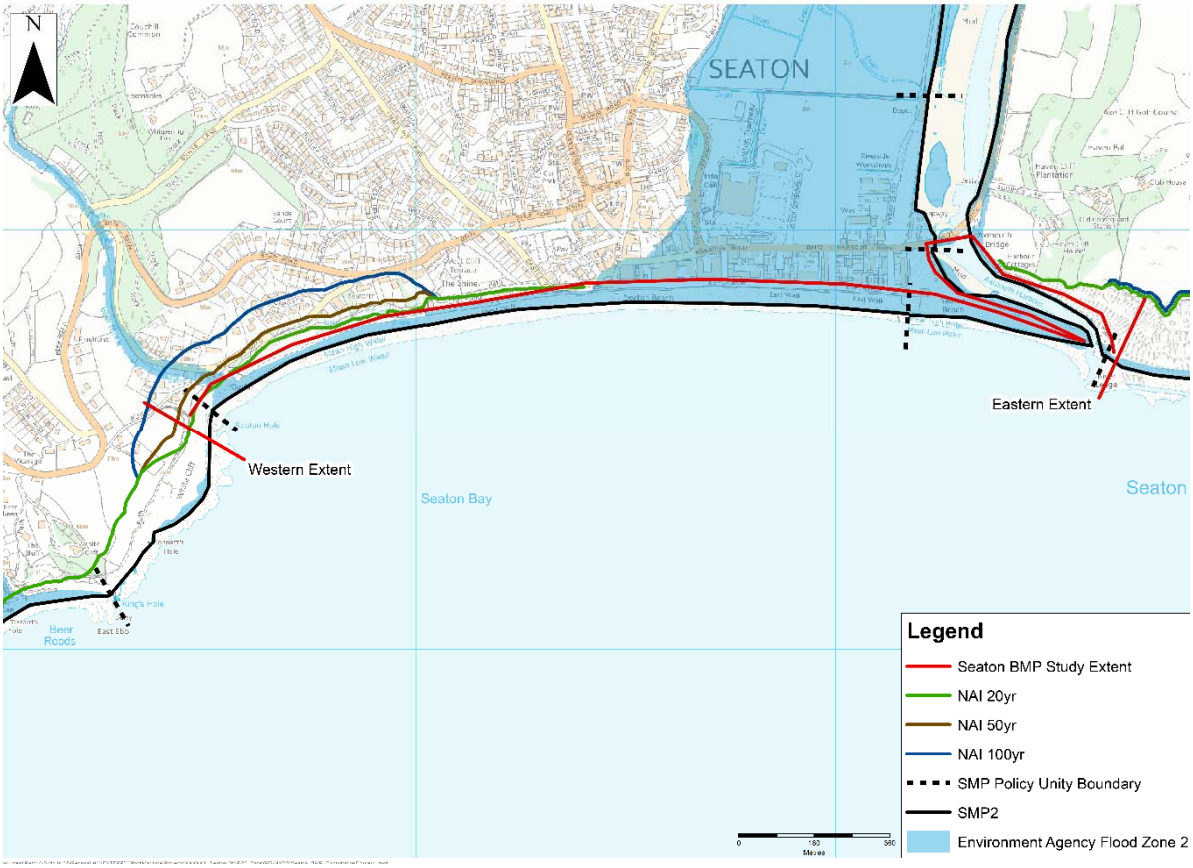

Figure 1-1 Seaton BMP extent, including flood and erosion risk zones

1.2 The Basis of This Report

This Economics Baseline Report is a supporting document to the BMP. Studies covering coastal processes, environment and economics are being undertaken separately and a detailed options appraisal will be completed as part of the BMP process.

This document provides details of the economic basis (i.e. the economic benefits) for both ongoing and future beach management and coastal flood and erosion risk management activities along the BMP frontage.

This economic basis for future management of this coastline is developed from a combination of previous economic assessments used to provide the case for past coastal protection and flood defence schemes along the BMP frontage (Section 2), and new assessments of flood and erosion risk undertaken for this project to develop a new BMP (Section 3). The economic baseline is summarised in Section 4.

Economic Appraisals from Previous Studies

A number of previous studies, completed between 1994 and 2017, demonstrate the value of continued investment in coastal flood and erosion risk management measures along all or parts of the BMP frontage. This Section provides a summary of the economic case put forward by those previous studies.

The summary includes details of the economic benefits (i.e. potential flood and/or erosion damages under a Do Nothing scenario) that were assumed in each study, and what was assumed in defining those benefits.

2.1 Seaton Coastal Study (Posford Duvivier, 1994)

The *Seaton Coastal Study* (Posford Duvivier, 1994) included an economic appraisal of coastal management options for three different parts of the Seaton frontage. The estimated benefits of protecting each sub-frontage are summarised in Table 2-1.

Table 2-1 Summary of the benefits of protecting each sub-frontage
Source: Posford Duvivier (1994)

Frontage	Losses/damages	Loss mechanism	Asset market value (i.e. benefits)
Seaton Hole to West Walk Promenade	14 properties over a 100-year period (half of which would be lost over a 50-year period)	Erosion	£4,000,000
	Old Beer Road, re-diversion of services (electricity, telephone, water, gas)	Erosion	£220,000
	Old Beer Road, re-routing access to properties	Erosion	£20,000
West Walk Promenade	Promenade	Erosion	£25,000
	Chine Café, toilets and pumping station	Erosion	£180,000
	Castle Hill Road, re-diversion of services	Erosion	£30,000
	3 properties	Erosion	£970,000
Main Seaton Frontage	Damage to 71 properties and 490 chalets	Flooding	£1,000,000
	Seawall collapse and immediate loss of properties along the Esplanade	Erosion	£14,350,000

In addition to asset benefits, the study also assessed the amenity benefits that would be lost if the West Walk Promenade was allowed to collapse. This assessment of amenity benefits was based upon the Flood Hazard Research Centre (FHRC) Yellow Manual (FHRC, 1992), which was best-practice guidance at the time the analysis was undertaken.

The assessment used the following estimates of visitor numbers to the promenade and associated beach, as no site-specific survey was undertaken at the time:

- Average of 50 visitors per day over a 100-day summer season (5000 visitors)
- Average of 10 visitors per day over the remainder of the year (2650 visitors).

These visitor numbers were then multiplied by 3.59, which was the FHRC Yellow Manual figure for average loss of enjoyment per adult per visit. A 6% discount factor was applied (as per national guidance at that time) to give Present Value (PV) amenity benefits of:

- £411,000 for promenade collapse in year 1
- £299,000 for promenade collapse in year 5.

A 6% discount factor was also applied to the asset values to calculate PV benefits for different management options along the frontage lengths for a 50-year appraisal period. The PV asset and amenity benefits are summarised in Table 2-2.

Table 2-2 Present value benefits estimated for coastal management options along three sub-frontages at Seaton (from Posford Duvivier, 1994)

Sub-frontage	Management option	Preventing loss of	Loss year	Present Value Benefits
Seaton Hole to West Walk Promenade	Old Beer Road backstop protection full length (440m)	Old Beer Road and 7 properties	5	£287,942
			10	£134,014
			15	£100,142
	Old Beer Road backstop protection part length (80m)	Old Beer Road and 3 properties	5	£266,042
			10	£134,014
			15	£100,142
West Walk Promenade	Sea wall toe protection, seawall encasement, or rock revetment	Promenade collapse and immediate property loss	1	£457,045 (£868,045 including amenity benefit)
			5	£339,635 (£638,635 including amenity benefit)
Main Seaton Frontage	Beach recharge	Flooding of properties	Every 5 years	£2,850,100
		Seawall collapse and immediate property loss	1	£13,000,000
			10	£8,000,000
			50	£800,000

The preferred options and their benefit:cost ratios were:

- Rock revetment 80m in length along the cliff toe where Old Beer Road is at risk, with an estimated cost of £180,000, giving a benefit:cost ratio of:
    - 1.26 for road loss in year 5.
    - 0.74 for road loss in year 10.
    - 0.56 for road loss in year 15
- Full encasement of West Walk Promenade seawall, with an estimated cost of £300,000, giving a benefit:cost ratio of:
    - 1.52 for promenade collapse in year 1 (2.89 including amenity benefits).
    - 1.13 for promenade collapse in year 5 (2.13 including amenity benefits).

The following methods/assumptions were used for this assessment:

- Property values were provided by East Devon District Council.
- Costs for diverting services were provided by utility companies. *NB: South West Water services at Old Beer Road have been diverted inland since this report was completed.*

- A 0.5m/year erosion rate was assumed along all cliffed frontages.
- Properties were assumed uninhabitable (therefore 'lost') when the cliff edge encroached within a 10m of the property, due to the height of cliffs and the instability of the cliff top.
- Flood damages for the Main Seaton sub-frontage were based on overtopping and breaching of the shingle ridge and seawall, but did not account for catastrophic failure of the sea wall.
- Flood damages were estimated at the present prices at the time using a comparison between the Retail Price Index and the Tender Price Index.
- Flood damages did not account for risk to life, health damage, stress, disruption etc.
- Seafront properties were assumed to be lost immediately after the West Walk Promenade and the sea wall along the Main Seaton sub-frontage had collapsed.

2.2 Wall to the West of West Walk Promenade, Seaton: Engineers Report (Posford Duvivier, 1996)

The *Wall to the West of West Walk Promenade, Seaton: Engineers Report* (Posford Duvivier, 1996) provided economic justification for works to prevent collapse of the 65m long seawall to the west of West Walk Promenade, and prevent subsequent erosion of the cliff behind and outflanking of the adjacent promenade. The benefits were estimated for upper and lower estimates of cliff erosion rate as:

- £250,000 for a 0.5m/year cliff erosion rate that would result in the loss of Chine Café, toilets and pumping station.
- £400,000 for a 1.0m/year cliff erosion rate that would result in the loss of Chine Café, toilets and pumping station and the Stonecliff property.

Property values were provided by East Devon District Council. A 6% discount factor was applied (as per national guidance at that time) to give PV benefits over a 50-year appraisal period of:

- £73,719 for a cliff erosion rate of 0.5m/year, with loss of Chine Café toilets and pumping station in year 20.
- £156,719 for a cliff erosion rate of 1.0m/year, with loss of Chine Café, toilets and pumping station in year 10, and Stonecliff in year 30.

The cost of the preferred option to underpin the wall foundations was estimated at £400,000, giving benefit:cost ratios of 1.84–3.92 for cliff erosion rates of 0.5–1m/year. It is believed this option was subsequently implemented. The following methods/assumptions were used for this assessment:

- The seawall protecting the cliff toe would fail in Year 1.
- Benefits only accounted for property benefits; no amenity or business losses were included.
- The cost of clearing the beach of debris if the wall collapsed was excluded (estimated at £5,000–£10,000).
- Stonecliff would be lost via cliff erosion, whereas the Chine Café would be lost via outflanking of the adjacent promenade seawall.
- A 10m wide cliff edge buffer was used in front of Stonecliff and Check House, due to the height of the cliff (as described in Section 2.1). This buffer was reduced to 5m at the Chine Café.

2.3 Seaton Town to Seaton Hole: Engineers Report (Posford Duvivier, 1997)

The *Seaton Town to Seaton Hole: Engineers Report* (Posford Duvivier, 1997) provided economic justification for a rock revetment 385m long to protect the cliff toe between Seaton Hole and West Walk Promenade. The rock revetment option was previously discounted in the 1996 appraisal due to high estimated construction costs (~£130,000; Posford Duviver, 1996) but was re-considered in 1997 because the cliff erosion rate was considerably greater than that previously estimated (1.5m/year instead of 0.5–1m/year use in previous studies (and also used most recently – see Section 2.7)), and a longer length of cliff was found to be at risk (400m instead of 80m).

The benefits of protecting properties and infrastructure at risk of erosion were calculated as:

- £3,240,000 for 14 properties on the cliff top, based on property values provided by East Devon District Council.
- £404,000 attributable to rearrangement of services (electricity, telephone, water, sewage and gas) and access following the loss of Old Beer Road.

A 6% discount factor was applied (as per national guidance at that time) to calculate PV benefits over a 50-year appraisal period for different cliff erosion rates (1.0, 1.5 and 2.0m/year) and different estimates of life extension for Old Beer Road (extended from either year 2 to year 7, or year 5 to year 15). The most likely scenario was assumed to a 1.5m/year cliff erosion rate and life extension of Old Beer Road from year 5 to year 15, giving a PV benefit of £1,042,407.

The cost of the rock revetment was estimated at £900,000, giving a benefit:cost ratio of 1.16.

It should be noted that the total outturn cost for the rock revetment was £554,885 (Posford Duvivier, 2001). Applying this outturn cost of the works to the benefits calculated in 1997 would indicate the works had an outturn benefit:cost ratio of 1.88.

2.4 Seaton Hole Landslip Review of Options (David Roche GeoConsulting, 2001)

The *Seaton Hole Landslip Review of Options* (David Roche GeoConsulting, 2001) provides a short review of options to address a recent landslip and severed beach access at Seaton Hole, and was intended for use in collaboration with Posford Duvivier, who would later use the information to assist a more thorough economic assessment (described in Section 2.5). The benefits of preventing further cliff erosion and reinstating access to the beach were estimated as:

- £300,000 for the Lew Hollow property on the cliff top, with diminished value due to progressive loss of the garden in the short term estimated at £50,000.
- £400,000 for the severed beach access.
- £50,000 for severed access to the undercliff.
- £20,000 for tourism amenity of Seaton Hole Beach, based on 10,000 visitors per year at £20 each.

There was no explanation in the report regarding what these values were based upon. Four management options were identified and costed but a preferred option was not identified, and benefit:cost ratios were not provided. This information was later provided in the Posford Duvivier (2001) report (see Section 2.5).

2.5 Report on Seaton Hole Landslip (Posford Duvivier, 2001)

The *Report on Seaton Hole Landslip* (Posford Duvivier, 2001) includes an economic appraisal of options to address the landslip issues at Seaton Hole, to the southwest of the existing rock revetment. The benefit of preventing further cliff erosion at the site and protecting the Lew Hollow property was estimated at £300,000 based on the market value of the property provided by East Devon District Council.

A 6% discount factor was applied (as per national guidance at that time) to calculate PV benefits over for two different cliff erosion rate estimates:

- £89,000 for a cliff erosion rate of 1.0m/year, with loss of Lew Hollow in year 20.
- £840 for a cliff erosion rate of 0.2m/year, with loss of Lew Hollow in year 100.

The preferred management option was 'full stabilisation', involving reinforcement of the cliff with geogrid and rock bolts/anchors, drainage improvements, reprofiling, and rock armour at the cliff toe. The estimated cost of this option was £400,000 giving a benefit:cost ratio of 0.002–0.22 for cliff erosion rates of 0.2–1.0m/year. This ratio was well below 1 so it was concluded that there was insufficient economic justification for the stabilisation scheme to qualify for approval and grant aid.

2.6 South Devon & Dorset Shoreline Management Plan Review (SMP2) (Halcrow, 2011)

The *South Devon & Dorset Shoreline Management Plan Review (SMP2)* (Halcrow, 2011) includes a broad assessment of the economic robustness of the preferred SMP policies for each Policy Unit.

The BMP frontage covers four SMP Policy Units:

- The southern part of Policy Unit 6a25: Axe Estuary (Mouth Breakwater to Axmouth North).
- 6a28: Axe Estuary (Spit).
- 6a29: Axe Estuary (Spit) to Seaton (West).
- 6A30: Seaton (West) to Seaton Hole.

The economic assessment for each of these Policy Units is summarised in Table 2-3.

Table 2-3 Economic assessment of the preferred SMP policies for each Policy Unit within the BMP frontage (from Halcrow, 2011)

Policy Unit		Preferred Policy	Broad-scale SMP Review (PV, £m)		Not included in benefit:cost ratio	Benefit:cost ratio
No.	Description		Benefits	Costs		
6a25	Axe Estuary (Mouth Breakwater to Axmouth North)	Short, Medium & Long Term: Hold the Line	£0.70	£3.09	Hold the Line here to protect key local transport link between Seaton and Axmouth, as well as retain breakwater at the estuary mouth that serves to keep the mouth navigable for vessels to use facilities within the estuary. The economic value of these assets is not included in the SMP economics.	0.23
6a28	Axe Estuary (Spit)	Short, Medium & Long Term: No Active Intervention	£0.16	£0.00	No Active Intervention along this predominantly undefended coast would result in naturally functioning coastline with benefits for designated geological features.	N/A – natural frontage

Policy Unit		Preferred Policy	Broad-scale SMP Review (PV, £m)		Not included in benefit:cost ratio	Benefit:cost ratio
No.	Description		Benefits	Costs		
6a29	Axe Estuary (Spit) to Seaton (West)	Short, Medium & Long Term: Hold the Line	£12.23	£8.90	Hold the Line to reduce flood and erosion risk to the extensive urban area of the town of Seaton. Economics do not account for the tourism and amenity value of this area.	1.37
6a30	Seaton (West) to Seaton Hole	Short Term: Hold the Line Medium & Long Term: Managed Retreat	£1.51	£1.77	Continued defence here will reduce but not prevent erosion altogether.	0.85

Note: The Seaton BMP frontage only covers part of the 6a25 Policy Unit

The following methods/assumptions were used for this assessment:

- Benefits were based only on residential and commercial property values. Other assets, such as utilities, highways and intangibles (e.g. recreation) and other impacts on the local economy or environmental were not included.
- Average erosion rates for each epoch were used.
- Detailed flood modelling was not undertaken. Instead the flood damages were calculated by summing the capital value of all the 'at risk' assets (identified using the Environment Agency's flood mapping).
- The potential for short-term accelerated or delayed losses compared to No Active Intervention was not accounted for, other than the total adjustment in shoreline position at the end of each epoch.
- The following discount factors were used to calculate PV benefits: 3.5% for years 0-30, 3.0% for years 31-75, and 2.5% thereafter.
- Policy costs were estimated using defence replacement costs from the revised Shoreline Management Plan Guidance (DEFRA, 2006) and maintenance costs from the National Appraisal of Defence Needs and Costs study (DEFRA, 2004).
- An Optimism Bias of 60% was applied to all costs, in line with DEFRA and HM Treasury guidance.

2.7 Old Beer Road Initial Assessment (CH2M, 2017)

As part of CH2M's Devon and Cornwall Flood Coastal Erosion Risk Management (FCERM) support contract with the Environment Agency, an initial assessment was completed in 2017 to determine whether intervention works in the form of cliff stabilisation near Old Beer Road in Seaton, East Devon, can be justified and attract FCERM Grant in Aid (GiA) funding. This is in part driven by recent cliff recession activity that has resulted in the loss of part of a local road along and associated facilities, cutting cliff top access to a 160m long Section of Old Beer Road. This 2012 slip also caused the loss of outbuildings and garden from Ashcliff House. The closure of Old Beer Road forces all traffic to use Beer Road, whilst pedestrians following the South West Coast Path have the option to use the beach/foreshore, when the tide allows. Utilities spanning the landslip have been rerouted or temporarily bridge the site.

The need for the initial assessment is also driven by the SMP2 Policy for this area (see Section 2.6), which is to initially hold the line (up to 2025) and then for Managed Realignment in the long term (from 2025 to 2110), which supports investment intervention works to manage the rate of future

cliff recession. Project partners for any scheme, if taken forward, would include East Devon District Council, Devon County Council (as Highways Authority) and the Environment Agency.

To support this initial assessment, appraisal included determining the number of cliff top property assets at risk of coastal erosion under the no active intervention scenario. This used available erosion risk mapping from the SMP2 (which also aligns to the National Coastal Erosion Risk Map and assumes an average annual cliff recession rate of 0.5-1.0m/year) along with average property prices for the area based on information from property websites. This work indicates that approximately 21 properties fall within the 100-year erosion risk extent. In addition, a Section of the alternative and important local coastal route is also at risk (at the junction Old Beer Road and the B3172) and costs would be incurred to manage changes to this junction (thus it can be considered in the economics damages assessment as being potential costs avoided by "doing something"). Another 9 properties fall just beyond this line and could be affected by loss of access or proximity to the realigned cliff edge.

Table 2-4 summarises what assets are predicted to be at risk of erosion under the No Active Intervention scenario and when, as well the erosion damages, discounted to Present Value (PV) over a 100-year appraisal period for the No Active Intervention scenario only. Taking in to account difference in analysis assumptions etc., these values are comparable to previous estimates of erosion damages in this area.

Table 2-4 Indicative No Active Intervention erosion damages economic assessment (from CH2M, 2017)

SMP2 Epoch	**No Active Intervention (indicative year of loss from 2017)**	**Estimated risk free erosion valuation of property / Estimated costs to address impacts of erosion on infrastructure (capital costs, £)**	**Present Value (PV) damages (capital value discounted for year of loss assumed)**
2010 to 2025	3 properties (Year 8; 2025)	£1,800,000	£1,366,941
2025 to 2055	16 properties + 8 flats (Year 38; 2055)	£11,200,000	£3,149,994
2055 to 2110	9 properties (Year 93; 2110); junction of B3172 impacted; utilities impacted	£5,400,000 £10,000,000 £1,000,000	£326,196 £604,047 £60,407
TOTAL PV Damages			£4,843,131 *(properties only)* £5,507,604 *(inc. utilities and highways impacts)*

New Economic Assessments for this BMP

As part of developing the BMP for Seaton, a new initial assessment of flood risk damages has been undertaken, and for the East Axe Estuary, erosion risk damages, and makes use of the most recent best-available data from recent studies. The following Section 3.1 describes the approach taken to assessing potential flood and erosion risk damages along the BMP extent.

No new assessment has been made of coastal erosion risk damages for the BMP frontage, as these have only recently been assessed for the Old Beer Road Initial Assessment (CH2M, 2017), and use the best available data (see Section 2.7) so are considered to be valid to use for the present economic analysis.

3.1 Flood Risk Damages

The Lyme Bay Coastal Flood Forecasting Phase 2 work, currently being undertaken by CH2M for the Environment Agency, includes flood risk modelling and mapping for a range of extreme return period events to determine flood risk as a result of wave overtopping of the Seaton coastal defences as well as from tidal surge and fluvial flows from the Axe Estuary. The flood depth and extent data from this Lyme Bay Coastal Flood Forecasting Phase 2 work has been used to undertake an initial assessment of flood risk damages for the Seaton BMP. Specifically, depth grids were available for the following return periods: 1 in 2, 1 in 10, 1 in 30, 1 in 50, 1 in 75, 1 in 100, 1 in 200 and 1 in 1000 year. All simulations were available for the present-day scenario only and so no assessment of climate change risks are included in this flood risk damages assessment.

It is important to note that this is the best available data suitable for the purpose of this economic appraisal. As such, the economic assessment presented in this Section is considered to only be appropriate for an initial assessment of potential flood benefits, and further assessment informed by further numerical modelling would be required to refine this work when developing any future scheme business case for the BMP frontage.

Full details of the flood damages assessment using this previous flood extent/depth data described above are provided in Appendix A. However, in summary, the flood damages assessment incorporates the following components:

- Direct property damages for saline flooding using National Receptor Database asset data and Multi-Coloured Manual (MCM; FHRC, 2013) depth-damage curves for short duration saline flooding. Damage values are capped based on estimated capital values of properties. Properties are assumed to have a threshold depth of 100mm.
- Emergency services: additional damages added at rate of 5.57% of direct property damages (using this lower value as this is an urban area).
- Vehicles: If a vehicle is flooded above 0.35m (with depth offset from property flood depth), 1.15 vehicles per residential property is assumed to be damaged. This may lead to a slight underestimate of damage where properties have substantially raised property threshold. Following the MCM guidance, we have also assumed 25% of vehicles are moved if a flood warning is issued.
- Residential evacuation/accommodation: using the average values from the MCM tables depending on depth and property type.
- Non-Residential Property (NRP) indirect damages: taken to be 3% of NRP direct damages.

NB: The following were not considered significant for the overall economic appraisal and were not included in this assessment: human health intangibles, risk to life, agricultural damages, infrastructure damages (except, direct damage to small electricity distribution substations which are included in the NRD) and environmental benefits.

Based on the components listed above, Table 3-1 presents the present-day Annual Average Damage (AAD) values by MCM asset category for each return period. It also presents the total AADs before and after capping, and how this translates to a Present Value Damages value assuming these AADs are applied over a 100-year appraisal period. Table 3-2 reports the number of properties affected by tidal flooding per frequency (return period) and property type that generate the damages presented in Table 3-1.

The key finding of this new assessment based on a very limited present-day assessment of flood risk from wave overtopping indicates a potential flood risk PV Damages value of £571k over 100 years. This is much lower than previous studies have estimated (using still water level only once defences are assessed to be breached). This PV damages figure is based on a property threshold level of 100mm. Sensitivity testing presented in Appendix A shows that the PV damages are very sensitive to this threshold level. If the property threshold levels were increased to 300mm PV damages reduce to £350k, whilst if the property threshold level is reduced to 0mm, the PV damages increase by almost a factor of 10 to £5,267k.

When viewing these figures, it is vital to note that as the source flood depth data is only for present day and using the present day AADs over a 100-year appraisal period does not include any impacts of sea level rise. As such, this must be considered a low-end estimate of potential damages. Section 3.1.1 below further details the limitations of this assessment.

Table 3-1 AADs divided per frequency (return period) and category (£k).

Return period (1 in X years)	2	10	30	50	75	100	200	1000
Uncapped Residential	-	1.0	64.0	69.7	74.3	75.9	117.0	188.0
Uncapped Non Residential	-	-	16.0	17.8	38.7	49.5	72.0	305.9
Residential Evacuation/ Accommodation	-	0.9	27.0	28.5	29.3	29.3	47.7	73.3
Non Residential Properties Indirect	-	-	0.5	0.5	1.2	1.5	2.2	9.2
Vehicles	-	-	-	-	-	-	-	19.2
Emergency response and recovery	-	0.1	4.5	4.9	6.3	7.0	10.5	27.5
Write- offs								**254.8**
Excess AAD								**-**
Total AAD After Capping								**10.6**
PV $_{100}$ After Capping								**316.1**
PV $_{100}$ After Capping plus Write-offs								**571.0**

Table 3-2 Property count divided per frequency (return period) and property type

MCM Code	Description	Return period (1 in X years)								
		2	10	30	50	75	100	200	1000	Over 1000	Total
1	Residential properties	-	1	12	-	-	-	7	2	45	67
2	Retail	1	-	2	-	2	1	-	4	-	10
3	Offices	-	-	-	-	-	-	-	1	-	1
4	Warehouses	1	-	-	-	-	-	-	-	-	1
8	Industry	2	-	-	-	-	-	-	-	-	2
51	Leisure	1	-	-	-	-	-	-	1	-	2
523	Sports centre	-	-	-	-	-	-	-	1	1	2
999	Undefined property	2	-	1	1	-	-	-	3	2	9
Total		**7**	**1**	**15**	**1**	**2**	**1**	**7**	**12**	**48**	**94**

3.1.1 Limitations of Assessment

The AADs prepared as part of this exercise used up-to-date guidance and used a proportionate approach given the initial stage of the business case. Limitations in the current approach and suggested improvements are listed below:

- The current benefits assessment does not include damages to the Seaton and District Tramway and to local roads. Damages (including disruption costs) to these infrastructure assets should be separately evaluated as the business case proceeds.
- Incorporation of accurate, actual property threshold data derived from a property threshold survey. Model results show several properties to be at risk from the 1 in 2 year event and, as demonstrated in SSection 3.2, AADs were shown to be sensitive to this parameter: this could therefore change significantly the amount of benefits available for any given scheme.
- As shown in the tables above, there are a number of '999' coded properties (i.e. undefined properties). It may be necessary to further explore, and recode these properties as appropriate, since they contribute 30% of the damages. For example, at 0.25m depth, code '999' would be £290/m^2, whereas code '8' (Industry) would only be £60/m^2, and code '4' (Warehouses) would be £290/m^2.
- The current assessment made used of readily available data. A range of climate change epochs should also be included for all options at appraisal stage as the flood modelling data available only includes climate change runs for two return periods, not a full suite of return periods as available for the present-day scenario used in this analysis.
- Assets included in this assessment may also be at risk from fluvial/ surface water flooding. Benefits may require to be apportioned to other schemes during the considered benefit period.

Finally, it is also crucial to understand what proportions (if any) of the existing benefits (and residential property counts) may have already been claimed for construction/capital works on the existing defences. The current exercise did not attempt to quantify the proportion of available benefits for the proposed works. This is important for partnership funding. Consultation should be sought on this matter with the Environment Agency.

3.2 Erosion Risk Damages

In order to make an assessment of potential erosion risk damages along the east bank of the Axe Estuary, the erosion risk bands developed as part of the National Coastal Erosion Risk Management (NCERM) dataset were used. This provides an 'intermediate' estimate of erosion risk bands for year 20, year 50 and year 100 assuming a No Active Intervention (NAI) scenario.

These erosion risk bands are used along with NRD data to identify properties at risk of erosion over the next 20, 50 and 100 years. In total, only up to 6 assets in the NRD data are determined to be at risk of erosion over 100 years; 4 of these are believed to be residential properties (see Table 3.1 below) with its loss occurring within 50 years. The map in Figure 3-1 shows the locations of the assets within the NCERM erosion bands.

Table 3-1 Assets at risk of erosion over next 50 years on the east bank of the Axe Estuary

MCM Code >>	1 - Residences	2 - Retail	8 -Industry	9 - Miscellaneous	999 -	TOTAL NRD assets
50 years	1	4	0	0	1	6

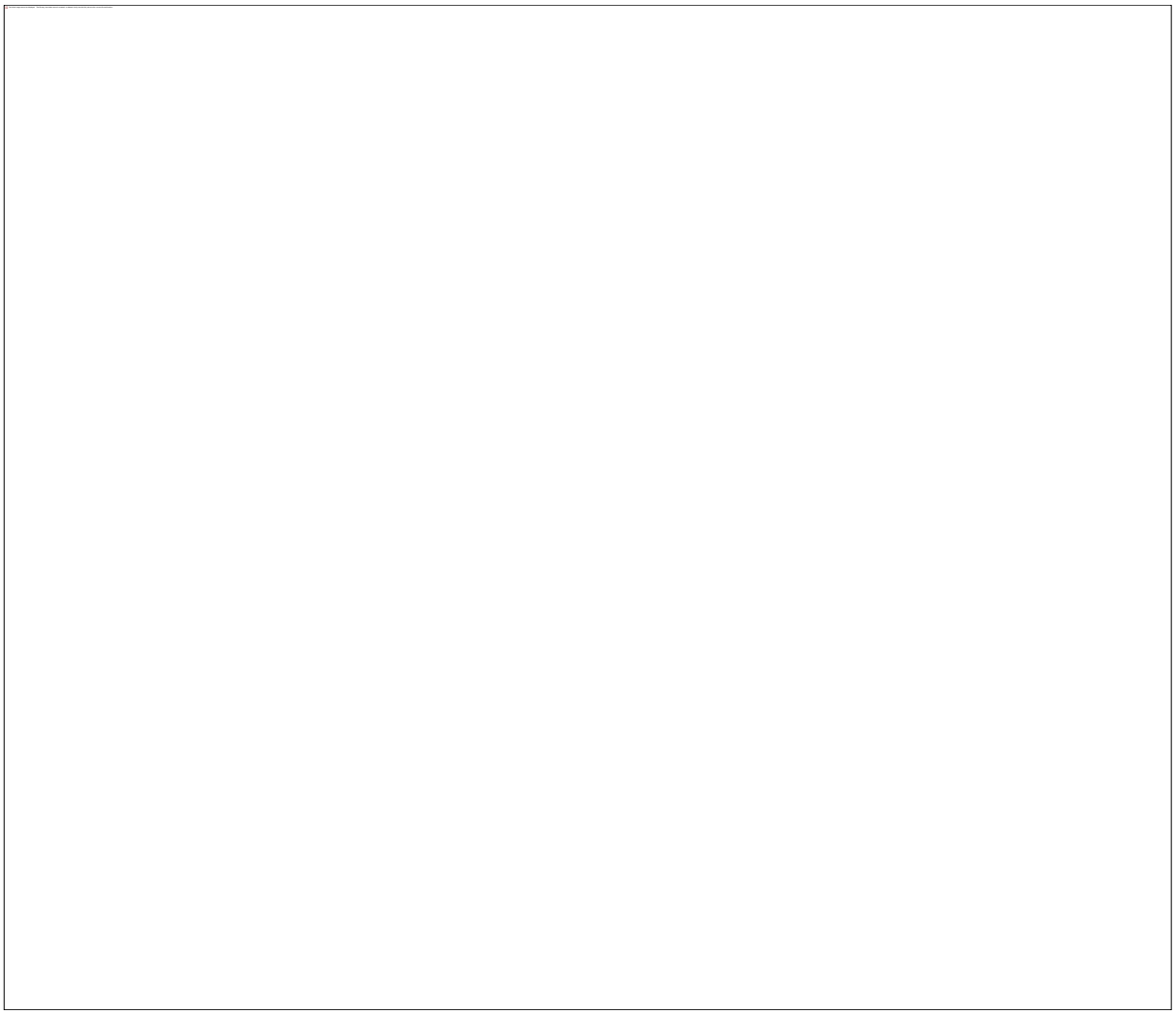

Figure 3-1 Properties at risk of erosion east bank Axe Estuary

Table 3-2 summarises the new erosion risk damages/benefits calculated for the study area.

Table 3-2 Summary of erosion damages/benefits for east bank Axe Estuary

SMP2 Epoch	Assets	Estimate Risk Free Erosion Valuation of The Property	Total (PV) Damages (capital value discounted for year of loss assumed)
2017 to 2025	0*	0	0
2025 to 2055	6 properties	£934,468**	£357,761

**Defences along east bank estuary assumed to have 35-year residual life; assets assumed to be lost in year 35 once defences fail with no 'erosion lag' allowed for.*

***Additional benefits of the erosion protection may be achieved if it is possible to better define the property count in the NRD database and establish any other benefits provided by access routes.*

Conclusions

4.1 Do Nothing Damages for Use in BMP Appraisals

Based on the recent erosion risk damages analysis discussed in Section 2.7, and the new flood risk damages analysis undertaken as part of this BMP presented in Section 3, it can be concluded that the minimum Present Value damages for the BMP frontage can be summarised as follows:

- Flood damages: £571k
- Erosion damages (property assets only): £4,843k + £358k
- Erosion damages (highways and utilities only): £664k
- **TOTAL:** **£6,436k**

Given the limitations of available data (particularly for flood damage assessment) as described in Section 3, and with comparison to previous study estimates of damages for parts of the BMP frontage (refer to Section 2), this PV damages total of £6,436k is considered to be a minimum level of benefits that would justify FCERM activities in the near future, particularly in regards to flood risk along Seaton town part of the frontage. Further assessment outlined in Section 4.1.1 would be expected to significantly increase the PV damages totals over a 100-year appraisal period.

It should be noted that based solely on this £6,436k PV damages figure, plus residential properties assessed as being at present risk, then this would yield approximately £600k of FCERM Grant in Aid funding over 100 years. This splits out as about £490k for the western erosion risk part of the BMP frontage, £70k for the eastern coastal flood risk part of the BMP frontage, and £40k for eastern erosion risk part of the frontage. Based on this, a significant proportion of any future funding needs for beach management activities will need to come from non-FCERM Grant in Aid sources.

4.1.1 Recommendations for Further Assessment

4.1.1.1 Flood Risk Damages

The current exercise gave a first estimate of the AADs from tidal flood events at Seaton, following the 2016 MCM guidance and the 2010 FCERM Appraisal Guidance. The estimates were based on 2014 NRD data and readily available modelling data from the recent Lyme Bay Coastal Flood Forecasting Phase 2 project undertaken by CH2M for the Environment Agency.

The total AADs after capping is equal to £10.6k. AADs estimate calculated as part of this initial assessment are considered a 'ball park' value. Estimates could be improved in the next stage of the project by the following (in order of likely largest influence):

- Including a range of climate change epochs as applicable.
- Incorporation of property-specific threshold surveys (if available) would decrease uncertainty in final AADs estimates. Commission of property surveys (if not readily available) would incur additional costs.
- MCM code for residential properties used in this assessment was '1', regardless of the type of property. This could be further refined into two or more digits.
- Recoding '999' properties and investigating further the non-residential rental yield.
- Including damages to Seaton Tramway Line and other utility assets. However, further work may be needed to establish existing levels of defence/resilience of these.
- Understanding if any of the assets are also at risk from fluvial/surface water flooding and requires sharing with other schemes.

Finally, it is also crucial to understand what proportions of the existing benefits (and residential property counts) have already been claimed for construction/capital works on the existing defences. The current exercise did not attempt to quantify the proportion of available benefits for the proposed works. This is important for partnership funding. Consultation with the Environment Agency should be sought on this matter.

4.1.1.2 Erosion Risk Damages

The assessment of erosion risk damages assumes assets are all lost at the same point in time and so may be under-estimating slightly the potential damages. In reality this is unlikely, so refinement of the analysis should determine bespoke "year of loss" for each asset at risk. In doing so, it would also be appropriate to assess the impact on the resulting PV damages of different safety buffers (i.e. allowing a set distance seawards of the asset at which it is deemed unsafe to continue to use – in effect bringing forward the "year of loss"; previous assessment assumed 5-10m buffers for this purpose).

Further work to potentially refine the analysis could also usefully include:

- Determining bespoke capital valuations (not at erosion risk valuations) of each asset.
- Refining the assumptions about costs associated with loss of highway infrastructure.

4.1.1.3 Amenity Damages / Gains

Some of the previous studies assessed the potential impacts of flooding/erosion on amenity value using crude assumptions about visitor numbers rather than actual visitor number data. This amenity value is likely to be a significant value[1] and could be assessed using actual data if further damages (benefits) to justify a business case are required in future beyond those that are likely to be achieved by undertaking the additional work recommended above to develop the flood and erosion damage assessments.

Best practice for calculating amenity benefits involves assessing the value of enjoyment of the preferred beach minus the value of enjoyment of the nearest equivalent beach plus the difference in travel time and vehicle operation costs between the preferred and alternative sites, using the following formula:

$$\text{Loss of amenity} = (VoE_1 - VoE_2) + (Tc_1 - Tc_2)$$

Where:

VoE_1 = Value of enjoyment at existing site

VoE_2 = Value of enjoyment at alternative site

Tc_1 = Travel costs to existing site

Tc_2 = Travel costs to alternative site.

Therefore, in order to undertake assessment of amenity damages and potential gains using the above formula, the following data would be required:

- (Estimated or Actual) day, staying and local visitor numbers in 2015 / 2016.
- Identification of a nearest equivalent beach / location amenity (likely would select one of Sidmouth / Budleigh Salterton / Lyme Regis).
- Estimated additional travel costs to the alternative beach / location for each type of visitor
- Conduct a survey of visitor preference and use contingent valuation methods to appreciate the value of enjoyment at the preferred and alternative sites. *NB: this aspect can be quite*

[1] *East Devon-wide annual visitor data states that annually, 1.49m day visitors come to the East Devon coast, spending a total of £45.982m. A proportion of this annual spend would be spent in Seaton thus providing a significant amenity benefit.* Source: The Economic Impact of Devon's Visitor Economy 2015 East Devon Produced on behalf of the Devon Tourism Partnership by The South West Research Company Ltd (October 2016).

costly so it may be appropriate to use values contained in the MCM from previous studies around the coast of the UK to provide valuation.

4.2 Potential Beneficiaries

From the review of previous studies and new analysis undertaken for this BMP, it is apparent that there are a variety of beneficiaries from FCERM activities along the BMP frontage continuing in to the future. These potential beneficiaries and likelihood of each being able/willing to contribute to future FCERM activities is summarised in Table 4-1.

Based on the assessment in Table 4-1, it is most likely that partnership funding efforts should focus on seeking contributions from the Environment Agency, East Devon District Council, and Devon County Council in the first instance.

Table 4-1 Summary of potential beneficiaries of FCERM activities along BMP frontage, and likelihood of ability/willingness to contribute to a funding partnership

Organisation / Group	Why would the benefit / want to contribute?	Potential scale of funds available (£)	Likelihood of gaining contribution	Comments / Notes
Environment Agency	Maintainer of assets at Seaton town (i.e. seawall and flood gates)	Hundreds of thousands to low millions of pounds.	High	Funding would be via FCERM Grant in Aid. Possible access to natural flood risk management funding (e.g. for managing the spit), though only small amounts.
East Devon District Council	Maintainer of assets along the eastern (cliffed) part of BMP frontage. Derives revenue from property and businesses (and car parking) at risk of flooding and erosion. Derives revenue from development for Community Infrastructure Levy.	Tens of thousands to hundreds of thousands of pounds (possibly more if use loans/bonds etc.).	High	Funding would most likely be via FCERM Grant in Aid or Regional Flood and Coastal Committee (RFCC) Local Levy. May also be available via Community Infrastructure Levy, Council reserves or some form of capital loan (would need to discuss with Council finance director. Also, possible Local Enterprise Partnership (LEP) / Coastal Community Fund (CCF) bids if meet criteria for economic re-generation.
Devon County Council (Highways)	Operator of B3172 road and wider local road network. Operator of on street parking immediately behind Seaton Beach.	Tens of thousands to hundreds of thousands of pounds.	High whilst road remains viable; Low once road becomes unviable and diversion needed.	**Will need to confirm with DCC (Highways)** but DCC already contributes by way of road maintenance would be assumed they would continue to contribute in terms of any future realignment of the road if appropriate to do so.
Devon County Council (LLFA)	Responsible for surface water drainage.	**Uncertain**	**Uncertain**	LLFA contributions unlikely to be forthcoming if no surface water risks in this area. **Need to confirm with LLFA.**
Seaton Town Council	Benefit from protection afforded to town in terms of supporting development and growth for local community.	**Uncertain**	**Uncertain**	Uncertain what funds town council may be able to access. Likely similar to those available to East Devon District Council.
South West Water	If they have infrastructure at risk	Tens of thousands to hundreds of thousands of pounds.	Low	If assets are at risk, then contribution would secure infrastructure assets in current location likely at lower cost than relocating, but only in area where they occur – so may not be applicable along much (if any) of the BMP frontage.
Gas network operator	If they have infrastructure at risk	Tens of thousands to hundreds of thousands of pounds.	Low	If assets are at risk, then contribution would secure infrastructure assets in current location likely at lower cost than relocating, but only in area where they occur – so may not be applicable along much (if any) of the BMP frontage.
Electricity network operator	If they have infrastructure at risk	Tens of thousands to hundreds of thousands of pounds.	Low	If assets are at risk, then contribution would secure infrastructure assets in current location likely at lower cost than relocating, but only in area where they occur – so may not be applicable along much (if any) of the BMP frontage.
Private landowners	Continued protection of privately owned land	**Uncertain**	**Uncertain**	Private landowners have contributed in the past including funding their own localised defences. Contributions for future joined-up scheme uncertain but would need to be explored.
Local Businesses	Continued protection of frontage helps to support local economy.	Hundreds to thousands of pounds (if any)	Low	Local businesses already pay business rates and likely to be resistant to paying further charges.

Organisation / Group	Why would the benefit / want to contribute?	Potential scale of funds available (£)	Likelihood of gaining contribution	Comments / Notes
Local residents	Continued protection of frontage helps to support local communities.	Hundreds to thousands of pounds (if any)	Low	Local residents already pay council tax which include precepts for RFCC and so likely to be resistant to paying further charges.
South West Coast Path	Supports alignment of current path, thought protection of the path cannot be used as justification for FCERM activities	Zero to hundreds of pounds.	Low	SWCP may contribute to enhancements / education along Path but not significant amount towards any intervention works.
Natural England	Supports natural environmental features of designated feautes within/adjacent to BMP area.	Zero to hundreds of pounds.	Low	NE may contribute to environmental enhancements / education along English Coast Path but not significant amount towards any intervention works.
Big Lottery Fund	Funds projects that meet specific, defined criteria.	Thousands to hundreds of thousands of pounds (based on previous funds awarded elsewhere; scale of funds depends on funding scheme applied to).	Low	Funding is for projects that meet specific, defined, funding criteria, generally aimed at community and charitable groups. Would need to demonstrate any project meets these criteria to access funds; e.g. Is there potential for delivering aspects of the defined funding criteria as part of overall environmental enhancements to be delivered by FCERM?.
Heritage Lottery Fund	Funds projects that meet specific, defined criteria.	Thousands to millions of pounds (based on previous funds awarded elsewhere; scale of funds depends on which grant scheme applied to).	Low	Funding is for projects that improve health, education, the environment, UK heritage. Would need to demonstrate any project meets these criteria to access funds; e.g. Is there potential for delivering aspects of the defined funding criteria as part of overall environmental enhancements to be delivered by FCERM?.

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Appendix A Flood Risk Damages Technical Note

Benefits Summary- Seaton Beach Management Plan

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REVISION NO.:	1.1
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1.0 Introduction

1.1 Overview

CH2M was commissioned by the East Devon District Council to develop a beach management plan for Seaton Beach, Devon, UK. The new beach management plan is required to guide coastal flood and erosion risk management activities along the frontage over the next 100 years.

The project extent is shown in Figure 1. The study area includes the town of Seaton. Seaton sits at the mouth of the River Axe, which lies to the east of the town between the town and haven cliffs.

As part of the project, Annual Average Damages (AADs) and Present Values (PV) for a nominal appraisal period of 100 years were computed to determine the economic damages arising from coastal flooding. The related Lyme Bay Coastal Flood Forecasting Phase 2 study being undertaken by CH2M for the Environment Agency that has developed flood risk mapping for the entire study area was made available for this exercise. The main aim of this exercise is to provide a first estimate of the available benefits from existing data and guide the future economic/options assessment.

This technical note reports on the evaluation of benefits which will be used in the appraisal process.

Figure 1: Extent of the study area

1.2 Flood Risk in the Area

Due to its position, Seaton is at risk from both fluvial and tidal flooding. Fluvial flooding arises from high flows in the River Axe. The Lyme Bay Coastal Flood Forecasting Phase 2 modelling work by CH2M reports that tidal flooding is mostly caused by wave overtopping, as defence levels along the sea front are sufficiently high to protect against extreme still water levels. Flooding could also result from a combination of moderate tides and moderate fluvial flow via the Axe Estuary.

The Lyme Bay Coastal Flood Forecasting Phase 2 study concluded that:

- Seaton is at risk from tidal flooding as a result of wave overtopping of coastal defences along the sea front and tidal flooding via the estuary. The extents of tidal flooding are smaller than those observed from fluvial flooding.
- Seaton is at risk from fluvial flooding. This is predicted to occur less frequently than tidal inundation (around a 1 in 30 year) for present day flows. Fluvial flooding is, however, predicted to be more severe than tidal flooding in terms of extent and depth.
- Fluvial flooding is heavily influenced by the outlet of the Axe estuary to the sea where conveyance is significantly reduced. It is thought that this dynamically adjusts through scour during an event to increase conveyance.

1.3 Proportionality

The following statement is from the Multi Coloured Handbook (MCH) 2016: “The effort in the assessment of any type of loss should be proportional to its impact and although it may be technically feasible to assess the potential of loss to many assets, it may not be effective or necessary to do so.” A proportionate approach to damage assessment has therefore been adopted to limit the work to the areas expected to give highest returns.

1.4 Study Objectives

Objectives of the current studies include:

- Identify the maximum assets at risk of tidal flooding, assign capping values to both residential and non-residential assets and calculate AADs in terms of PV100 and capital values of assets.

- Document number of assets at risk for tidal flooding for each return period split by Multi Coloured Manual (MCM) code.

2.0 Data Sources

2.1 Data List

The following data have been made available at the beginning of this project:

- 2017 hydraulic model outputs for a range of scenarios and accompanying model report from CH2M's work on the Lyme Bay Coastal Flood Forecasting Phase 2 project. The model was developed in an ISIS-TuFLOW environment and considered wave transformation and overtopping of defences along the sea front at Seaton, as well as tidal and fluvial overflow from the Axe estuary. Please note that the model has been approved by the Environment Agency as part of that project and so was not fully reviewed as part of this economic assessment for the Seaton BMP.
- National Receptors Database (NRD) 2014 from EA Partner Data Store.
- Multi-coloured Handbook 2016 including economic depth damage data for short duration saline flooding.

2. 2 Data Quality and Implications

The hydraulic model has not been reviewed/updated as part of this economic assessment.

Depth grids were available for the following return periods: 1 in 2, 1 in 10, 1 in 30, 1 in 50, 1 in 75, 1 in 100, 1 in 200 and 1 in 1000 year (see Figure 2). All simulations were available for the present day scenario only. No further simulations of the model were run. This is considered appropriate for an initial assessment.

The NRD was used with little modification/verification. The database was filtered to exclude properties considered to be either upper floors, water compatible (e.g. ponds) or low flood damage costs (e.g. post boxes). Residential properties with zero floor area were taken as being upper floor properties and therefore excluded. A list of excluded categories is reported in Annex A. As part of the initial data review property ID 29601312 was moved from not-classified building (MCM code '999') to warehouse (MCM code '4').

Figure 2: Present day flood risk from wave overtopping of coastal defences under a range of extreme return period events (from Lyme Bay Coastal Flood Forecasting Phase 2 (CH2M, 2017)).

3.0 Technical Method and Implementation

3.1 Annual Average Damages

The assessment follows the procedure set out in Flood and Coastal Erosion Risk Management Appraisal Guidance (FCERM-AG), Environment Agency, 2010; the Multi Coloured manual (MCM) and the Multi Coloured Handbook (MCH), Flood Hazard Research Centre, 2016. The analysis has used our Appraisal Depth -Damage Spreadsheet. Depth damage values are at 2016 Q1 prices and updated to 2017 Q1 using the GDP Deflator Index.

Property information was obtained from the NRD 2014. Residential properties were described using the code '1' and were not described using the two digits MCM code to distinguish between detached, bungalows, etc. Residential property values have been capped using market values obtained from the "Land Registry" for Devon, July 2016. Figure 3 shows the distribution of the NRD in the study area.

Figure 3: Distribution of NRD data in the study area.

The "national archive" for South West England was used to give rateable values per square meter for retail, office, industrial, and other property types. These were updated from 2012 using the GDP Deflator Index. To derive market values from these, a rental yield of 8% has been assumed, giving a multiplier of 12.5.

As no site specific surveys were available, the threshold level above ground levels for properties was set to +100mm for residential properties and zero for non-residential. From an inspection of the study area using Google Maps, this might be overestimating onset of flooding at properties along the Harbour Road (Figure 4), but might be more realistic for properties along the Esplanade and Trevelyan Road (Figure 5).

Figure 4: Residential properties along Harbour Road, Seaton (©2017 Google)

Figure 5: Residential properties along the Esplanade, Seaton (©2017 Google)

The following components have been incorporated in the damages:

- Direct property damages for saline flooding (given the length of the tidal event, short duration damages were deemed appropriate).
- Emergency services: at 5.57% of direct property damages (using this lower value as this is an urban area).

- Vehicles: If vehicle flooded above 0.35m (with depth offset from property flood depth), 1.15 vehicles per residential property. This may lead to a slight underestimate of damage where properties have substantially raised threshold. Following the MCH guidance, we have also assumed 25% of vehicles are moved if a flood warning is issued.
- Residential evacuation/accommodation: using the average values from the MCH tables depending on depth and property type.
- NRP indirect: 3% of NRP direct damage.

Since the four-digit MCM codes / damage curves were not used, the socio-economic equity multipliers were not applied *(NB: depending on social grade categorisation and weighted factor by occupation, this can apply a multiplier to flood depth damages of between 0.74 and 1.64)*. Detailed information such as property age and social class would be required. Such information is rarely easily obtainable.

The following were not considered significant for the overall economic appraisal and were not included: human health intangibles, risk to life, agricultural damages, infrastructure damages (except, direct damage to small electricity distribution substations which are included in the NRD) and environmental benefits. Eight non-residential properties were shown to be at risk of flooding from the 1 in 2 year event. These were written-off in year 0 following MCM guidance.

Table 1 includes AAD values divided per category and frequency, and the total AADs after capping. Table 2 reports the number of properties affected by tidal flooding per frequency (return period) and property type.

Table 1: AADs divided per frequency (return period) and category (£k)

Return period (1 in X years)	2	10	30	50	75	100	200	1000
Uncapped Residential	-	1.0	64.0	69.7	74.3	75.9	117.0	188.0
Uncapped Non Residential	-	-	16.0	17.8	38.7	49.5	72.0	305.9
Residential Evacuation/ Accommodation	-	0.9	27.0	28.5	29.3	29.3	47.7	73.3
Non Residential Properties Indirect	-	-	0.5	0.5	1.2	1.5	2.2	9.2
Vehicles	-	-	-	-	-	-	-	19.2
Emergency response and recovery	-	0.1	4.5	4.9	6.3	7.0	10.5	27.5
Write offs								**254.8**
Excess AAD								**-**
Total AAD After Capping								**10.6**
PV $_{100}$ After Capping								**316.1**
PV $_{100}$ After Capping plus Write offs								**571.0**

Table 2: Property count divided per onset of flooding (return period) and property type.

MCM Code	Description	Return period (1 in X years)									
		2	10	30	50	75	100	200	1000	Over 1000	Total
1	Residential properties	-	1	12	-	-	-	7	2	45	67
2	Retail	1	-	2	-	2	1	-	4	-	10
3	Offices	-	-	-	-	-	-	-	1	-	1
4	Warehouses	1	-	-	-	-	-	-	-	-	1
8	Industry	2	-	-	-	-	-	-	-	-	2
51	Leisure	1	-	-	-	-	-	-	1	-	2
523	Sports centre	-	-	-	-	-	-	-	1	1	2
999	Undefined property	2	-	1	1	-	-	-	3	2	9
Total		**7**	**1**	**15**	**1**	**2**	**1**	**7**	**12**	**48**	**94**

3.2 Sensitivity Analysis

The sensitivity of the AADs to the threshold selected was determined by choosing a 0.0m and 0.3m threshold level (respectively) for residential properties. Results from the sensitivity tests are summarised in Table 3 and Table 4. The results show that the AADs after capping using a 0.0m threshold level are two times higher than AADs calculated in section 3.1 and AADs after capping using a 0.3m threshold level are 70% lower than AADs calculated in Section 3.1. Results using a threshold of 0.0m do not appear realistic as write-off PV damages in the 1 in 2 year event are particularly high (19 residential properties are shown as flooded and written-off).

Results show therefore that threshold choice has a big impact on the final AADs result.

Table 3: AADs (£k) divided per frequency (return period) and category, using a threshold of 0.0m

Return period (years)	2	10	30	50	75	100	200	1000
Uncapped Residential	-	1.8	126.0	135.7	218.7	233.1	319.2	518.3
Uncapped Non Residential	-	-	27.3	31.5	77.9	103.4	176.3	653.9
Residential Evacuation/ Accommodation	-	0.9	47.3	50.9	70.1	76.8	96.0	126.9
Non Residential Properties Indirect	-	-	0.8	0.9	2.3	3.1	5.3	19.6
Vehicles	-	-	-	-	-	-	-	19.2
Emergency response and recovery	-	0.1	8.5	9.3	16.5	18.7	27.6	65.3
Write offs								**4,693.6**
Excess AAD								**-**
Total AAD After Capping								**19.2**
PV $_{100}$ After Capping								**573.8**
PV $_{100}$ After Capping plus Write offs								**5,267.3**

Table 4: AADs (£k) divided per frequency (return period) and category, using a threshold of 0.3m

Return period (years)	2	10	30	50	75	100	200	1000
Uncapped Residential	-	-	1.0	1.6	2.1	2.2	3.2	50.5
Uncapped Non Residential	-	-	16.0	17.8	38.7	49.5	72.0	305.9
Residential Evacuation/ Accommodation	-	-	1.7	1.7	1.7	1.7	2.5	23.2
Non Residential Properties Indirect	-	-	0.5	0.5	1.2	1.5	2.2	9.2
Vehicles	-	-	-	-	-	-	-	19.2
Emergency response and recovery	-	-	0.9	1.1	2.3	2.9	4.2	19.9
Write offs								**254.8**
Excess AAD								**-**
Total AAD After Capping								**3.2**
PV $_{100}$ After Capping								**95.5**
PV $_{100}$ After Capping plus Write offs								**350.4**

4.0 Limitations

The AADs prepared as part of this exercise used up-to-date guidance and used a proportionate approach given the initial stage of the business case. Limitations in the current approach and suggested improvements are listed below:

- The current benefits assessment does not include damages to the Seaton and District Tramway and to local roads. Damages (including disruption costs) to these infrastructure assets should be separately evaluated as the business case proceeds.
- Incorporation of accurate, actual property threshold data derived from a property threshold survey. Model results show several properties to be at risk from the 1 in 2 year event and, as demonstrated in section 7.2, AADs were shown to be sensitive to this parameter: this could therefore change significantly the amount of benefits available for any given scheme.
- As shown in the tables above, there are a number of '999' coded properties. It may be necessary to further explore, and recode these properties as appropriate, since they contribute 30% of the damages. For example, at 0.25m depth, code '999' would be £290/m^2, whereas code '8' (Industry) would only be £60/m^2, and code '4' (Warehouses) would be £290/m^2.
- The current assessment made used of readily available data. A range of climate change epochs should also be included for all options at appraisal stage.
- Assets included in this assessment may also be at risk from fluvial/ surface water flooding. Benefits may require to be apportioned to other schemes during the considered benefit period.

Finally, it is also crucial to understand what (if any) proportions of the existing benefits (and residential property counts) may have already been claimed for construction/capital works on the existing defences in the past. The current exercise did not attempt to quantify the proportion of available benefits for the proposed works. This is important for partnership funding. Consultation should be sought on this matter with the Environment Agency.

5.0 Conclusions and Recommendations

The current exercise gave a first estimate of the AADs from tidal flood events at Seaton, following the 2016 MCM guidance and the 2010 FCERM Appraisal Guidance. The estimates were based on 2014 NRD data and readily available modelling data from the recent Lyme Bay Coastal Flood Forecasting Phase 2 project undertaken by CH2M for the Environment Agency.

The total AADs after capping is equal to £10.6k. AADs estimate calculated as part of this initial assessment are considered a 'ball park' value. Estimates could be improved in the next stage of the project by:

- Including damages to Seaton Tramway Line and other utility assets. However, further work may be needed to establish existing levels of defence/resilience of these.
- Incorporation of property-specific threshold surveys (if available) would decrease uncertainty in final AADs estimates. Commission of property surveys (if not readily available) would incur additional costs.
- MCM code for residential properties used in this assessment was '1', regardless of the type of property. This could be further refined into two or more digits.
- Recoding '999' properties and investigating further the non-residential rental yield.
- Including a range of climate change epochs as applicable.
- Understanding if any of the assets are also at risk from fluvial/surface water flooding and requires sharing with other schemes.
- Finally, it is also crucial to understand what proportions of the existing benefits (and residential property counts) have already been claimed for construction/capital works on the existing defences. The current exercise did not attempt to quantify the proportion of available benefits for the proposed works. This is important for partnership funding. Consultation with the Environment Agency should be sought on this matter.

Annex A

List of OS classes excluded from the damage assessment.

OS classes excluded from NRD	
U,Unclassified	LW02IW,Static Water
UC,Awaiting Classification	ZM03,Statue
CZ01,Advertising Hoarding	CS,Storage Land
LA,Agricultural	PS,Street Record
CT01,Airfield / Airstrip / Airport / Air Transport Infrastructure Facility	CU11,Telephone Box
RC01,Allocated Parking	OS03,Telescope / Observation Infrastructure / Astronomy
LL,Allotment	CZ02,Tourist Information Signage
LM,Amenity - Open areas not attracting visitors	CZ03,Traffic Information Signage
ZA,Archaeological Dig Site	CT,Transport
CR11,Automated Teller Machine (ATM)	CT11,Transport Related Infrastructure
CL09,Beach Hut (Recreational, Non-Residential Use Only)	CT09,Transport Track / Way
CS02,Builders' Yard	ZU,Underground Feature
LC,Burial Ground	LU,Unused Land
CT02,Bus Shelter	CU,Utility
OP01,Butt / Hide	LU01,Vacant / Derelict Land
OI02,Caisson / Dry Dock / Grid	OT23,Vehicle Dip
CL02CG,Camping	LM02,Verge / Central Reservation
CT03,Car / Coach / Commercial Vehicle / Taxi Parking / Park And Ride Sit	CA03VY,Vineyard
RC,Car Park Space	CZ02VI,Visitor Information
CL02CV,Caravanning	CU10,Waste Management
ZM04,Castle / Historic Ruin	LW,Water
ZU01,Cave	LW03,Waterway
CC11,CCTV	ZV03,Well / Spring
CC06CY,Cemetery	CU03WF,Wind Farm
OI03,Channel / Conveyor / Conduit / Pipe	LF03,Woodland
OI04,Chimney / Flue	LA02,Permanent Crop / Crop Rotation
OI05,Crane / Hoist / Winch / Material Elevator	LP03,Playground
OG03,Currick	OR03,PO Box
CU12,Dam	CX08,Police Box / Kiosk
LD,Development	OR01,Postal Box
LD01,Development Site	ZU04,Pothole / Natural Hole
ZV02,Disused Mine	LP04,Private Park / Garden
CU01,Electricity Sub-Station	PP,Property Shell
OE04,Emergency Equipment Point / Emergency Siren / Warning Flag	CT03PP,Public Car Parking
OE02,Emergency Telephone (Non Motorway)	CC05,Public Convenience
OG01,Fish Ladder / Lock / Pen / Trap	LP02,Public Open Space / Nature Reserve
OI06,Flare Stack	LP01,Public Park / Garden

OS classes excluded from NRD	
LF02,Forest / Arboretum / Pinetum (Managed / Unmanaged)	OT13,Rail Infrastructure Services
LF,Forestry	CT07,Railway Asset
CS01,General Storage Land	CT04RH,Road Freight Transport
OI08,Grab / Skip / Other Industrial Waste Machinery / Discharging	OO03,Simple Ornamental Object
LA01,Grazing Land	OG04,Slurry Bed / Pit
CT13,Harbour / Port / Dock / Dockyard / Slipway / Landing Stage / Pier / Jetty / Pontoon / Terminal / Berthing / Quay	OI13,Solar Panel / Waterwheel
LO01,Heath / Moorland	OO04,Maze
LC01,Historic / Disused Cemetery / Graveyard	ZM02,Memorial / Market Cross
OH01,Historic Structure / Object	OS01,Meteorological Station / Equipment
CL02,Holiday / Campsite	CI02,Mineral / Ore Working / Quarry / Mine
OI07,Hopper / Silo / Cistern / Tank	CI02QA,Mineral Quarrying / Open Extraction / Active
CA03,Horticulture	OP03,Miniature Railway
CZ,Information	ZM,Monument
OI09,Kiln / Oven / Smelter	CT06,Mooring
LW01,Lake / Reservoir	LW02,Named Pond
L,Land	ZM01,Obelisk / Milestone / Standing Stone
CU02,Landfill	Z,Object of Interest
LM01,Landscaped Roundabout	CI02OA,Oil / Gas Extraction / Active
LM03,Maintained Amenity Land	LO,Open Space
LM04,Maintained Surfaced Area	ZM05,Other Structure
OI10,Manhole / Shaft	ZV,Other Underground Feature
CT05,Marina	CU09,Other Utility Use
OO02,Mausoleum / Tomb / Grave	CT12,Overnight Lorry Park
LP,Park	P,Parent Shell
UP,Pending Internal Investigation	