South Devon and Dorset Coastal Advisory Group (SDADCAG)

Shoreline Management Plan SMP2
Durlston Head to Rame Head

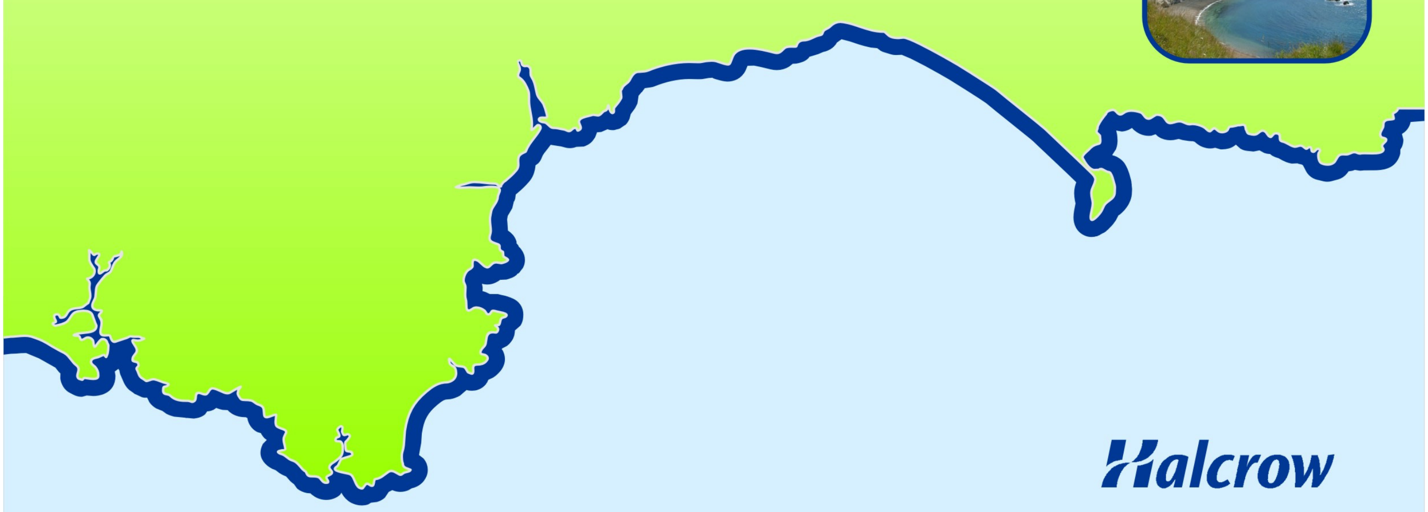
Appendix C – Baseline Processes Understanding











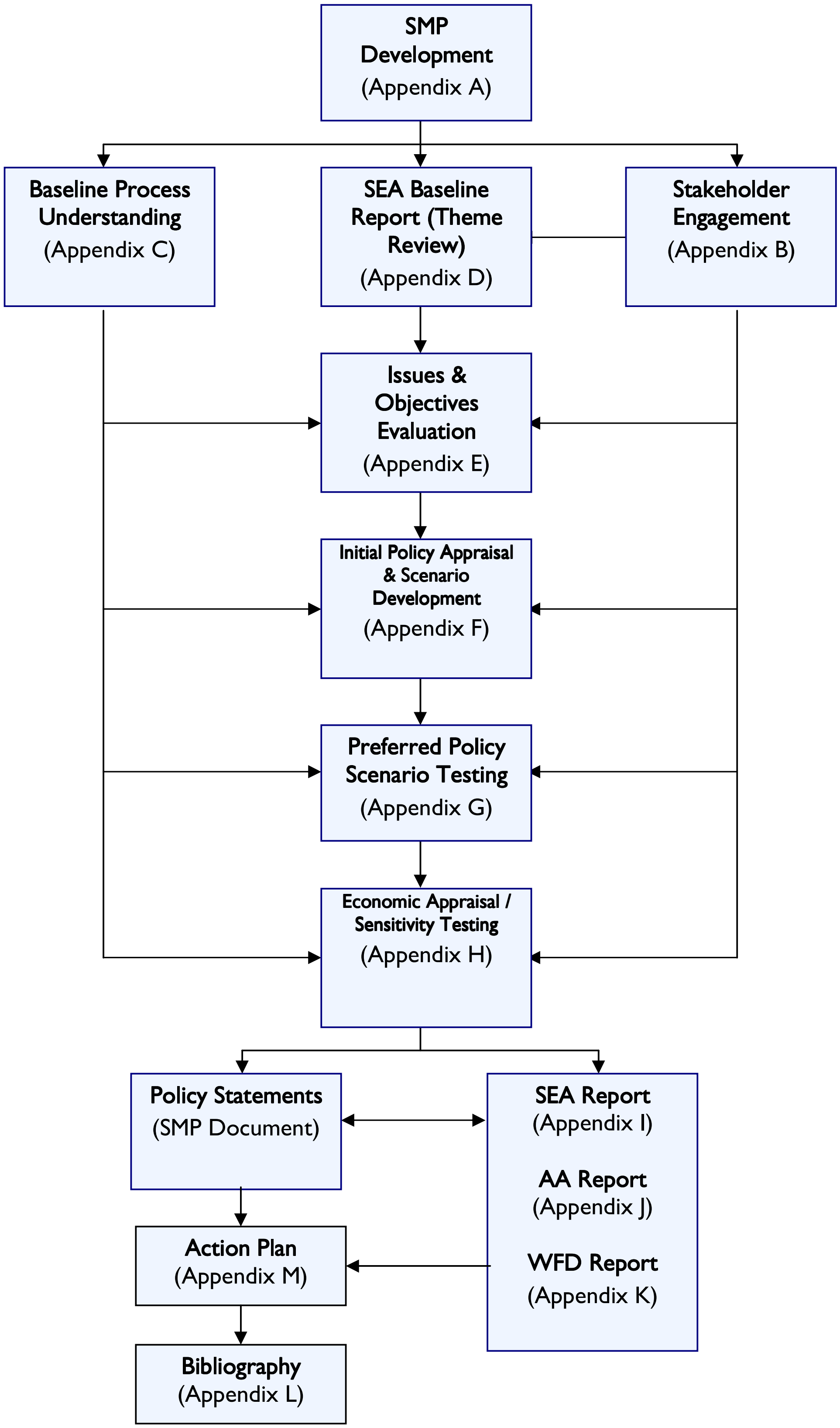
Halcrow

The Supporting Appendices

These appendices and the accompanying documents provide all of the information required to support the Shoreline Management Plan. This is to ensure that there is clarity in the decision-making process and that the rationale behind the policies being promoted is both transparent and auditable. The appendices are:

A: SMP Development	This reports the history of development of the SMP, describing more fully the plan and policy decision-making process.
B: Stakeholder Engagement	All communications from the stakeholder process are provided here, together with information arising from the consultation process.
C: Baseline Process Understanding	Includes baseline process report, defence assessment, NAI and WPM assessments and summarises data used in assessments.
D: SEA Environmental Baseline Report (Theme Review)	This report identifies and evaluates the environmental features (human, natural, historical and landscape).
E: Issues & Objectives Evaluation	Provides information on the issues and objectives identified as part of the Plan development, including appraisal of their importance.
F: Initial Policy Appraisal & Scenario Development	Presents the consideration of generic policy options for each frontage, identifying possible acceptable policies, and their combination into 'scenarios' for testing. Also presents the appraisal of impacts upon shoreline evolution and the appraisal of objective achievement.
G: Preferred Policy Scenario Testing	Presents the policy assessment and appraisal of objective achievement towards definition of the Preferred Plan (as presented in the Shoreline Management Plan document).
H: Economic Appraisal and Sensitivity Testing	Presents the economic analysis undertaken in support of the Preferred Plan.
I: Strategic Environmental Assessment (SEA) Report	Presents the various items undertaken in developing the Plan that specifically relate to the requirements of the EU Council Directive 2001/42/EC (the Strategic Environmental Assessment Directive), such that all of this information is readily accessible in one document.
J: Appropriate Assessment Report	Presents the Appropriate Assessment of SMP policies upon European designated sites (SPAs and SACs) as well as Ramsar sites, where policies might have a likely significant effect upon these sites. This is carried out in accordance with the Conservation (Natural Habitats, &c.) Regulations 1994 (the Habitats Regulations).
K: Water Framework Development Report	Presents assessment of potential impacts of SMP policies upon coastal and estuarine water bodies, in accordance with the requirements of EU Council Directive 2000/60/EC (the Water Framework Directive).
L: Metadatabase and Bibliographic database	All supporting information used to develop the SMP is referenced for future examination and retrieval.
M: Action Plan Summary Table	Presents the Action Plan items included in Section 6 of the main SMP document (The Plan) in tabular format for national consistency in line with guidance from the National Quality Review Group.

Within each appendix, cross-referencing highlights the documents where related appraisals are presented. The broad relationships between the appendices are illustrated below.



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C.1 Assessment of Shoreline and Estuary Dynamics

C.1.1 Introduction

This report should be viewed as supplementary to information held within Futurecoast[1] (Halcrow, 2002) and more specifically the Shoreline Behaviour Statements (SBS) for the following areas:

- South Coast:
  - Durlston Head to White Nothe;
  - White Nothe to Portland Bill;
  - Portland Bill to Eype;
  - Eype to Beer Head;
  - Beer Head to Otterton Ledge;
  - Otterton Ledge to Straight Point;
  - Straight Point to Hope's Nose;
  - Torbay;
  - Berry Head to Start Point.
- West Coast:
  - Start Point to Gribbin Head (though only information up to Rame Head used).

The report contains a synopsis of the information contained within Futurecoast supplemented with relevant information and analysis produced either post-Futurecoast, or at a level of detail not included within Futurecoast (e.g. alongshore variations in sediment transport and cliff retreat rates based upon analysis of historical mapping covering over 100 years to 2000). The two should be read in conjunction with one another to provide a full understanding of dynamics and behaviour across different spatial and temporal scales. It should be noted that the information in this report, unless otherwise stated, is taken from Futurecoast (Halcrow, 2002).

It should also be noted that the Futurecoast SBS units stated above have been adjusted in this report based upon the review of available information. For example, the Straight Point to Hope's Nose SBS from Futurecoast has been divided at Holcombe in this report. The evidence suggests the headland is a barrier to longshore transport of coarse sediment, and that this area is also likely to be one of drift divergence.

The assessment of shoreline and estuary processes presented here is also split between discussion of large scale and local scale processes. This is because large-scale and long-term understanding is necessary to assess the sustainability of management options and to take into account any long-term trends or drivers of coastal change. The long term trends may vary from short-term and local observations. For instance, trends of shoreline movement purely based upon recent beach monitoring, or sediment movements derived from a decade of wave data, are not necessarily representative of long-term processes. Shorter-term and smaller-scale understanding is therefore also important because it identifies local detail and variations from the larger-scale. For example, long-term prediction of change from high-level studies, such as Futurecoast, may not reflect variability at the shorter timescales, which may be a key factor in setting policy for the 0 to 20 year period (Halcrow, 2002).

C.1.2 Overview of Shoreline Evolution

The coastline between Durlston Head in the east and Rame Head in the west has been retreating and changing in orientation over the last millennia in response to sea level rise and the large scale drowning of the English Channel since the Holocene marine transgression (c.10, 000 years Before Present (BP)).

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[1] Futurecoast was a Defra-commissioned project to look at future coastal evolution around the coast of England and Wales. Further details are available on the Defra website.

Prior to the Holocene transgression, sea levels were 100 to 120m lower than present, and it is possible that there was even a prototype continuous 'super' barrier between what is now Portland Bill and Start Point (SCOPAC, 2004).

Following the end of the last ice-age sea levels rose rapidly sweeping coarse sand and shingle sediment, from what is now the sea bed, landwards to form barriers of non-cohesive sediment that inundated low-lying river valleys. With the stabilisation of sea level c.5,000 years BP these barriers migrated landwards at a more gradual rate. The land topography against which the barriers migrated, eventually leading to the segmentation of the barriers into a number of smaller sections situated between headlands consisting of more resistant rocks. These rocks have, in turn, been gradually eroded to provide additional sediment to the barrier beaches.

These barrier beach features are still present along parts of the SMP2 coastline, notably at Slapton Sands and Chesil Beach, as well as the beach lining Weymouth Bay. Where the barrier beaches have rolled back against higher topography, they now form fronting shingle beaches.

The majority of the shoreline is characterised by eroding cliffs of varying types, with cliff erosion being controlled by lithology, geological structure and exposure to wave attack. East of Portland the rate and location of sea cliff erosion is controlled by geological sequencing, dip and jointing of rocks. The geological structure has resulted in the headland and pocket beach coastal form that dominates much of this section of the coast (particularly east of Redcliff Point to Durlston Head).

The central and eastern parts of Lyme Bay comprise cliffs of soft, easily eroded sand and clay formations that have given rise to large scale complex land-sliding. Most notably this includes the Black Ven complex between Charmouth and Lyme Regis, which is one of Europe's largest and most active landslide complexes.

The western parts of Lyme Bay and around Start Point to Rame Head, consist of cliffs formed of resistant lithology meaning that these cliffs erode very slowly over a long period of time. This section of the coast is relatively static when compared to the coast further to the east along the study frontage.

The varying geological and lithological character along the coast leads to the occurrence of differential erosion that has, over the centuries and millennia, resulted in the segmentation of the shoreline as numerous headlands have emerged and developed to offer varying degrees of control on the local coastline. These controls have, in turn, led to shoreline and nearshore sediment transport being contained within discrete sediment cells along the SMP2 frontage. Within these cells, accretion and erosion are inter-related. However, despite similar characteristics and past evolution, there are no strong (if any) interactions between adjacent cells.

The dominant wave direction along the shoreline is from the south-west. Long term exposure to Atlantic waves has been instrumental in the large-scale shaping of the coast by generating a net west to east longshore transport along much of the otherwise swash aligned coast, when wave activity is sufficient to cause such transport. The net eastward transport is modified by the presence of headlands and sea bed features that cause local drift reversals.

For locations sheltered from the dominant south-westerly waves, such as locations to east of Portland Bill and along the western part of Lyme Bay, the shoreline evolution has been, and continues to be, controlled by exposure to east and south-easterly wave conditions.

The section of coast between Start Point and Rame Head is directly exposed to the south-westerly waves. As a result of both the high energy environment caused by this direct wave exposure, combined with a resistant geology, this section of coast is largely starved of sediment. The shoreline generally consists of rocky sea cliffs with only a few small pocket beaches intersected by several deep water ria-type estuaries.

The offshore area between Start Point and Rame Head is also characterised by a steep sub-tidal profile with no large scale sediment transport processes occurring in this area. This contrasts with the offshore area between Durlston Head and Start Point, which is largely shallow and featureless, with many places having exposed bedrock or only thin layers of sediment less than 1m thick. The exceptions to this are within the embayments of Tor Bay, Start Bay and Weymouth Bay. The only significant offshore features along the SMP2 frontage are Skerries Bank and The Shambles. Whilst both these features have an influence on wave climate at the nearshore, neither has a significant sedimentary influence on the development of the coast.

There is a lack of contemporary sediment inputs throughout the shoreline, therefore when longshore transport occurs it is generally a re-working of existing material rather than an influx of new sediment. Erosion of cliffs of suitable beach material is often restricted by coastal defence structures. The eroding cliffs in the study area, such as the Black Ven complex in Lyme Bay, contribute mostly fine material, which is transported offshore in suspension and so does not contribute to the shoreline sediment system.

There are numerous estuaries along the frontage, particularly the South Devon section that has several large estuaries. However, only the Exe and Teign estuaries have a significant (although localised) impact on coastal processes, both of these estuaries have significant sand features at their mouths (i.e. ebb tidal deltas) that form part of complex cyclic sediment transport systems. The Brit (West Bay), Axe and Otter estuaries also have small local scale impacts on coastal sediment transport of coarse sediment.

Given the size of both the Tamar and Dart estuaries, it is perhaps surprising that they do not have a significant interaction with coastal processes. The reason for this is that, despite their size, neither contributes a large amount of sediment to the sea because of the hard, resistant geology through which their rivers flow.

Discussion of all of the estuaries and their varying interactions with open coastal processes is contained in the relevant sections of this report. For convenience **Annex C.1** provides a summary of the estuary-coast direct interactions.

C.1.3 Overview of Present Coastal Conditions

Information on the wave and tide conditions along the South Devon and Dorset coastline is presented in this section to demonstrate the coastal conditions that are driving the present day evolution of the coast.

C.1.3.1 Wave climate

The wave climate information presented below is taken from the regional coastal monitoring programmes annual reports (Channel Coastal Observatory, 2008; Plymouth Coastal Observatory, 2009). Data presented is from the five wave buoys deployed at Weymouth, Chesil, West Bay, Tor Bay and Start Bay. The data show typical mean wave heights experienced in the recent past (Tables C.1.1 to C.1.5) as well as the five highest wave events recorded at each location (Table C.1.6).

This information confirms that the largest waves along this coastline are from the south-westerly direction. Coasts that are sheltered from south-westerly waves are commonly prone to waves from the south-east. This more recent information from the regional coastal monitoring programmes is also further supported by the inshore wave climate analysis of 10 years of Met Office wave model data as presented in Futurecoast (Halcrow, 2002).

Month	Hs (m)	Tp (s)	Tz (s)	Direction (°)	SST (°C)	No. of Days
June	0.36	5.8	3.7	159	15.6	29
July	0.41	5.3	3.5	164	16.6	30
August	0.32	4.9	3.5	147	17.6	31
September	0.28	4.9	3.5	157	17.5	30
October	0.41	6.0	3.8	147	15.7	31
November	0.38	5.5	3.9	156	13.0	30
December	0.67	7.0	4.0	152	10.4	31
January	0.73	7.6	4.1	166	9.3	31
February	0.57	6.4	3.7	153	9.0	29
March	0.50	6.5	3.9	166	8.9	31
April	0.42	5.7	3.6	154	9.9	30
May	0.39	5.1	3.4	135	12.5	30

Table C.1.1 Monthly mean wave heights for Weymouth wave buoy between June 2007 and May 2008 (Channel Coastal Observatory, 2008)

Month	Hs (m)	Tp (s)	Tz (s)	Direction (°)	SST (°C)	No. of Days
June	0.70	7.6	4.2	226	14.3	28
July	0.93	6.8	4.1	222	16.1	30
August	1.13	6.5	4.2	224	17.1	30
September	0.88	7.1	4.6	204	16.4	29
October	1.18	7.1	4.6	223	14.6	31
November	0.98	7.2	4.4	216	11.7	26
December	0.86	8.1	5.0	215	9.0	29
January	1.41	11.4	5.9	214	7.3	30
February	0.77	11.8	5.4	215	7.2	28
March	0.85	8.6	4.5	221	8.1	30
April	0.75	8.6	5.0	223	9.9	29
May	0.90	8.1	4.6	215	12.1	31

Table C.1.2 Monthly mean wave heights for Chesil wave buoy between June 2008 and May 2009 (Plymouth Coastal Observatory, 2009)

Month	Hs (m)	Tp (s)	Tz (s)	Direction (°)	SST (°C)	No. of Days
June	0.61	7.6	4.0	216	14.6	28
July	0.84	6.5	3.8	209	16.3	29
August	1.00	5.9	4.0	213	17.2	29
September	0.81	7.3	4.2	195	16.3	29
October	1.06	7.1	4.4	213	14.6	30
November	0.79	7.5	4.2	205	11.5	28
December	0.73	8.4	4.6	202	8.8	29
January	1.33	11.0	5.5	208	7.1	31
February	0.69	11.8	5.3	210	7.0	28
March	0.72	8.7	4.3	212	8.3	31
April	0.67	8.9	4.7	209	10.4	29
May	0.80	8.2	4.1	208	12.5	30

Table C.1.3 Monthly mean wave heights for West Bay wave buoy between June 2008 and May 2009 (Plymouth Coastal Observatory, 2009)

Month	Hs (m)	Tp (s)	Tz (s)	Direction (°)	SST (°C)	No. of Days
June	-	-	-	-	-	0
July	0.31	4.8	3.1	153	-	28
August	0.29	4.3	3.1	166	-	26
September	-	-	-	-	-	0
October	-	-	-	-	-	0
November	0.34	4.7	3.4	163	12.0	17
December	0.60	6.2	3.7	133	9.9	31
January	0.74	6.5	3.8	121	7.7	18
February	-	-	-	-	-	0
March	0.32	5.2	3.3	156	9.1	19
April	0.34	5.7	3.5	119	10.6	30
May	0.38	5.4	3.2	155	12.0	31

Table C.1.4 Monthly mean wave heights for Tor Bay wave buoy between June 2008 and May 2009 (Plymouth Coastal Observatory, 2009)

Month	Hs (m)	Tp (s)	Tz (s)	Direction (°)	SST (°C)	No. of Days
June	0.37	7.9	4.0	168	13.9	30
July	0.55	6.8	4.0	161	14.8	31
August	0.66	7.2	4.1	176	15.5	30
September	0.71	6.7	4.1	143	15.7	30
October	0.70	8.3	4.6	171	14.8	30
November	0.70	7.1	4.4	145	12.3	30
December	0.85	8.5	4.5	144	10.4	31
January	1.23	9.4	5.2	157	8.5	31
February	0.69	10.8	5.4	166	7.8	28
March	0.53	9.2	4.5	170	8.7	31
April	0.57	7.9	4.3	159	10.2	30
May	0.74	8.2	4.2	166	11.5	24

Table C.1.5 Monthly mean wave heights for Start Bay wave buoy between June 2008 and May 2009 (Plymouth Coastal Observatory, 2009)

Location	Period of Record	Date	Hs (m)	Tp (s)	Tz (s)	Direction (degN)	Water Level (mOD)
Weymouth	2007/8*	03/02/2008	2.74	7.7	5.7	160	0.39
		13/01/2008	2.58	7.7	5.5	162	0.84
		18/11/2007	2.56	7.7	5.6	162	-
		10/03/2008	2.41	8.3	5.3	169	1.06
		17/04/2008	2.03	7.1	4.9	118	-0.36
Chesil	2008/9**	17/01/2009	4.43	8.3	6.9	231	1.53
		04/10/2008	4.37	8.3	6.9	225	1.36
		09/11/2008	4.28	9.1	6.8	224	-0.36
		13/12/2008	3.89	9.1	6.8	207	1.88
		05/07/2008	3.82	10.0	6.8	229	2.06
West Bay	2008/9**	17/01/2009	4.24	9.1	6.7	218	1.43
		04/10/2008	4.02	8.3	6.7	221	1.82
		13/12/2008	3.87	8.3	6.3	205	1.79
		25/01/2009	3.82	8.3	6.3	207	0.73
		09/11/2008	3.77	8.3	6.3	215	-0.27
Tor Bay	2008/9**	12/05/2009	2.88	8.3	6.3	106	0.35
		28/12/2008	2.60	7.7	5.6	107	0.50
Start Bay	2008/9**	01/02/2009	3.36	8.3	6.3	97	2.00
		30/10/2008	3.14	7.1	5.6	96	-0.27
		04/02/2009	2.91	7.7	5.7	117	-0.65
		12/05/2009	2.90	8.3	6.0	103	0.53
		29/12/2008	2.72	7.7	5.5	94	-1.83

*Table C.1.6 Five highest wave events recorded in the recent past for each wave buoy location (*Channel Coastal Observatory, 2008;**Plymouth Coastal Observatory, 2009)*

C.1.3.2 Tides

Table C.1.7 presents the tide conditions for a number of locations along the South Devon and Dorset coast, taken from the Admiralty Tide Tables (United Kingdom Hydrographic Office, 2008). All of the tide values have been converted to a common datum (Ordnance Datum from Chart Datum). Towards the eastern end of the SMP area the high tide levels are about a metre lower than towards the western end, whilst the low water levels are about a metre higher.

For comparative purposes, extreme tide levels calculated for several of these locations are shown in Table C.1.8. These are taken from the Environment Agency report on regional extreme tide levels in the South-West (Posford Duvivier, 2003).

Location	Tide Level (mOD) for Tidal Condition							CD to OD conversion
	HAT	MHWS	MHWN	MSL	MLWN	MLWS	LAT	
Plymouth (Devonport)	2.68	2.28	1.18	0.08	-1.02	-2.42	-3.22	-3.22
Saltash	2.78	2.38	1.28	-	-0.92	-2.32	-	-3.22
Cargreen	2.64	2.24	1.14	-	-1.16	-2.46	-	-3.26
Cotehele Quay	2.87	2.47	1.37	-	-0.73	-1.73	-	-2.13
Jupiter Point	2.68	2.28	1.18	-	-0.92	-2.42	-	-3.22
St. Germans	2.28	1.98	1.08	-	-1.02	-2.22	-	-3.22
Turnchapel	2.68	2.28	1.28	-	-0.82	-2.32	-	-3.22
River Yealm Entrance	2.75	2.35	1.25	-	-0.95	-2.35	-	-3.05
Salcombe	2.65	2.25	1.05	-	-0.95	-2.35	-	-3.05
Dartmouth	2.68	2.28	1.18	0.28	-0.62	-2.02	-2.82	-2.62
Dartmouth Greenway Quay	2.98	2.28	1.18	-	-0.62	-2.02	-	-2.62
Totnes	2.90	2.30	1.10	-	-	-	-	-1.20
Torquay	2.60	2.20	1.10	0.20	-0.60	-1.90	-2.70	-2.80
Teignmouth (Approaches)	2.75	1.95	0.95	-	-0.65	-1.95	-	-2.65
Teignmouth (New Quay)	2.93	2.13	1.03	-	-0.57	-1.87	-	-2.57
Exmouth (Approaches)	2.36	2.16	0.96	-	-0.74	-1.94	-	-2.44
Exmouth Dock	2.67	2.17	0.97	-	-0.53	-1.63	-	-1.83
Starcross	2.77	2.27	1.07	-	-0.43	-1.13	-	-1.83
Turf Lock	2.52	2.12	1.02	-	-0.78	-1.38	-	-1.78
Topsham	2.75	2.25	1.05	-	-	-	-	-1.75
Lyme Regis	2.45	1.95	0.75	-	-0.65	-1.75	-	-2.35
Bridport	2.25	1.85	0.75	-	-0.65	-1.65	-	-2.25
Chesil Beach	2.30	1.80	0.80	-	-0.40	-1.30	-	-2.10
Portland	1.57	1.17	0.47	0.07	-0.13	-0.83	-1.13	-0.93
Lulworth Cove	1.58	1.18	0.48	-	-0.02	-0.82	-	-1.02
Mupe Bay	1.55	1.15	0.45	-	-0.05	-0.85	-	-1.05

Table C.1.7 Tide levels between Plymouth (Devonport) and Mupe Bay from the 2009 Admiralty Tide Tables (United Kingdom Hydrographic Office, 2008)

Location	Return Period (1 in X Years)					
	1	10	50	100	200	500
Mouth of Tamar	2.95	3.25	3.46	3.59	3.69	3.83
Devonport*	2.95	3.25	3.46	3.59	3.68	3.83
Devonport	2.95	3.25	3.46	3.59	3.68	3.83
Jupiter Point*	3.09	3.39	3.60	3.73	3.82	3.97
St Germans, R Lynher*	3.12	3.42	3.63	3.76	3.85	4.00
Polbathic*	3.18	3.48	3.69	3.82	3.91	4.06
Tideford*	3.16	3.46	3.67	3.80	3.89	4.04
Notter Bridge*	2.95	3.25	3.46	3.59	3.68	3.83
Saltash*	3.28	3.58	3.79	3.92	4.01	4.16
Calstock, R Tamar*	3.43	3.73	3.94	4.07	4.16	4.31
Gunnislake, R Tamar*	3.13	3.43	3.64	3.77	3.86	4.01
Lopwell, R Tavy*	3.05	3.35	3.56	3.69	3.78	3.93
Marsh Mills, R Plym*	2.95	3.25	3.46	3.59	3.68	3.83

Location	Return Period (1 in X Years)					
	1	10	50	100	200	500
Puslinch, R Yealm*	2.97	3.28	3.49	3.63	3.73	3.88
Bigbury on Sea	2.97	3.28	3.49	3.63	3.73	3.88
Aveton Giffird, R Avon*	2.96	3.27	3.49	3.63	3.74	3.89
Bolt Head (Salcombe)	2.96	3.27	3.49	3.63	3.74	3.89
Salcombe*	2.96	3.27	3.49	3.63	3.74	3.89
Kingsbridge*	2.91	3.23	3.47	3.62	3.74	3.90
Torcross	2.88	3.22	3.47	3.64	3.76	3.93
Mouth of Dart	2.88	3.22	3.47	3.64	3.76	3.93
Dartmouth*	2.97	3.31	3.56	3.73	3.85	4.02
Totnes*	2.84	3.20	3.46	3.63	3.76	3.94
Paignton	2.84	3.20	3.46	3.63	3.76	3.94
Teignmouth	2.78	3.15	3.43	3.62	3.75	3.95
Newton Abbot, R Teign*	2.78	3.16	3.43	3.62	3.75	3.95
Exmouth	2.75	3.14	3.42	3.62	3.76	3.96
Starcross*	2.76	3.15	3.43	3.63	3.77	3.97
Topsham*	2.81	3.20	3.48	3.68	3.82	4.02
Sidmouth	2.66	3.09	3.38	3.51	3.64	3.81
Seaton	2.59	2.99	3.27	3.39	3.51	3.67
Axmouth*	2.59	2.99	3.27	3.39	3.51	3.67
Lyme Regis	2.52	2.88	3.13	3.23	3.34	3.48
West Bay	2.44	2.76	2.98	3.07	3.17	3.30
Abbotsbury	2.22	2.52	2.73	2.82	2.91	3.03
Wyke-Regis	1.86	2.16	2.36	2.45	2.54	2.66
Portland	1.81	2.08	2.26	2.34	2.42	2.53
Weymouth	1.77	2.03	2.21	2.29	2.37	2.47
Lulworth	1.58	1.82	1.99	2.07	2.14	2.24

*Table C.1.8 Extreme tide levels for a range of return periods at locations along the South Devon and Dorset coast (Posford Duvivier, 2003). NB: Estuary Sites are indicated by *.*

C.1.4 Durlston Head to White Nothe

LARGE SCALE

Interactions

The eastern-most section of the SMP2 frontage is dominated by sea cliffs consisting of varying geological resistance that has resulted in differential erosion between the resistant chalk and limestone and the softer clay lithologies. Geology has been the dominant control for the formation and evolution of the present shoreline, with its many controlling headlands separated by embayments that are occupied by small pocket beaches whose sole source of sediment is the erosion of the backing cliffs.

Despite a large potential for wave induced transport there is no actual strong littoral transport of sediment either across (within the frontage) or beyond (to adjacent frontages) (Halcrow, 2002). This is due to the headland and embayment nature of this section of coast combined with a lack of mobile littoral sediment on most shorelines (SCOPAC, 2004).

Material within embayments form pocket beaches whose sediment is derived from local cliff erosion, including from a series of thin pebble beds. However, there is no discernable interaction between beaches.

The offshore zone is also steeply sloping, with cliffs plunging directly into deep water between St Alban's Head and Durlston Head, and this, along with the indented character of the shoreline, results in there being no large scale sediment transport processes occurring. SCOPAC (2004) postulates that tidal induced sand transport along the seabed may occur in a west-south-west direction from the west of Worbarrow Bay to be deposited at the Adamant Shoal and The Shambles. This would make The Shambles a possible sediment store, however it is important to note that this is an unproven theory.

Movement

Futurecoast (Halcrow, 2002) describes the long-term process by which the differential erosion has formed the headland and pocket beach coast that is observed today. This evolutionary process may be modified by the presence of (a) geological faults that undergo preferential erosion to form small pocket beaches, and (b) several river valleys that run parallel to the coast that may be captured and exploited by marine erosion. SCOPAC (2004) suggests that the partial inundation of valleys (created by fluvial erosion) during the Holocene marine transgression (c.10,000 years BP) was the dominant evolutionary factor that has since been overtaken by the evolutionary process described in Futurecoast (Halcrow, 2002).

Whilst marine erosion has been, and continues to be, a controlling factor in the long-term evolution of the coastal form in the study area, it is less important to the cliff morphology than long-term sub-aerial denudation (though marine erosion to remove debris from the toe is also important) (SCOPAC, 2004).

The strong geological control exerted on this section of coast causes two general types of response:

- Areas of resistant geology (e.g. chalk and limestone) remains relatively immobile;
- Areas of softer geology (e.g. clays overlaid with chalk) experience erosion.

The erosion of softer cliffs contributes much material to the coastal sediment transport system, though much of this is fine clays that are transported offshore in suspension (SCOPAC, 2004).

Modifications

There has been very little in the way of coastal defence or management intervention activity along this section of largely sea cliff dominated coast. The exceptions are at Lulworth Cove and Kimmeridge Bay, where small scale localised defence works have been constructed.

LOCAL SCALE: Durlston Head to St Alban's Head

Interactions

This section consists of vertical plunging cliffs of bedded Portland limestone capped by Purbeck limestone that rise to inland plateaus 140m high.

Net potential longshore transport is eastwards, however the rate of transport is very low and intermittent along the frontage, with virtually no feed of sediment past Durlston Head. There is therefore negligible linkage with areas outside the SMP boundary.

Movement

The limestone cliffs are very resistant to erosion, with negligible cliff top recession occurring over the past century. What erosion there is, is confined to joint planes, or is the result of wave undercutting. Analysis of historical mapping carried out for Futurecoast (Halcrow, 2002) shows that there has been no discernable recession here over the past 100 years.

Existing Predictions of Shoreline Evolution

For an 'unconstrained' scenario, Futurecoast (Halcrow, 2002) predicted that the cliffs of this section are so resistant that over the next century there will be no noticeable change in cliff top position.

As there is presently no human intervention along this section, the Futurecoast (Halcrow, 2002) prediction for a 'with present management' scenario is the same as for the unconstrained scenario behaviour over the next 100 years.

LOCAL SCALE: St Alban's Head to Worbarrow Tout

Interactions

The clay dominated cliffs that occur within this section increase in height westwards from St Alban's Head. The cliffs are fronted by a combination of rocky shore platforms and thin/discontinuous sand and shingle beaches. There are hardly any coastal defences along this section. The exception is at Kimmeridge Bay where there is a small localised seawall and revetment along the eastern part of the bay.

Erosion of both the cliffs and shore platforms contribute to the coarse sediment supply of the local pocket beaches. Much of the material derived from this erosion is fine material that is transported offshore in suspension. The presence of the shore platforms also serve to dissipate wave energy reaching the shoreline and so reduce the actual littoral transport that can occur along the shoreline, as well as reduce the rate of cliff recession (SCOPAC, 2004).

As for the adjacent Durlston Head to St Alban's Head section, there is very low intermittent eastwards littoral transport along this section. This is due to a combination of trapping of sediment in embayments and coves confined by hard rock headlands, dissipation of wave energy by rocky shore platforms, poor availability of coarse beach-building sediment and the presence of deep water adjacent to parts of the cliffed coastline (SCOPAC, 2004).

Therefore any coarse sediment material released from the cliffs tends to remain locally within pocket beaches whilst finer sediment is transported offshore and is lost from the system.

Movement

Some of the cliffs along this section are of a composite nature (e.g. at Gadd Cliff, Honnstant Cliff and St. Alban's Head). In these cliffs seaward dipping Portland Limestone overlies Kimmeridge Clay and they experience deep seated landslides as a result. There is some variation in the geological resistance of the cliffs, and this has led to differential erosion creating several deeply incised bays at Brandy Bay, Hobarrow Bay, Kimmeridge Bay, Egmont Bight and Chapman's Pool.

Therefore, compared to the adjacent sections of coast more rapid cliff recession has been observed here, although rates are still generally low. Analysis carried out as part of Futurecoast (Halcrow, 2002) suggests historic rates of cliff top erosion over the past 100 years has been between 0.05 to 0.1m/year at various locations along this section.

SCOPAC (2004) suggests the upper limit of recession may be as much as 0.15m/year based upon analysis of data between 1880 and 1990 for the area between Worbarrow Tout and Hobarrow Bay, and about 0.1m/year from Kimmeridge Ledges to St Alban's Head. However, SCOPAC (2004) suggests higher rates of retreat for other parts of this section of coast, with rates of between 0.2 to 0.4m/year applicable between Broad Bench and Kimmeridge Bay (increasing to 0.8m/year where the shore platform width is less).

From a comparison of historic Ordnance Survey maps from the years 1890 and 1989 undertaken for this SMP2, it is apparent that the shoreline position at Chapman's Pool has eroded slightly over this period.

Existing Predictions of Shoreline Evolution

For an 'unconstrained' scenario, Futurecoast (Halcrow, 2002) predicted that the cliffs of this section will be dominated in the future by recession that is controlled by land-slide events. Coarser material derived from this erosion would contribute locally to pocket beaches within embayments controlled by headlands, with finer material being transported offshore in suspension.

There is limited human intervention along this section. The Futurecoast (Halcrow, 2002) prediction for a 'with present management' scenario is for this scenario to not be unduly different from the unconstrained scenario behaviour over the next 100 years.

LOCAL SCALE: Worbarrow Tout to White Nothe

Interactions

The section of coast between Worbarrow Tout and White Nothe consists of sea cliffs indented by a series of coves and embayments. The largest of which are Lulworth Cove and Worbarrow Bay, both of which formed following breaches through the seaward limestone ridge that allowed subsequent erosion of the softer clay beds that lie behind it. These bays represent various stages of the very long term evolutionary process that occurs along this coastline. Another stage in the evolutionary process is that breaching of the limestone ridge follows formation and eventual collapse of arches. One such arch along this section of coast is Durdle Door, a vertical Portland Limestone arch formed by wave action (SCOPAC, 2004). The cliffs between White Nothe and Durdle Door are vertical and formed from chalk with a fronting chalk platform. In places along this section, cliffs overhang where there has been erosion by marine action of the underlying clay base that is exposed in some parts.

Human intervention has been very limited along this coast, with only a small seawall existing at the back (north side) of Lulworth Cove. As such this section of coast is essentially natural, with the chalk cliffs being the dominant control.

Despite the potential for eastward littoral transport, eroded material tends to remain in local pocket beaches such as those found fronting the cliffs at Durdle Door and Man 'o' War Bay. This is due to a combination of the many headlands along this section that limit littoral transport both along the unit and beyond it, as well as the limited supply of coarse material to be transported being derived from coastal erosion.

Movement

The chalk cliffs have given rise to relative low rates of recession over the past decades and centuries along this section of coast. Analysis of historical data as part of Futurecoast (Halcrow, 2002) suggests recession rates of between 0.06 to 0.12m/year at the western end of this section over the past century. SCOPAC (2004) suggests that these low rates of recession occur as a result of debris at the cliff toe temporarily preventing erosion, and that the underlying mean annual rate of recession is between 0.2 to 0.46m/year. SCOPAC (2004) also suggests rates of 0.08 to 0.12m/year occur towards the eastern end of this section.

Analysis presented in the 2006 Strategic Regional Coastal Monitoring Annual Report (Channel Coastal Observatory, 2006) suggests that there has been accretion of the beach in the eastern part of Worbarrow Bay between 2003 and 2006. Over the same period, the beaches at Lulworth Cove and between Man 'o' War Rocks to Stair Hole have experienced slight erosion.

A comparison of historic Ordnance Survey maps from the years 1890 and 1989 undertaken for this SMP2 has shown that within Lulworth Cove, the longer term trend of beach movement has been for the northern part of the beach to accrete over this period whilst erosion occurs in the western and eastern parts of the beach.

Existing Predictions of Shoreline Evolution

For an 'unconstrained' scenario, Futurecoast (Halcrow, 2002) predicted that the past long-term evolutionary process of slow localised breaching of the limestone and chalk ridge followed by rapid expansion in the clay beds behind the limestone will continue to be the dominating process in the future. The process of breaching is next likely to commence at Stair Hole to the west of Lulworth Cove, although it is unlikely that significant erosion to form a new cove would occur over the next 100 years.

There is limited human intervention along this section. As a result the Futurecoast (Halcrow, 2002) prediction for a 'with present management' scenario is for this scenario is very similar to the unconstrained scenario behaviour over the next 100 years.

C.1.5 White Nothe to Portland Bill

LARGE SCALE

Interactions

The coast between White Nothe and Portland Bill is predominantly made up of cliffs consisting of both resistant rock (e.g. Portland Limestone) and less resistant lithologies (e.g. Kimmeridge and Oxford Clays). The varying resistance of the cliffs has resulted in the occurrence of differential erosion, which has formed the present configuration of the shoreline with a series of headlands and embayments. Weymouth Bay is the largest embayment in this section.

Weymouth Bay formed when sea level rise during the Holocene marine transgression (c.10,000 years BP) led to the inundation of the River Wey's low relief valley (Halcrow, 2002). The valley is carved through Oxford Clay and bounded by hard limestone cliffs (that now form the headlands of Redcliff Point and The Nothe). A spit-barrier beach also formed across what was the Wey Estuary as a result of the landward migration of sediments combed from the sea bed during the sea level rise. This enclosed the estuary from the north at Bowleaze Cove towards the south, leaving a small entrance channel between the southern end of the barrier and The Nothe headland. The enclosure also led to the infilling of the estuary with sediment. Both the infilled estuary and the spit-barrier beach have been 'fixed' in position in recent centuries by the development of Weymouth, and now form the main low-lying part of the town.

There are a number of other beaches throughout this frontage. There is a major pocket beach at Ringstead Bay (SCOPAC 2004) as well as a second shingle barrier beach (Ham Beach) that lines part of Portland Harbour from the Isle of Portland to the mainland, and is broken at the northern end by the presence of the tidal inlet to The Fleet (refer to Section C.1.6 – Portland Bill to Eype).

A significant control to shoreline behaviour along this section of coast is provided by the Isle of Portland. The island was once separated from the mainland only to be re-attached by the formation of Chesil Beach during the Holocene marine transgression in a similar evolutionary process to that which formed the barrier beach across Weymouth Bay (refer to Section C.1.6 – Portland Bill to Eype).

The presence of the Isle of Portland provides shelter to this section of coast from direct exposure to the dominant south-westerly waves. the incoming south-westerly waves diffract around the Isle of Portland and in turn assist in a localised littoral drift reversal from east to west between White Nothe to Weymouth Bay. The process is aided by the presence of a number of shallow banks on the seabed to the east of Portland Bill, most notably The Shambles bank. These banks are present due to the circulatory tidal currents that are generated by tidal flow around Portland Bill and in turn cause refraction of waves as they approach the inshore (SCOPAC, 2004). The banks themselves are thought to have little interaction with the coast (Halcrow, 2002). Although SCOPAC (2004) suggests that there may be some sand transport along the seabed towards the banks by tidal flows, with material moving from the inshore areas to be deposited in these possible sediment stores, though this is an unproven theory.

The Shambles is the only significant feature of the offshore area, which is steeply sloping between White Nothe and Ringstead Ledge, before becoming more gently sloping within the Weymouth Bay embayment and Portland Harbour.

There is potential for a sediment transport from east to west towards Weymouth Bay. However, the actual sediment transport is very small (if any) due to the presence of secondary headlands that intercept sediment as well as a limited contemporary sediment supply to the foreshore from the erosion of cliffs in Ringstead Bay (Halcrow, 2002). SCOPAC (2004) suggests that the east to west littoral drift of sediment became greatly reduced once the secondary headland at Redcliff Point formed. As a result, Weymouth Bay is largely closed to new sediment inputs. As a result, over time the movement of material both alongshore (during 'normal' wave and tide conditions and onshore-offshore (which is the significant process during storm events) has resulted in the beaches in the northern part of the bay being gradually eroded and losing volume (Posford Duvivier, 2001).

The River Wey, which discharges to the sea through Weymouth Harbour mouth, is an in-filled estuary with a small tidal prism that has been completely modified by human intervention. The Wey exerts only a very limited and localised influence on the open coast.

Movement

The material strength and stratigraphy of the geology along this section of coast controls the present day rates and locations of sea cliff erosion. The resistant geology at Portland, Weymouth Bay (The Nothe and Redcliff Point), and White Nothe constrains evolution along the coast. Although between these locations there are areas of cliff comprised of Kimmeridge and Oxford Clays that demonstrate complex landsliding characteristics, particularly between Furzy Cliff (north end of Weymouth Bay) and White Nothe. The activity of the landslides are controlled by groundwater conditions more than marine action (though this is also an important factor in the cliff stability) (SCOPAC, 2004).

Landslides in Ringstead Bay can also provide a contemporary source of sediment to the coastal sediment system. However, this is potentially limited to episodic cross-shore sediment exchange during storm wave events between the beach and the floor of Ringstead Bay out to a distance of 100 to 150m, where the cross-shore movement is confined to being landwards of a series of rocky reefs that are present here. These reefs are important for retaining coarse sediment for beach-building. Gaps within the reefs can allow sediment to escape from the bay and be transported offshore (SCOPAC, 2004).

Erosion also occurs along parts of the Isle of Portland, primarily the northern part, where the limestone is underlain with clay beds that are exposed to wave action. The section of the Isle of Portland south from Church Ope Cove is very resistant to erosion as the southward dipping strata that forms the island exposes the resistant Portland limestone to wave action.

Within Weymouth Bay there is an accumulation of sand in the southern part of the bay (NB: the beaches in Weymouth Bay are graded from shingle to the north and sand to the south) resulting from the natural feed of sediment from offshore due to wave and tide action. This process of accumulation is added to by the southerly drift of sand along the frontage and has resulted in the shallowing of the nearshore slope and the occasional need to undertake maintenance dredging at the mouth of Weymouth Harbour (SCOPAC, 2004).

Modifications

There has been human intervention along many parts of this section of coast for many centuries associated with the development and expansion of the town of Weymouth upon low-lying reclaimed land, this continues to the present day.

The largest example of human intervention has been the construction of the Portland Harbour Breakwaters in the second half of the 19^{th} century, which exert a significant effect upon shoreline behaviour in their lee and along the adjacent coast. In particular, the breakwaters shelter the backing sea cliffs along the north-western shore of Portland Harbour and Ham Beach, along the western shore, from wave action. The breakwaters, and the sheltering they afford, also serve to sever any potential linkage (if any existed before their construction) between the eroding sea cliffs along the north-east and north-west sides of the Isle of Portland. These cliffs historically supplied sediment to Ham Beach, which would have been transported along the base of the cliffs that line the north-west side of Portland Harbour towards The Nothe headland and possibly beyond this into Weymouth Bay.

Other significant human interventions along this shoreline are as follows:

- A rock breakwater was constructed in Ringstead Bay in 1996, replacing an older timber sea wall, and was associated with approximately 25,000m^3 of beach recharge (SCOPAC, 2004);
- The cliffs at Bowleaze Cove are (in part) protected from toe erosion by wave action by rock armour and gabions constructed here in about 1984 (SCOPAC, 2004);
- Preston Beach area of Weymouth Bay has been extensively managed by seawalls and groyne fields over the past two centuries. The most recent defences were constructed here by the Environment Agency in 1995/96 and consisted of a new seawall and 207,000m^3 of sand and shingle beach recharge, along with construction of a terminal rock groyne to reduce drift of sediment southwards within Weymouth Bay;

  Since this recharge, there has been ongoing recycling of sediment along the shoreline from the rock groyne to Bowleaze Cove and re-profiling of the beach to retain the required standard of protection. Further beach recharge in the future is also likely to be required (Posford Duvivier, 2001);
- Extending north from Preston Beach and along part of the southern end of Furzy Cliff is a section of concrete wave return wall constructed as part of a 1984 coast protection scheme that also included regarding of the Furzy Cliff slope at the southern end of this cliff;

- A seawall and esplanade extend along most of the Weymouth Bay frontage, from the northern end of Preston Beach southwards to the Ferry Terminal Peninsula (that forms the northern side of Weymouth Harbour Entrance). This seawall and esplanade has been replaced and extended several times over the past two centuries as previous structures were destroyed by storm events, the most notable occasion being during the great storm of 1824;
- The entrance to Weymouth Harbour is controlled by a jetty on either side. These jetties have been extended over the centuries to provide a safe entrance to the harbour. The northern jetty in particular has been increased in size by reclamation as recently as 1978, which created the Ferry Terminal Peninsula seen today. The gradual increase in size of the northern harbour jetty led to the coincidental increase in the 'trap zone' for sand sediment in the southern part of Weymouth Bay (SCOPAC, 2004);
- Weymouth Harbour is completely modified by human activity, from reclamation of large areas of the Wey Estuary to quay walls lining the entire harbour and sluice gates at controlling discharge from the river upstream out through the harbour to the sea. This modification is associated with the growth of the town of Weymouth, which has largely 'fixed' in position the barrier beach/spit upon which part of the town is constructed;
- The southern harbour jetty (the Stone Pier), was re-constructed in the 1980s and attaches to The Nothe headland. This pier forms the start of a continuously armoured section of coast that protects the southern side of The Nothe from erosion by wave action. The most recent works were carried out along part of this coast in 2002, and involved the construction of a new seawall and rock armouring (Weymouth & Portland Borough Council, 2002); and,
- Within Portland Harbour there is a culvert that allows discharge of water flowing over/through the Chesil Beach to discharge to Portland Harbour. This culvert forms part of the larger Chesil Beach Flood Protection Scheme constructed in the 1980s and 1990s to reduce the risk of breaching of Chesil Beach.

LOCAL SCALE: White Nothe to Redcliff Point

Interactions

The sea cliffs along this section of coast consist of clays that demonstrate complex landslide characteristics. Undercliffs have formed at both Osmington and White Nothe. The foreshore is made up of sections of shingle and boulder beaches that overlay rocky shore platforms and reefs.

Any material released to the coastal sediment system has the potential to be transported towards Weymouth Bay as a result of the localised drift reversal that has developed in this area as a result of the influence of the Isle of Portland. However, the actual westward drift is largely inhibited by the presence of rock platforms and reefs, as well as the presence of the emergent headland at Redcliff Point. The reefs in Ringstead Bay for example, help to retain coarse beach material within the bay, allowing only finer material to exit the bay to the offshore zone in suspension (SCOPAC, 2004).

There is limited human intervention here with only a small length of rock revetment and some beach recharge associated with a controlling rock groyne having been constructed within Ringstead Bay in 1996. This recent recharge may have affected the very recent rates of cliff recession in the area affected by the 1996 construction, which otherwise appear to have accelerated in the past 50 years compared to the first part of the 20th century (SCOPAC, 2004).

Movement

It is likely that the primary mechanism for cliff failure along this section is due to groundwater and not wave action at the toe (although this is also an important factor in ongoing cliff stability). The importance of groundwater has been demonstrated by the occurrence of mudslides at Black Head between 1910 and 1914, which developed due to groundwater conditions and now continue to be unstable as a result of cliff toe erosion (SCOPAC, 2004).

The rates of cliff recession along this section are rated as medium to high (Halcrow, 2002). These cliffs show a number of failure types including mudflows and large, episodic rotational land slips that are active at a number of locations such as Black Head at Osmington Mills and Burning Cliff in Ringstead Bay. SCOPAC (2004) suggests the periodicity of events at Osmington Mills may be of the order of 10 to 15 years.

Futurecoast (Halcrow, 2002) and SCOPAC (2004) both estimate that the cliffs at Osmington and Ringstead Bay are eroding at a mean annual rate of about 0.50m/year.

The beach in Ringstead Bay has accreted slightly in the west and eroded slightly in the east between 2003 and 2006 (Channel Coastal Observatory, 2006).

Existing Predictions of Shoreline Evolution

For an 'unconstrained' scenario, Futurecoast (Halcrow, 2002) predicted that due to the cliffs in this area being formed of clays inter-bedded with permeable strata, the large scale episodic rotational landslides that have previously occurred along the coast will continue to occur over the next 100 years. There is also a possibility that some of the material that is eroded to be transported to the west, though this depends upon the evolution of secondary headlands, specifically at Redcliff Point.

As there is limited human intervention along this section, the Futurecoast (Halcrow, 2002) prediction for a 'with present management' scenario is similar to the unconstrained scenario behaviour over the next 100 years. The exception is at Ringstead Bay where the continued defences within the bay would be likely to hinder the erosion of the cliff toe and so affect the frequency of landslide events.

LOCAL SCALE: Weymouth Bay

Interactions

Weymouth Bay extends from Redcliff Point in the north to the Stone Pier, which marks the southern jetty at the entrance to Weymouth Harbour, where the Wey Estuary enters the sea.

The main feature of the bay is the continuous beach ridge that fronts a large low-lying expanse of land, south of Furzy Cliffs. The ridge was once a barrier beach and spit fronting an in-filled estuary containing mudflats and marsh land. However, it has been extensively built on as the town of Weymouth has grown over the centuries. The beach ridge is backed by a seawall and promenade over the majority of its length, except for a section at the northern end of the bay where there is a clay cliff (Furzy Cliff) that exhibits landslide activity. Between Furzy Cliff and Redcliff Point, there are further seawalls, revetments and gabions providing sea defence functions to Bowleaze Cove.

The beach sediment size increases from fine sands in the southern end of the bay to shingle sized sediment in the north. This grading of beach sediment is accompanied by an increase in steepness and reduction in width of the foreshore slope towards the northern end of the bay.

There have been several studies of Weymouth Bay to establish the sediment transport patterns within the bay. The general consensus presented in Futurecoast (Halcrow, 2002) is that there is net drift from north to south in the southern part of the bay, and from west to east in the northern part of the bay. A drift divide exists in the vicinity of Lodmoor. The bay is affected by the sheltering affects of both the Isle of Portland and Portland Harbour Breakwaters, as well as the natural morphology of the bay. Despite these studies, there is still a poor level of understanding of the sediment transport processes within the bay (SCOPAC, 2004).

In the past it is likely that sediment was supplied to the beaches in Weymouth Bay by transport of sediment to the bay from White Nothe as a result of the local littoral drift reversal from east to west that occurs here. However, it appears that this historical transport pathway has been discontinued and as such the beaches are dependent upon artificial inputs of sediment.

The entrance to Weymouth Harbour is the mouth of the small River Wey. Prior to the growth of the town of Weymouth, this was a single spit enclosed estuary that flowed out through a channel between the southern end of the spit and the hard Nothe headland. As Weymouth has developed the estuary has been completely altered by man. The spit was completely built over and extended to form the north harbour arm. The flow of the River Wey to the sea is also now managed, with a series of sluice gates dividing the mouth from the freshwater Radipole Lake upstream and controlling the discharge rate (except at times of high river flows when they are opened to reduce flood risk upstream). As a result there is little fluvial sediment input to the coast. The only other interaction between the estuary and the coast is that some sediment enters the mouth from the sea and is deposited (Halcrow, 2002). Thus the mouth requires occasional dredging (SCOPAC, 2004).

The Wey Estuary is largely unaffected by wave action, with waves propagating towards land from offshore only affecting the outer part of the harbour entrance between the two harbour piers. Within the Wey Estuary small wind driven waves occur given favourable wind conditions blowing over a fairly linear water course, though these are of limited significance to flood defence within the harbour.

Movement

The beaches of the central and northern parts of Weymouth Bay have a history of sediment loss and beach narrowing in front of the seawall (Halcrow, 2002). The narrowness of the Preston Beach part of the bay and the vulnerability of the road it protects to wave overtopping during storms as a result, was the primary driver for the construction of the Preston Beach Sea Defence Scheme in 1995/6 (Posford Duvivier, 2001).

The sand beach to the southern end of the bay shows anaerobic conditions, indicating that material here is relatively immobile (Halcrow, 2002). This may also be a function of the sand accumulation that occurs in the south end of the bay, a process that has been aided over the decades by the gradual increase in length and size (by land reclamation) of the northern jetty at the entrance to Weymouth Harbour (SCOPAC, 2004). Analysis presented in the 2006 Strategic Regional Coastal Monitoring Annual Report (Channel Coastal Observatory, 2006) shows that the southern part of Weymouth Bay has accreted by between 5 and 15% since 2003.

The only potential natural sources of sediment input are from the erosion of Furzy Cliff and Redcliff. Furzy Cliff is estimated to be retreating at a mean annual rate of 0.75m/year (Weymouth & Portland Borough Council, 2002). Redcliff has a mean annual recession rate of 0.62m/year (Mouchel, 1998), although as both of these are clay cliffs it is unlikely that much beach-building sediment will be supplied.

Existing Predictions of Shoreline Evolution

For an 'unconstrained' scenario, Futurecoast (Halcrow, 2002) predicted that the shingle barrier in the north part of the bay (Preston Beach) would roll-back in response to future sea level rise. This could lead to a possible breach of the barrier in the vicinity of the proposed littoral drift divergence at Lodmoor. Should a breach occur then a tidal inlet could form, and this could eventually be 're-sealed' over time as material drifts along the shoreline. The sand beach in the southern part of the bay would oscillate in response to periodic pulses of sediment input from the erosion of limestone cliffs at Portland and also possibly The Nothe, which is comprised of mixed sandstone and clay beds.

The Futurecoast (Halcrow, 2002) prediction for a 'with present management' scenario is for the seawall that runs behind the beach for most of the length of the bay will inhibit any roll-back of the beach in response to sea level rise. As a consequence this will lead to narrowing of the foreshore by the process of coastal squeeze. The frontage will require the continued artificial input of sediment to the foreshore, as has previously occurred at Preston Beach. The extent of managed input would likely need to be extended to the sand beach in the south of the bay, as this area would also diminish due to a lack of sediment input.

LOCAL SCALE: Weymouth Bay to Portland Harbour

Interactions

This short section of coast covers the southern shore of The Nothe headland between the Stone Pier and the northern-most Portland Harbour Breakwater where it attaches to the land at Bincleaves. The coast here is characterised by steep sea cliffs composed of clays capped by limestone. Where these clays are exposed the cliffs are susceptible to landsliding, as was experienced in 1987 and 1988 where parts of the original retaining wall that runs around the seaward base of The Nothe was destroyed by landslides.

The base of the sea cliffs at The Nothe is completely protected by a combination of concrete sea walls and rock armour revetment, and is fronted by rock platforms and, at Newton's Cove, a small area of shingle beach. The sea wall around The Nothe was largely re-constructed in 2002 as part of the Newton's Cove Coast Protection Scheme, which also included extensive pinning of the cliff and cliff drainage works to reduce the risk of future landslides damaging the new seawall as happened in the late 1980s (Weymouth & Portland Borough Council, 2002).

Movement

Where clays are exposed, the cliffs are susceptible to landsliding, as was experienced in 1987 and 1988 when parts of the original retaining wall that runs around the seaward base of The Nothe was destroyed by landslides. Analysis presented in the Newton's Cove Coast Protection Scheme: Engineers Report (Weymouth and Portland Borough Council, 2002) suggests that if there were no defences around The Nothe, then an erosion rate of 0.50m/year would be likely.

If erosion of the cliffs were to occur, then coarse material would contribute to the local beaches, and could potentially be transported around The Nothe to the beaches within Weymouth Bay. However, the size of The Nothe headland may prevent transport of coarse material beyond it.

Existing Predictions of Shoreline Evolution

For an 'unconstrained' scenario, Futurecoast (Halcrow, 2002) predicted that there would be continued landsliding due to increased exposure of the toe of the cliffs to wave action as sea levels rise. Futurecoast went on to suggest that the frequency of landslide events could increase in the future, both due to this increased exposure and due to an increase in rainfall due to climate change. Material released by erosion could potentially be transported to beaches within either Weymouth Bay or Portland Harbour. Fine material (i.e. clays) would be transported offshore in suspension.

The Futurecoast (Halcrow, 2002) prediction for a 'with present management' scenario is for the present scenario of occasional landslide events occurring. The frequency of landslides is inhibited by the lack of wave action at the cliff toe due to the presence of the seawalls, as well as intervention measures to improve drainage of groundwater from the cliffs.

LOCAL SCALE: Portland Harbour

Interactions

This section covers the area between the northern-most Portland Harbour Breakwater, where it attaches to the mainland at Bincleaves. The study area extends around the north-west and western parts of the Portland Harbour shoreline, up to where the eastward facing shingle barrier of Ham Beach meets the Isle of Portland at the start of the former Royal Navy Air Station, and Osprey Quay.

Ham Beach is a small shingle barrier beach along the eastern side of Chesil Beach, which is distinctly different to Chesil Beach. Ham Beach is comprised of angular and sub-angular limestones and cherts from the east cliffs of the Isle of Portland (West, 2006). The beach almost encloses the Fleet lagoon except for the artificial culvert that allows tidal exchange between the lagoon and Portland Harbour at Ferrybridge.

Research by West (2006) states that the Ham Beach shingle barrier also connected the Isle of Portland to the mainland, and as such formed a 'double tombolo' along with Chesil Beach but which was separated from Chesil Beach at the Portland end by a lagoon area called the Mere. The Mere was once connected to The Fleet (c. 16th century) but roll-back of the Chesil Barrier closed this channel, forcing The Fleet to find a new outlet to the sea at Small Mouth. As a result the Mere became a mudflat, which was then built on to form the former Royal Naval Air Station at Portland.

Portland Harbour is sheltered by the Portland Harbour Breakwaters, as well as the Isle of Portland and Chesil Beach. As a result, there is very limited wave action to drive sediment transport, this, combined with the long low water tidal stand, allows fine sediment to settle and become trapped within the harbour. This has led to the gradual accretion in the harbour, which acts as a partial sediment sink (SCOPAC, 2004).

Movement

Along the north-west shore of Portland Harbour are several clay cliffs capped with limestone that experience landsliding. These cliffs are similar in nature to those to the east that form the Nothe headland. They have been eroding for many centuries as a result of high groundwater levels in the landslide system and exposure to wave action at the toe. Landsliding lead to the rapid retreat of the cliffs in the vicinity of Sandsfoot Castle in the 16th century that caused part of the castle to collapse in to the sea.

The construction of the Portland Harbour Breakwaters greatly reduced the rate of recession of the cliffs along the north-west shore of Portland Harbour by reducing the exposure to wave erosion at the toe of the cliffs. In recent times the cliffs have been relatively stable. Landslides along this section are occasional and largely driven by a combination of groundwater conditions and cliff toe erosion by wave action. Removal of the toe by waves occurs when periods of strong winds are able to generate waves within Portland Harbour of sufficient size, and occurring with high water levels (Halcrow, 2008).

The shingle barrier of Ham Beach has also been relatively stable over the past century, probably due to the protection afforded by the breakwaters.

The Portland Harbour North-Western Shore Strategic Study (Halcrow, 2008) undertook analysis of historical mapping and aerial photography between 1903 and 2006 to determine erosion rates for the north-western shore cliffs over the past century. This analysis determined that mean annual rates of erosion along this part of the coast vary from almost 0m/yr to about 0.5m/yr, depending upon local geological variations. These rates reflect erosion over the past century, and include the effect of sheltering by the Portland Harbour breakwaters. These rates reflect the recession observed since construction of the breakwaters and if the breakwaters were to cease to function in their current manner the rate of recession would increase due to the increase in exposure to incoming waves.

From a comparison of historic Ordnance Survey maps from the years 1903 and 1998 undertaken for this SMP2, it is apparent that there has been a loss of material around the former entrance to the Fleet at Small Mouth. Both Small Mouth Spit and Small Mouth Sand have reduced dramatically in size over this period.

Existing Predictions of Shoreline Evolution

For an 'unconstrained' scenario, Futurecoast (Halcrow, 2002) predicted an increase in wave action at the toe of the cliffs. The rates of cliff recession experienced prior to the construction of the Portland Harbour Breakwaters would be likely to resume. This would lead to an increase in the amount of sediment released to the coastal sediment system. The shingle barrier beach would also slowly roll-back across the mouth of The Fleet, possibly closing off the tidal link between the lagoon and the open sea.

The unconstrained scenario is highly dependent upon the stability of Chesil Beach, and assumes that the Chesil Beach will not breach during the next 100 years. If Chesil Beach was to breach and break down over the next century, then there would be a significant change in the hydrodynamic regime through Portland Harbour between the mainland and the 'detached' Isle of Portland. These changes in the hydrodynamic regime would mean the small shingle barrier of Ham Beach would be lost, and could possibly be replaced by a range of features such as a shingle spit extending from the mainland towards the Isle of Portland and a tidal delta within the harbour. The changes caused by such a breach of the Chesil Barrier would also affect the processes further afield, such as the sediment transport processes within the presently sheltered Weymouth Bay.

The Futurecoast (Halcrow, 2002) prediction for a 'with present management' scenario is for the shingle barrier beach to experience minimal roll-back in response to future sea level rise, the entrance to The Fleet would remain open. The infrequent landslides along the north-western shore of Portland Harbour would continue as at present, though future predicted increases in rainfall could increase the frequency of events over time.

LOCAL SCALE: Isle of Portland

Interactions

Whilst this Section C.1.5 (White Nothe to Portland Bill) focuses on the section of coast between White Nothe and Portland Bill, this part of the document looks at the Isle of Portland as a whole and as such also informs in part the following Section C.1.6 (Portland Bill to Eype).

The Isle of Portland, which is not actually an island as it is attached to the mainland by the Chesil Barrier, consists of sea cliffs ranging in height from 10m to 130m. The cliff behaviour is controlled by the geology. Along the north-west and north-east parts of the island, clays outcrop along the lower cliff. These are capped by Portland limestone and facilitate landslide behaviour that dominates these sections of the frontage. Frequent landslides have been recorded along these cliffs over recent centuries.

In places, the bases of the cliffs are strewn with rock debris and scree slopes. Whilst some of the debris is natural, much is the result of quarrying waste being dumped here in the past. The long history of quarrying of Portland Limestone has also drastically altered the form of some of the cliffs. Prior to construction of the Portland Harbour Breakwaters and (former) Royal Naval Dockyard, erosion of the cliffs on the Portland Harbour side of the Chesil Barrier would have released sediment to the foreshore to be transported to the shingle barrier Ham Beach and the north-western shore of Portland Harbour, and possibly into Weymouth Bay. Since the construction, this process has largely ceased to occur.

Movement

Due to the construction of the breakwaters and the dockyard in the late 19th century, the cliffs around the Portland Harbour frontage of the Isle of Portland have been largely restricted in their retreat. Analysis of historical data was undertaken for Futurecoast (Halcrow, 2002) and suggests no change in position for at least a century.

The southern part of the island is dominated by vertical limestone cliffs, because the clay outcrops disappear as the strata dips towards the south. Failure of these cliffs is controlled by jointing of the geology that leads to infrequent rock falls, rather than large scale land slides observed on the northern part of the island. As a result there has been little change in the cliffline position. In some places small coves have developed, in which small shingle and boulder beaches, such as the one situated in Church Ope Cove, are located.

The most active erosion around the Isle of Portland has occurred along the north-western shore over the recent past in the vicinity of Chiswell. Futurecoast (Halcrow, 2002) suggests that mean annual erosion of the cliffs in this area over the historic record has been at a rate of 0.11m/year.

From a comparison of historic Ordnance Survey maps from the years 1903 and 1978 undertaken for this SMP2, it is apparent that the small pocket beaches, such as at Church Ope Cove, have generally experienced erosion over this period.

Existing Predictions of Shoreline Evolution

For an ‘unconstrained’ scenario, Futurecoast (Halcrow, 2002) predicted that erosion by landsliding would continue to be the dominant process along the northern shores of the Isle of Portland. The retreat has the potential to supply large amounts of sediment to the foreshore that could be transported towards Weymouth Bay by longshore transport processes. Due to the resistance of the Portland limestone that forms the southern coast of the island, this section would experience no significant change over the next 100 years.

The Futurecoast (Halcrow, 2002) prediction for a ‘with present management’ scenario is for the evolution of most of the coast to be not unduly changed from the unconstrained scenario. The exception is the frontage in Portland Harbour which would continue to be restricted from erosion by the presence of the breakwaters and other structures in this area.

C.1.6 Portland Bill to Eype

LARGE SCALE

Interactions

This section of coast is dominated by the Chesil Beach, a 28km long continuous swash-aligned shingle barrier that extends from the Isle of Portland along the shore of Lyme Bay to West Bay, where it is halted by the presence of the eastern jetty at the entrance to West Bay Harbour.

Despite much research over the decades, the formation of Chesil Beach is still not fully understood. The most widely accepted theory is that during the Holocene marine transgression (c.10,000 years BP), rising sea levels combed up coarse sand and shingle sediment from what is now the sea floor of Lyme Bay to form a predominantly sandy barrier that continued to roll-back as sea levels rose. The sand barrier’s landward migration gradually became impeded by high topography, allowing landslides of once relict cliffs to become reactivated about 4-5,000 years BP (SCOPAC, 2004). The re-activation of these cliff landslides led to the release of shingle material that was then transported towards the eastern end of Lyme Bay, becoming deposited on top of the sand barrier and gradually changing its composition to being one of the shingle barrier seen today.

The present Chesil Beach consists of 98% flint and chert and is very similar in composition to sediments found further west at Budleigh Salterton. It is therefore probable that there was once a continuous shingle barrier extending from the Isle of Portland to Budleigh Salterton. However, the continued roll-back of the barrier over the centuries under rising sea levels led to the continued erosion of the backing cliffs. The cliffs gradually emerged as a series of headlands that served to segment the once continuous barrier and hinder the longshore transport of sediment from west to east along this part of Lyme Bay.

As the barrier formed and rolled-back landwards, a lagoon formed between the barrier and the higher topography to the north. The lagoon was gradually compressed, in-filled, leading to the creation of peat beds within the lagoon. The peat beds were lost as the barrier rolled-back to the base of the cliff. The eastern end of the Chesil Beach is still backed by The Fleet, a tidal saline lagoon that is connected to the sea by a small culverted entrance at Ferrybridge in Portland Harbour. The Fleet is not connected to the mainland for 13km between Portland and Abbotsbury, though at its narrowest point at Wyke Narrows, the distance between the barrier and the mainland is only about 60m. West of Abbotsbury the shingle barrier is largely fixed against coastal slopes and cliffs that restrict the further roll-back of the barrier. In these areas the shingle beach is narrow, such as at Burton Bradstock and West Bay.

The formation of Chesil Beach was supplied by sediment from erosion of cliffs to the west. Since the development of headlands along the coast to the west has occurred, there has been a gradual reduction in sediment supply to Chesil Beach from the west, such that there is no longer a sediment transport link with the beaches to the west of Eype. The cessation of alongshore supply, combined with a lack of offshore sediment sources from the largely featureless, sloping sea bed of Lyme Bay, means Chesil Beach is now largely a relict feature.

The Chesil Barrier is directly exposed to south-westerly Atlantic waves in a 'window' of 215° to 240° that is delimited by Start Point and the north-western coast of Brittany, France (SCOPAC, 2004). The eastern end of the barrier (towards Portland) is the most exposed to these waves. The exposure to south-westerly waves reduces towards the west as the influence of Start Point on waves propagating into Lyme Bay increases in this direction.

The dominant south-west waves are also the reason for the well defined sediment grading (increasing shingle size from west to east) along the Chesil Barrier that is observed above the low water mark. Below the low water mark the sediment grading is generally coarser and less well sorted (SCOPAC, 2004). These dominant wave conditions have established a low rate of net sediment drift from west to east over many centuries and millennia, with the energy provided by these conditions being sufficient to transport the large shingle sizes towards Portland. Periodic exposure to waves from the south and south-easterly direction then set-up drift reversals that are able to transport only the smaller sized single back towards the west.

The long-term exposure to this transport regime is thought to be the reason for the Chesil Barrier's present smooth swash-aligned plan-form, as well as its great height (the crest height of the barrier increases from +6.0mOD in the west to about +15.0mOD at Portland (SCOPAC, 2004)).

Futurecoast (Halcrow, 2002) reports that the sediment transport regime along the length of Chesil Beach is very sensitive to wave direction. Even small changes in the wave direction have been observed to result in drift reversals that have led to problems relating to both sedimentation and erosion.

Movement

Whilst wave driven long-shore transport is important to the grading and maintenance of the plan form of Chesil Beach, it is the response of the beach to large swell and storm wave events that is responsible for the long-term gradual roll-back of the feature towards the land. Roll-back of the Chesil Barrier occurs as a result of overwash events that occur during high energy storm and swell wave events (Halcrow, 2002). Recent research by the University of Portsmouth (Bray *et al*, 2007) suggests that the process by which overwash occurs differs depending upon the type of wave event:

- Storm waves – tend to cause cut-back of the beach crest, causing the lowering of the crest that in turn allows waves to overwash the beach.

- Swell waves – these cause direct overwashing without the initially erosion of the crest (i.e. the waves simply run-up over the beach crest).

The effect of overwashing is to deposit beach material on the landward side of the barrier. The re-building of the beach by the sediment transport process described above then occurs on top of these deposits, such that the beach crest forms in a more landward position to that which it occupied before the overwash event.

SCOPAC (2004) suggests that the section of Chesil Beach at the eastern end between Wyke Regis and Chiswell is the most sensitive part of the Chesil Barrier to changes during storm events. This susceptibility may in part be due to the focussing of swell waves on this area caused by the refraction and diffraction of waves as they pass over irregularities in the offshore seabed of Lyme Bay. This process also causes swell wave focussing at Abbotsbury and West Bexington (Halcrow, 2002).

Modifications

Human intervention along this section of coast has occurred in several forms, from the construction of the harbour piers to provide an entrance to West Bay Harbour and sea defences at Chiswell and West Bay, to the mining of shingle from parts of the beach for use as aggregate. More recently, recycling and re-profiling of the beaches at the western end of Chesil Beach has taken place (at East Beach, West Bay and Freshwater Beach, Burton Bradstock) (Environment Agency, 2003).

The piers at West Bay Harbour entrance were first constructed in the 1740's. The presence of a shingle bar across and between the open-piled structures until the early-mid 19th century (coinciding with the first attempts to infill the harbour piers) indicates that they did not form a complete barrier to sediment transport (High-Point Rendel, 1997). Since about 1860, when the piers were re-built as solid structures, they have formed a more complete artificial barrier to the longshore transport of sediment. Some material is likely to still be transported across the entrance as evidenced by the periodic accumulation of shingle in the harbour mouth and so these piers are not a complete barrier to sediment transport (SCOPAC, 2004). The material accumulated in the mouth is unlikely to contribute very much to the beaches either side of the piers, because the material is removed by dredging for sale as aggregate on a commercial basis (Personal Communication, November 2007).

The effect of the piers was to cause net accretion of East Beach (against the eastern pier), though this has fluctuated over time with the position of Mean High Water having varied by about 65m (SCOPAC, 2004). West Beach has experienced significant erosion and set-back of the coast (up to 100m (SCOPAC, 2004)), particularly between 1823 and 1916, since when the beach has remained in its depleted condition with little further change (High-Point Rendel, 1997). This pattern of erosion is contrary to the classic down-drift effect normally observed around such structures (given the west to east net transport, East Beach would be expected to erode and West Beach accrete).

The reason for the observed pattern is differential sediment supply to the East and West Beaches. East Beach is supplied by the abundance of material from Chesil Beach (by frequent local drift reversals resulting from the sensitivity of longshore transport to changes in wave direction), while West Beach receives insufficient sediment supply from the shoreline to the west (SCOPAC, 2004). The reason for this problem not occurring until the latter part of the 19th century (given the piers were constructed a century before) is likely to be related, in part, to the development of the Doghouse Hill-Thorncombe Beacon headland as a permanent sediment barrier to the west of Eype between 1787 and 1850. The headland cut off the supply of sediment to the area from the shoreline further to the west (High-Point Rendel, 1997).

In response to the erosion at West Beach, a seawall was constructed to provide protection against further erosion. However, this is likely to have led to further scour and reduction in volume of West Beach, further exacerbating the problem here. As part of the West Bay scheme constructed in 2005 that altered the configuration of the harbour piers, West Beach was re-nourished with imported sediment and rock groynes were constructed to retain the material in front of the seawall to alleviate this problem.

In addition to the recycling and re-profiling of Freshwater Beach, there has been some reclamation of the back of the beach in the form of a clay/earth bund, associated with expansion of the caravan park.

At the eastern end of Chesil Beach sea defences have been constructed over several decades to provide protection for the low-lying settlements of Portland from flooding, caused by overwashing of the beach during storms. The majority of the construction occurred in the 1980s following a severe flood event in February

1979. The defences consist of seawalls, gabions, and a storm water interceptor drain that channels flood water via culverts to Portland Harbour.

LOCAL SCALE: Chesil Beach and The Fleet

Interactions

This section covers the 13km 'detached' or 'free-standing' part of Chesil Beach between the Isle of Portland and Abbotsbury that is backed by The Fleet lagoon. The crest height and sediment size of Chesil Beach are greatest at the Portland end of this section, with large shingle pebbles and crest heights of upto +15.0mOD. These features reduce in size and height towards the western end of the section at Abbotsbury.

The beach here is in a dynamic equilibrium, with major storms producing profile changes (by overwash and crest lowering) and 'normal' energy conditions that follow allowing the recovery of the beach (though in a retreated position). This process produces cyclic changes in the beach that can span several years. The process is also not uniform along the length of the beach, with some parts remaining unchanged for 30 to 40 years whilst other parts experience more frequent changes. This increased frequency of changes may be due to the effects of wave focussing at specific parts of the beach at Abbotsbury and Wyke Regis to Chiswell. These areas are the most volatile parts of the beach, having exhibited the greatest variability in beach profile over the length of available observations. The construction of sea defences at Chiswell in the 1980's and 1990's has served to stabilise the beach crest in this area.

Chesil Beach itself serves to protect Weymouth Bay and The Fleet from direct exposure to the dominant south-westerly waves propagating from the Atlantic. These waves induce a littoral drift along the Chesil Barrier from west to east, though this drift is very sensitive to changes in wave direction and frequent localised drift reversals. The result of these frequent changes in drift direction is that the net drift along the beach is very low.

The Fleet lagoon that runs along the landward side of the Chesil Beach is a tidal saline lagoon that is connected to the sea by a culverted tidal entrance into Portland Harbour at Ferrybridge. At its western end a number of small streams drain into The Fleet, providing a freshwater input. At present there is no significant direct interaction between The Fleet and coastal processes, despite The Fleet having formed as a result of coastal processes. However, at the Wyke Narrows the tidal flow is constrained so that high currents flow through this channel that are sufficient to keep the channel open (and so stop the beach from rolling back and cutting off The Fleet from the open sea). Intrusion of saltwater occurs both through the tidal exchange with Portland Harbour and by gradual seepage through the shingle barrier and (less frequent) 'bursts' of salt water from the single barrier that form 'cans' on The Fleet side of Chesil Beach (Bray *et al*, 2007).

There is no reported problem of wave action within The Fleet, though its length and general linearity allows some small wind-generated waves to propagate within the lagoon given favourable wind conditions. Given this limited wave action, it is thought that the main cause of infrequent small scale landslide events in the coastal slopes on the landward side of The Fleet is driven by groundwater conditions.

Movement

Over the past century there has been a very slow rate of retreat of the Chesil Barrier. Futurecoast (Halcrow, 2002) suggests that the beach has retreated at a rate of about 0.10m/year.

SCOPAC (2004) also provides analysis of the movement of Chesil Beach, and states that between 1853 and 1993 the crest position of the beach section between Wyke Regis and Chiswell has retreated by between 8 to 17m (and the beach crest height has reduced by 0.5 to 2m). This compares to the beach west of Wyke Regis having remained largely stable in terms of net crest position, with the beach crest height having also increased by up to 1.5m in places.

Overall, the SCOPAC (2004) analysis suggests an annual average recession rate for this section of Chesil Beach of between 0.06 to 0.12m/year, which is in agreement with the analysis produced by Futurecoast (2002).

Existing Predictions of Shoreline Evolution

For an 'unconstrained' scenario, Futurecoast (Halcrow, 2002) predicted that overwash of the beach at the eastern end would occur during storm and swell wave events, leading to the roll-over of the beach into The Fleet lagoon. Eventually roll-over could cause the barrier to become attached to the mainland at Wyke Narrows. In this scenario the barrier could enclose The Fleet, cutting off its tidal exchange with the open sea at Portland Harbour and causing the segmentation of the Chesil Barrier. It is not anticipated that this would occur over the next 100 years.

Exposure of the leeward side to waves (depending upon the response of Ham Beach – refer to Section C.1.5 – Local Scale: Portland Harbour) from the east combined with overwash events could lead to a breach of the Chesil Barrier and its eventual breakdown. This would create a significantly altered hydrodynamic regime with the shingle barrier possibly being replaced by a range of features such as a shingle spit extending from the mainland towards the Isle of Portland and a tidal delta within the harbour.

The Futurecoast (Halcrow, 2002) prediction for a 'with present management' scenario is for the defences at Chiswell to prevent a breach of the barrier in this area. However, this could lead to a discontinuity in the beach plan form as the unprotected beach to the west rolls-back during storm events and this in turn would increase the exposure of the Chiswell section of the beach to wave attack.

LOCAL SCALE: Abbotsbury to Cogden Beach

Interactions

This section of Chesil Beach is attached to the mainland and is backed by a range of features from lowlands containing marshes, to small fresh water lagoons and the toes of coastal slopes that rise to heights of 100 to 200m about 1km inland from the beach. There are no cliffs along this section, though it is possible they could develop in the future as the slopes are eroded, due to beach retreat.

Historically this section acted as a link between the source of sediment (cliff erosion) in the west and the beach to the east. At present the net drift along the beach is very low due to the littoral drift being subject to frequent reversals in response to even small changes in wave direction, resulting in limited net sediment transport from west to east along the swash-aligned barrier.

The marsh areas located behind the beach, including Burton Mere, may once have been linked to The Fleet lagoon but would have been disconnected by the roll-back of the beach and subsequently infilled. There are no obvious interactions between Burton Mere and coastal processes. It is likely that Burton Mere and the other marshes are affected by saline intrusion by seepage through the shingle barrier and overwashing during storm events.

There are no man-made defences along this section, although shingle extraction has occurred historically at Cogden Beach (this has now ceased).

Movement

As with the 'free-standing' section of Chesil Beach to the east, there has been a slow landward retreat of the beach along this frontage, with significant changes in profile being caused by storm and swell wave events. Analysis undertaken for Futurecoast (Halcrow, 2002) indicated that the beach position has been relatively unchanged over the past 100 years.

Existing Predictions of Shoreline Evolution

For an 'unconstrained' scenario, Futurecoast (Halcrow, 2002) predicted that the continued gradual retreat of the beach in response to future sea level rise will slowly increase the amount of erosion at the toe of the backing coastal slopes (where they are present) and form cliffs. The slope erosion could over several centuries lead to the development of headlands where variations in geological resistance are encountered, though this is unlikely to occur in the next 100 years.

Without the presence of the West Bay defences and associated beach management activities, it is possible that alongshore transport linkages with the beaches to the west and east (as occurred historically) could be re-established. The potential renewed sediment transport would be dependent upon the transport of sediment from the beaches further to the west of West Bay and Eype, which in turn is controlled by the evolution of headlands such as at Thorncombe Beacon.

The Futurecoast (Halcrow, 2002) prediction for a 'with present management' scenario is the same as for the unconstrained scenario. Although the continued presence of the defences at West Bay would continue to cut-off the supply of sediment from the west.

LOCAL SCALE: Cogden Beach to West Bay (East Cliff)

Interactions

This section extends from Cogden Beach to the western end of East Cliff, and encompasses the section of Chesil Beach, which is backed by cliffs that formed as the Chesil Barrier rolled-back against higher topography.

East Cliff and Burton Cliff at the western end of this section of frontage consist of bedded sandstones that rise to a height of about 40m. These cliffs fail as a result of wave undercutting at the toe of the cliff causing the collapse of the cliff. The cliff failure process supplies sand material to the coastal system but not shingle. To the east of the sandstone cliffs are cliffs that are made up of clay beds. These are lower in height than the pure sandstone cliffs and exhibit simple landslide characteristics.

Between the cliffs are low sections of frontage at Burton Bradstock and Freshwater Beaches where there are large accumulations of beach shingle as the back of the beach is situated further back. This compares to the beaches that front the cliffs being relatively narrow as they have been prevented from retreating in response to storm events.

The beach at Freshwater is interrupted by the discharge through and over the beach of the River Bride. The channel through which the River Bride flows is actively managed to control flood risk upstream by closing and opening the entrance to prevent tidal inundation or allow fluvial drainage as necessary. The fluvial discharge does not appear to have a significant influence on the coastal processes along Chesil Beach, as the channel naturally infills with shingle if permitted to do so by the beach management activities, exacerbating the blockage of the River Bride (Environment Agency, 2003).

As with the other sections of Chesil Beach there is a very low net drift rate along this part of the beach, with storm driven beach profile responses being the main beach movement process leading to the roll-back of the beach.

Movement

The erosion of the cliffs along this frontage has been slow over the past 100 years, analysis undertaken as part of Futurecoast (Halcrow, 2002) suggested a mean annual rate of recession of 0.14m/year for this section of coast.

Analysis presented in Jacobs Babtie (2006) report suggests that Freshwater Beach has accreted by nearly 30,000m^3 between March 2003 and October 2005.

Existing Predictions of Shoreline Evolution

For an 'unconstrained' scenario, Futurecoast (Halcrow, 2002) predicted that there will be continued roll-back of the beach and erosion of the cliffs. The erosion of the cliffs could eventually lead to the formation of a headland and segmentation of the beach around Burton Cliff because the beach here narrows, though it is unlikely to occur over the next 100 years. Future sea level rise and predicted increases in storm waves could lead to increases in overwash and flooding of the low-lying parts of this section of coast.

Without the presence of the West Bay defences and associated beach management activities, it is possible that alongshore transport linkages with the beaches to the west and east could be re-established. The resumption of sediment transport would be dependent upon the influx of sediment from the beaches further to the west of West Bay and Eype, which in turn is controlled by the evolution of headlands such as at Thorncombe Beacon.

The Futurecoast (Halcrow, 2002) prediction for a 'with present management' scenario for the evolution of the shoreline is not significantly different to the unconstrained case. Although the presence of the West Bay piers would continue to cut off any sediment transport links with the beaches to the west.

LOCAL SCALE: West Bay to Eype

Interactions

This section of shoreline extends from the western end of East Cliff to Thorncombe Beacon, a headland to the west of Eype. Thorncombe Beacon forms a block to the longshore transport of sediment from the shoreline further to the west. The coast here comprises the low-lying area of West Bay that is bounded by sandstone cliffs. To the east is East Cliff (refer to section above), whilst to the west is a more degraded sandstone cliff that rises some 25m. Within the low-lying area between the cliffs there are two beaches situated either side of the entrance to West Bay Harbour which is also encompassed by this section of coast.

The present West Bay Harbour is completely artificial and is lined by vertical walls. It forms the mouth of the estuary of the River Brit that enters the harbour through a number of sluices, behind which there is a large lagoon that is only very slightly tidal and which is fringed with reed beds and flood embankments. The estuary has a very high flow ratio and a plume is present issuing from the mouth at almost all river flows and this in turn may modify the littoral transport of sediment from one side of the harbour to the other.

The entrance to West Bay Harbour is controlled by two piers, and has been since the 1740s (SCOPAC, 2004). The present configuration of these piers was constructed in 2005, they limit wave penetration into the harbour such that wave from offshore that propagate towards land only affect the outer part of the harbour entrance. The estuary length is very small and only very small fetch limited waves generated by the wind could occur.

The beaches either side of the harbour piers are quite different. East Beach is a wide shingle beach with low-lying land behind it, whilst West Beach is narrow, backed by a seawall and esplanade. Following the 2005 scheme, West Beach has a recharged beach controlled by rock groynes. The difference in East Beach and West Beach forms marks a clearly defined step change in the shoreline plan form.

Prior to construction of the piers there would have been a continuous shingle beach here that provided a link for sediment transport from the beaches to the west, along the shoreline eastwards to Chesil Beach. Local drift reversals would also have allowed transport from east to west to supply material to what is now West Beach. Since the piers were constructed they have formed an artificial end to Chesil Beach, forming an almost complete barrier to alongshore transport in either direction Minimal sediment transport occurs past the entrance of the piers.

Since the construction of the piers, West Beach has eroded about 100m, though this did not occur for nearly a century after the first construction. The observed erosion is likely to be, in part, a consequence of the development of the Thorncombe Beacon headland in the mid 1800's. The development of Thorncombe Beacon blocked the transport of sediment from beaches further to the west to Eype and West Beach. The loss of east to west transport from East Beach has effectively left this part of the shoreline between West Beach and Eype a closed sediment system.

At present, with the prevention of transport of material entering the frontage from further west, the only potential for contemporary sediment inputs to the coast here could come from the discharge of a small stream to the shore at Eype Mouth. However, there is no evidence showing that this discharge has any significant impact upon coastal processes at present.

Movement

Unlike the rest of Chesil Beach to the east, the response of the East Beach to storm wave events is not always to roll-back. HR Wallingford (2006) noted that the response of East Beach at West Bay is for the shingle to be drawn down during storm events rather than to be pushed back. This behaviour is more like that of a sandy beach and may be due to the natural enrichment of the beach with sand sized sediments. Such behaviour could lead to the loss of beach sediment to the nearshore or even offshore area.

The tendency for the draw-down of the beach under storm wave conditions also affects West Beach, though this process is exacerbated by the scour effects caused by the presence of the seawall and esplanade.

The management of both East and West Beach by recycling, re-profiling and recharge, along with the construction of various sea defence structures, has resulted in the beaches here being relatively stable with a small net movement. However, analysis presented in HR Wallingford (1997) shows that the MHW position of East Beach has fluctuated within a range of some 60m, whilst West Beach has experienced a long term erosion trend.

The cliffs to the west of West Bay have continually eroded. Analysis presented in SCOPAC (2004) suggests a mean annual recession rate of 0.05 to 0.5m/year towards Eype and Thorncombe Beacon, and 0.37m/year at West Cliff between 1887 and 1962, although this rate is now reduced due to the extension of the sea wall and promenade along the cliff toe in the late 1960's.

Existing Predictions of Shoreline Evolution

For an 'unconstrained' scenario, Futurecoast (Halcrow, 2002) predicted that the free movement of sediment along the shoreline that existed prior to construction of the West Bay piers would resume. This could in turn lead to the closure of the estuary mouth to form a lagoon behind the shingle barrier.

The beaches would roll-over into the hinterland as a result of future sea level rise. This would also be likely to cause increased occurrences of flooding of the hinterland by overwash of the beach. The roll-back of the beach combined with the removal of defences along the toe of parts of the cliffs to the west of West Bay would also lead to the reactivation of erosion from these cliffs, which would provide a sediment input to the coastal sediment transport regime.

The Futurecoast (Halcrow, 2002) prediction for a 'with present management' scenario assumes the continued presence of the West Bay piers cause local beach fluctuations. In this scenario beach sediments are lost to the nearshore and beyond as a result of draw down processes during storms. If the lost beach sediment is not replaced by material eroded from the backing cliffs or artificial beach nourishment, there is the potential for coastal squeeze to occur.

C.1.7 Eype to Beer Head

LARGE SCALE

Interactions

Extending from Thorncombe Beacon in the east to Beer Head in the west, this part of the shoreline consists of one of the largest and most active landslide complexes in Europe. There are also a number of stream and river discharges that are of varying significance to the coastal processes at work along this coast. The coastline is typified by a series of headlands, which are separated by embayments that contain narrow shingle beaches fronting eroding cliffs.

The formation and evolution of the present coastal form has taken place since the Holocene marine transgression (c.10,000 years BP) as the result of the landward migration of a previous barrier beach. The barrier beach was probably once connected to the Chesil Barrier to the east that re-occupied a former coastline and led to the re-activation of previously relict cliffs.

The reactivation of the previously relict landslides allowed the continued retreat of the coastline, supplying coarse sediment to local beaches, which was then transported eastwards by littoral drift processes. Over time, variations in the geological resistance of the cliffs led to the development of a number of emergent headlands along this shoreline. These headlands interrupted the continuous eastward transport of material and so transport would have occurred as periodic pulses of sediment around headlands and onto adjacent beaches to the east, ultimately supplying Chesil Beach.

The transport of material along the shoreline is further interrupted by the occurrence of lobes of failed landslide material forming temporary headlands. These temporary headlands cause material to be trapped in small bays until either sufficient sediment is stored to bypass the headland, or the headland lobe is eroded by marine processes thus removing the barrier. The latter is less likely to result in resumption of longshore transport as the erosion of the headland tends to leave behind a boulder apron that can continue to inhibit littoral drift processes.

The process described above would have historically resulted in the net eastwards transport of millions of cubic metres of material to Chesil Beach over several millennia. However, this transport pathway has largely ceased in recent decades as a result of the continued emergence of headlands. Major beach mining of shingle from Seatown Beach for use in construction projects has sufficiently depleted the beach stock, so that the accumulation of sufficient sediment to bypass the headlands no longer occurs (Halcrow, 2002).

The effect of the development of these headlands is that the embayments along the present day shoreline, at Seaton Bay, Charmouth Bay, Seatown Bay and Eype Bay (refer also to Section C.1.6 – Local Scale: West Bay to Eype), are largely closed systems with little or no movement of material between adjacent bays. The offshore area is also a gently sloping, featureless sea-bed that forms the floor of Lyme Bay with no obvious sediment transport features that could link these bays.

This section of coast is orientated towards the south and as such is exposed to waves from the south-west to the south-east. This exposure results in a net west to east littoral transport, though frequent reversals occur. Evidence of the net eastward drift is seen at the mouth of the Axe Estuary, which has been diverted about 400m to the east by the development of a shingle spit across the mouth from the west.

Movement

The effect of the lack of alongshore input of sediment is that the beaches fronting the cliffs are narrow and offer little in the way of protection to the toe of the cliffs. The narrow beaches allow the continued erosion of the cliff toe, which that contributes to the ongoing instability of the complex landslides that characterise these cliffs. Landslide instability is governed by groundwater conditions along unconformities between permeable Cretaceous rocks and Liassic clays (SCOPAC, 2004).

The cliffs along this section of coast are therefore retreating at a rapid rate as a result of complex landsliding processes. This erosion does produce some coarse material, which will be retained on local beaches or may be transported along the shore by littoral drift. Much of the erosion material is fine clay that is transported offshore in suspension.

SCOPAC (2004) suggests that the rate of recession of some of these cliffs is accelerating because marine erosion at the toe of the cliffs is leading to re-activation of ancient mudslide and translational slides.

Modifications

There are several locations through this section of shoreline where human intervention has occurred. The biggest intervention is at Lyme Regis, where defences have been present since 1789 when The Cobb (a breakwater structure) was constructed (SCOPAC, 2004). The Cobb has formed an almost total artificial barrier to alongshore drift since this time, and has been the reason for the accretion of sediment on Monmouth Beach to the immediate west of the structure. Whilst this barrier is important to the local beaches and shoreline, its effects are not considered to affect the shoreline for any significant distance to the east (Halcrow, 2002).

In addition to The Cobb, the shoreline around Lyme Regis has also been modified by the construction of seawalls and other structures. The most recent works have included the construction of rock groynes and breakwaters to act as control structures to hold sediment on beaches along the shoreline that have been recharged using sand and shingle. This scheme has also involved cliff stabilisation works to reduce the risk of landslides to the town of Lyme Regis (West Dorset District Council, 2005). The engineering works, which began in 1995, have been undertaken as a number of phases, and are still ongoing (Browning, 2008).

The net effect of all of the defences along the shoreline of Lyme Regis is to prevent sediment from cliff erosion entering the coastal sediment budget, thus depriving the local beaches (and beaches further a field) of sediment inputs. Analysis presented in SCOPAC (2004) suggests that whilst a large amount of material is provided to the shoreline from erosion, much is fine material that is lost offshore in suspension, and that the actual proportion of gravel yielded was small (370-445 m^3/year for the period 1901-88).

At Seaton the western end of the shingle spit that extends across the mouth of the Axe Estuary has been stabilised by the construction of coastal defences, whilst the eastern side of the entrance and the navigation channel are maintained by a breakwater and training walls. Also at Seaton, there is a seawall that runs along the length of the developed frontage behind the shingle beach. A cliff stabilisation scheme was also carried out at

Seatown in 1996 (SCOPAC, 2004). The stabilisation involved soil nailing and cliff drainage measures with rock revetment at the base of the cliff to protect the outfalls drains against the sea and covers the area to the west of the river. These defences have been subject to outflanking to the west and are in the process of being extended about 15m westwards in order to maintain the integrity of the scheme.

Coastal defences are the primary human intervention along this shoreline at present. In the past there has also been significant beach mining activities at several local beaches for both shingle and limestone (from foreshore ledges within Lyme Bay) that significantly affected historic beach levels. A location significantly affected by these mining activities is the beach at Seatown, where large amounts of material were removed during the 20th century. The effect of the mining has been to deplete the beach in Seatown Bay to such an extent that there is no longer sufficient material along the shoreline to allow littoral drift eastwards beyond Thorncombe Beacon to occur.

LOCAL SCALE: Eype to Axmouth

Interactions

The cliffs between Eype and Axmouth are soft and unstable and characterised by complex landslide behaviour. The high cliffs to the east of Lyme Regis are made up of a major coastal landslide complex, comprising of: The Spittles, East Cliff, Church Cliff, Golden Cap, Stonebarrow and Black Ven, which is one of the largest active landslide complexes in Europe.

The complexity of the landslide behaviour is demonstrated in the recent South-West Coast Path report (Halcrow, 2007a) that identified the key characteristics of the Black Ven complex as being:

- Tension cracking above the cliff top;
- Rotational landslides, slumps and gullying at the top of the slope;
- Rock falls from steep slopes;
- Mudflows, mudslides and sand flows onto undercliff beaches; and.
- Vegetation growth during periods of inactivity.

The cliffs to the west of Lyme Regis towards Axmouth are up to 150m high and extend about 500m inland from the sea. These cliffs also exhibit complex landslide behaviour characteristics and contain an undercliff zone that covers most of the 500m area between the sea and the cliff tops.

In between the cliffs that dominate this section of coast there are also a number of low-lying areas at Lyme Regis, Charmouth and Seatown. At each of these locations small fluvial discharges from the Rivers Lim, Char and Winniford occur. None of these three rivers have a significant effect upon the coastal processes. However, the River Char is known to erode a channel through the shingle beach (over which it normally flows) during a 20 to 30 year event, forming a temporary debris fan on the foreshore that is rapidly pushed back by wave action to restore the beach (Halcrow, 2002). In addition to this, SCOPAC (2004) reports that during summer months the shingle beach fronting the Char Estuary restricts discharge (presumably lower summer flows mean the river is unable to flow over the beach) to such an extent that the river is usually ‘ponded’ for a distance of up to 300m inland.

Wave driven littoral transport along this section is from west to east. However, this process is inhibited by the presence of both permanent emerging headlands and temporary headlands, which form as a result of lobes of failed material extending across the foreshore and blocking alongshore transport processes. This process is a cyclic one that regulates the ‘pulsing’ of sediment between beaches in adjacent bays. For example, Seatown Beach is presently controlled by two such headlands that have prevented the replenishment of the beach by material moving here from further west since the depletion of the beach by extensive beach mining. SCOPAC (2004) estimates that as the process of longshore transport is related to the cyclic growth and retreat of landslide lobe headlands, this situation will not remain indefinitely. By around 2020 (or later) erosion of the headlands will allow littoral drift to bring sediment from the west to re-build Seatown Beach.

Movement

The large landslide complexes that characterise this section of coast show cyclic backscar retreats with short (episodic) rapid retreat by rotational landsliding. At Stonebarrow for example, it is estimated that this cyclic process takes between 100 and 150 years, with a mean annual rate of recession for this complex being estimated at 0.39m/year (SCOPAC, 2004).

The cyclic behaviour of other landslide complexes may be more frequent. Indeed analysis presented in SCOPAC (2004) suggests that erosion of The Spittles and Black Ven complexes is accelerating from a mean annual recession rate of 0.9m/year between 1841 and 1901, to 2.5m/year (1901 to 1960) and 8.0m/year (1960 to 1988). More recent analysis undertaken for the South-West Coast Path report (Halcrow, 2007a) suggests the recession of Black Ven and The Spittles is not as high as the recent rates presented in SCOPAC (2004). The South-West Coast Path report (Halcrow, 2007a) analysis provides the following rates of recession for these landslide complexes:

- Black Ven East = 0.2 to 0.6m/year;
- Black Ven Central = 0.6m/year;
- Black Ven West = 3.26m/year; and
- The Spittles = 0.52m/year.

These rates are broadly similar to mean annual recession rates calculated for the South-West Coast Path report (Halcrow, 2007b) at Seatown. The report suggests the cliffs in this area are eroding at a rate of 0.33m/year where the cliffs are protected by armour at the toe, and by 0.7m/year where the cliffs are 'natural' (i.e. unprotected).

Recession rates for the Broom Hill and Golden Cap areas between Eype and Lyme Regis are also provided by SCOPAC (2004) and suggest that Broom Hill is eroding at a rate of 0.99m/year but that Golden Cap is retreating much slower at a rate of between 0.05 and 0.30m/year. Although SCOPAC (2004) also notes that Golden Cap has the potential to erode by about 20m over only a few landslide events.

The cliffs at Lyme Regis (East Cliff and Church Cliff) are at present prevented from significant erosion by the presence of a seawall that was constructed along the toe of the cliffs in 1957. Analysis presented in SCOPAC (2004) suggests that prior to this construction, these cliffs were eroding at a rate of 0.45m/year, though this may have risen to as much as 0.8m/year at East Cliff and 1.3m/year at Church Cliff.

Analysis presented in both Futurecoast (Halcrow, 2002) and SCOPAC (2004) suggest that the cliffs to the west of Lyme Regis are retreating at a mean annual rate of 0.2m/year, though this rate is highly variable from year to year due to the cyclic nature of the landslide behaviour.

Monmouth Beach has experienced a progressive loss of volume, and profile steepening, over at least the past 100-150 years. Although there has been some accretion that is limited to the area immediately updrift of The Cobb breakwater due to its function as a terminal groyne (SCOPAC, 2004). From a comparison of historic Ordnance Survey maps from the years 1890 and 1980 undertaken for this SMP2, it is apparent that this accretion occurred between both the groynes along the shoreline and offshore of The Cobb over this period. Recent construction of control structures and beach recharge are likely to affect this trend in the future.

Over the same period, the comparison of historic Ordnance Survey maps indicates that the beaches of Pinhay Bay and Charlton Bay have shown a slight trend of accretion.

Existing Predictions of Shoreline Evolution

For an 'unconstrained' scenario, Futurecoast (Halcrow, 2002) predicted that there would be continued erosion of the many active landslide complexes along this section of coast. The frequency of events would be similar to that seen today, with the ongoing 'pulsing' of material between beaches of adjacent bays as headlands form and erode as part of a cyclic process of the eastward transport of sediment towards Thorncombe Beacon. Sediment is not anticipated to pass Thorncombe Beacon in order to reach Eype and Chesil Beach.

The local beach stock is likely to be increased over time to feed this littoral transport as the landslides erode further back and trigger fresh landslides that could release beach building shingle. For example, SCOPAC (2004) indicates that continued erosion of Black Ven and The Spittles could trigger fresh landslides in Timber Hill which contains Upper Greensands that would form a suitable beach material. The influx of sediment would increase the proportion of beach building material derived from cliff erosion above that observed between

1901 and 1988. Increased sediment input to the beaches at Lyme Regis, where cliff erosion rates would occur at a natural rate of recession un-impeded by the presence of seawalls at the toe of the cliffs.

The Futurecoast (Halcrow, 2002) prediction for a 'with present management' scenario assumes the continued presence of hard defences at Lyme Regis to cause coastal squeeze as sea levels rise in response to global climate change in the future. This coastal squeeze will lead to the gradual increase in risk of failure of the defences. The remainder of the frontage would continue to evolve in a manner not unduly different to that of the unconstrained scenario.

LOCAL SCALE: Axe Estuary

Interactions

This section includes the shoreline of the Axe Estuary from Haven Cliff just to the east of the Axe Estuary mouth, to the western end of the shingle spit that has formed across the mouth of the estuary at Seaton. The Axe Estuary has a localised influence on shoreline development.

The Axe Estuary is a linear feature with large areas of mudflats and salt marsh. It has been extensively modified by human activity, with much of the western side of the estuary having been reclaimed and defences having been constructed along the sides of the estuary to provide flood protection to the towns of Seaton and Axmouth. Navigation through the mouth of the Axe Estuary is maintained by the presence of a breakwater along the eastern side of the entrance as well as training walls along both banks of the Axe, which keep the channel fixed (Halcrow, 2002). Mudflats and saltmarsh are located primarily within the eastern side of the estuary. Cliffing of the seaward edges of saltmarsh blocks suggests that erosion is now dominant, with enlargement of mudflats occurring at the expense of saltmarsh. This loss of salt-marsh is further exacerbated by constraints of human intervention that limits the ability of salt-marsh to adapt landwards as sea levels rise (SCOPAC, 2004).

The mouth of the Axe Estuary is diverted some 400m towards the east by the presence of a shingle spit that extends across the mouth from Seaton. The spit would have formed as a result of longshore transport of sediment from west to east, with the shingle being derived from the erosion of the cliffs that back the beach further to the west. There are a number of interactions between the Axe Estuary and the coastal processes in this area, which revolve around the presence of the spit across the mouth.

Coastal processes formed the spit and caused the mouth to be diverted towards the east. At low water the tide doesn't enter the estuary due to the shallow mouth caused by the shingle beach/spit 'cutting-off' the access with the sea. During periods of high river flow, the shingle spit is eroded by the river and a breach can form through the barrier forming a temporary inlet to the estuary that is closed by the re-forming of the spit as a result of littoral transport processes.

Other than at the mouth, there is likely to be little influence within the estuary from offshore waves propagating inshore, mainly due to the protection afforded the estuary by the shingle spit across its mouth. It is possible that small wind generated waves could occur within the estuary under favourable wind conditions, though there is no information available on waves within the Axe Estuary and in any case they are likely to be insignificant in terms of flood risk.

As indicated by the presence and orientation of the shingle spit across the mouth of the Axe Estuary, longshore sediment transport in this area is from west to east. Futurecoast (Halcrow, 2002) states that there is also some sediment transport across the mouth of the estuary to supply the beaches to the east. Information in SCOPAC (2004) provides a probable mechanism for this process: firstly material enters the channel from the west driven by wave action (as well as small amounts of shingle from fluvial processes) and this is then flushed a short distance offshore by a combination of tidal and river flow, before being moved back onshore by wave action.

Movement

In the past century the spit and beach have been relatively stable due to the presence of the training wall on the landward side and the construction of coastal defences at the western end of the spit. Short term changes of the spit and beach occur as a result of storm events.

Existing Predictions of Shoreline Evolution

For an 'unconstrained' scenario, Futurecoast (Halcrow, 2002) predicted that there would be continued sediment input to the shingle spit as a result of erosion of cliffs to the west, which would maintain the volume of the spit across the mouth of the Axe in more or less its present position, though some roll-back may occur.

There would be an increased risk of overwash and breaching of the spit as a result of future sea level rise and predicted increases in the frequency of storm events and the intensity of rainfall (which would lead to higher river flows). It is estimated that a cyclic pattern of breaching and inlet deflection could occur with a periodicity of 20 to 50 years.

Higher sea levels would be likely to lead to increased exposure of the toes of the high, inactive, cliffs that occur both along the coast and within the estuary (along the eastern shore) to erosion. Such erosion of the cliff toes could lead to the re-activation of ancient major landslides. Failure of the landslides would result in the deposition of a sediment on the shoreline, which could lead to the blocking of the present Axe channel and the back-up of freshwater upstream, flooding the lower Axe valley. The pressure build-up behind the blockage would eventually cause a breach and a new tidal inlet would form towards the western side of the Axe valley which in turn would eventually be deflected back towards the east by coastal longshore processes.

The Futurecoast (Halcrow, 2002) prediction for a 'with present management' scenario is for the training walls to retain a stable inlet position except during periods of river flood. The shingle spit may roll-back as a result of overwashing during storm events. The continued defence at the western end of the spit may lead to a discontinuity in the plan form of the spit which could cause a breach and the formation of a new tidal inlet to the west of the present entrance.

LOCAL SCALE: Axe Estuary to Beer Head

Interactions

This section is mostly comprised of cliffs, with the only low section occurring at Beer. This section also covers the seaward facing frontage of Seaton, which includes a continuous shingle beach that extends eastwards from Seaton Hole all the way along the shore to the point where the shingle spit across the mouth of the River Axe attaches to the land. Although there is a strong interaction with the spit itself as the shingle beach continues to the eastern end of the spit, so this section should be viewed in conjunction with the 'Axe Estuary' section above.

Between Beer and Beer Head the cliffs are high and formed from chalk. These cliffs are steep and largely resistant to erosion. East of Beer, from Seaton Hole to west Seaton, the cliffs are formed of sandstone overlying softer mudstone (at Seaton Hole) and reduce in height towards Seaton as the overlying sandstone disappears leaving only the softer mudstone. These cliffs provide a source of fine sediments to the coastal sediment transport system, but it is unclear what contribution, if any, they make to local beach stock (SCOPAC, 2004).

Along the developed frontage of Seaton a series of seawalls have been constructed to protect the town from sea flooding. These defences extend along the toe of the cliffed western section of the Seaton frontage and also prevent erosion of the cliffs adding fresh sediment to the local beach stock. A similar impact has occurred at Seaton Hole where rock revetment along the toe of the cliffs has resulted in a reduction in the rate of cliff erosion.

Movement

The cliffs between Seaton Hole and west Seaton have historically been unstable with marine erosion of the toe maintaining the occurrence of simple landsliding behaviour within the cliffs. The rate of this erosion has been reducing in recent years due to a combination of natural beach sediment accumulation leading to reduced exposure of the toe of the cliffs to wave action, and construction of defences at the toe of parts of the cliffs (Halcrow, 2002). It is unclear if this recent accumulation is permanent, or if it is part of a fluctuating process. As SCOPAC (2004) reports that there were significant losses of beach as a result of draw-down during storms in the early 1990's prior to the recent accumulation. However, from a comparison of historic Ordnance

Survey maps from the years 1890 and 1990 undertaken for this SMP2, it is apparent that the long term trend is for accretion of the beaches along this section of coast.

SCOPAC (2004) suggests that erosion of the cliffs since 1995 has occurred at a mean annual rate of 0.2m/year, compared with a rate of 1.0m/year between 1940 and 1990. This higher historical rate is supported by analysis contained in both the Seaton West Wall Study (Posford Duvivier, 1996) and the Seaton Hole Engineers Report (Posford Duvivier, 1997) which suggests that the rate of erosion of the west Seaton cliff is between 0.5 to 1.0m/year, and that the rate at Seaton Hole is about 1.5m/year.

The chalk cliffs west of Beer are largely resistant to erosion and have been largely unchanged over the past century, with only infrequent, localised failures occurring.

Existing Predictions of Shoreline Evolution

For an 'unconstrained' scenario, Futurecoast (Halcrow, 2002) predicted that the chalk cliffs between Beer and Beer Head will continue to experience only isolated failures at a similar frequency to that presently observed. The cliffs between Seaton Hole and Seaton would continue to experience toe erosion and simple landslide failures, releasing sediment to the shoreline allowing the slow accumulation of beach sediment stocks to continue.

The Futurecoast (Halcrow, 2002) prediction for a 'with present management' scenario is for the chalk cliff behaviour west of Beer to continue as per the unconstrained scenario, as these cliffs are unaffected by the presence of defences along the section of the frontage to the east.

The defended sections of cliff at Seaton and Seaton Hole would continue to keep the soft mud cliffs stable. This will lead to a lack of sediment input from the cliffs to the beaches and could, over time, lead to the narrowing of the beach in response to future sea level rise. Where defences occur, this narrowing could cause the increased risk of failure of defences by undermining.

C.1.8 Beer Head to Otterton Ledge

LARGE SCALE

Interactions

The formation of this section of coast to its present form is the result of sea level rise during the Holocene marine transgression (c.10,000 years BP) leading to the re-occupation by the sea of an ancient shoreline at the base of relict cliffs and coastal slopes. Following the re-occupation by the sea, these relict cliffs and slopes were re-activated, first by the removal of ancient landslide debris from the toe and then the development of new landslide failures in previously 'un-eroded' slopes.

This process of erosion supplied coarse sediment to the local beaches that would have been transported eastwards along the shore. SCOPAC (2004) suggests there is evidence for a continuous shingle barrier having once existed between Beer Head/Otterton Ledge extending eastwards along the length of this part of Lyme Bay all the way to where the present Chesil Beach attaches to the Isle of Portland (but seaward of the current shoreline position). Thus the supply of sediment to beaches between Beer Head and Otterton Ledge and its subsequent longshore transport eastwards was once an important sediment source for the development of the Chesil Barrier (refer also to Sections C.1.5 and C.1.6).

As with other parts of the coastline in the eastern part of Lyme Bay, the gradual roll-back and retreat of the shoreline in response to sea level rise and erosion processes has resulted in the segmentation of this once continuous beach through the emergence/ development of headlands that have evolved due to variations in geological resistance. The headlands control the longshore transport of sediment, with the major headlands along this section of coast being Otterton Ledge, Big Picket Rock and Beer Head.

Between the headlands the geology is relatively soft and erodible, though not uniformly so, which gives rise to different patterns of cliff erosion and failure. For example, the cliffs to the west of Sidmouth are comprised of Greensand and Chalk and as a result are steep to near vertical. In contrast, the cliffs to the east of Sidmouth are comprised of Keuper Marls, which experience large scale complex land-sliding, with the area between Beer Head and Branscombe containing an undercliff formed from land slide debris that conceals the underlying solid geology (SCOPAC, 2004). A number of low lying sections occur along the cliff line, mainly where the process of cliff recession has cut across the valleys of rivers and streams that run 'normal' to the shoreline, such as at Sidmouth and Branscombe.

There is presently no external input of sediment to this section of coast from adjacent shorelines or from offshore sources, because the seabed in this area is gently sloping and featureless. The ongoing erosion of these softer cliffs is now the only supply of new sediment input to the local beaches between Beer Head and Otterton Ledge. These beaches are comprised of an upper berm of coarse, clastic material and a low-gradient sandy foreshore (SCOPAC, 2004).

The north-south orientation of this section of coast means it is exposed to waves from the south-west to the south-east. The influence of Start Point does play some part in reducing the impact of the south-westerly swell waves from the Atlantic upon this area. The influence of waves from varying directions results in a weak net drift of sediment eastwards along this section of coast.

Evidence of the eastwards drift is seen in the greater quantities of beach material that has accumulated on the western sides of headlands along the shoreline, including an accumulation of beach sediments at Beer Head at the eastern end of this section of coast. It is considered that Beer Head forms a barrier to further longshore transport towards the east (although there could be periodic pulses of sediment transported around the headland during certain events). There is no sediment input from east of Otterton Ledge, therefore this section can be considered a largely 'closed' system in terms of sediment transport regime.

Movement

The main influences on beach changes are short-term storm events. These cause the temporary seaward transport (draw down) of beach material, leading to a reduction in beach levels. The effect of this short term storm response is to increase the exposure of the base of the cliffs to wave actions, which in turn promotes further erosion of the cliffs and coastal slopes that lie behind the beach.

The varying geology along this section of coast gives rise to different cliff erosion and failure processes. These different processes can be broadly summarised as follows. The western sandstone cliffs fail by rock falls, giving rise to a steep profile. The central and eastern parts, where softer marl cliffs occur, are more readily eroded and failure occurs by rock falls, simple landslides, mudslides and gullying. To the east of Branscombe, more complex landsliding occurs, giving rise to an undercliff area.

Modifications

Along this section of coast, the only coastal defence structures to be found are at Sidmouth, where the construction of seawalls, groynes and detached breakwaters with beach recharge has been implemented to prevent further erosion of the local cliffs. The defences act to inhibit both the eastwards littoral drift of beach material and the offshore transport (draw down) of beach levels during storm events.

The River Sid that discharges to the sea at Sidmouth has also been extensively modified by human intervention and is now largely trained along the east side of Sidmouth before flowing out to sea via an outfall.

The net effect of defence construction has been to reduce the supply of sediment to the beaches east of Sidmouth, which has led to a reduction of beaches in this area and an increase in cliff toe exposure to wave action (and so an increased risk of cliff failures here also).

LOCAL SCALE: Beer Head to Otterton Ledge

Interactions

This section of coast is typified by steep chalk cliffs to the east, and steep sandstone and marl cliffs to the west, which rise to heights of up to 160m. The form of the shoreline becomes more indented with headlands and embayments towards the west. The central section of cliffs is interrupted by the River Sid at Sidmouth. Due to the effect of human intervention, the River Sid has no significant impact upon shoreline processes. Although it can occasionally form a small pond on the foreshore that can disrupt the occurrence of the shingle barrier that forms intermittently across is mouth.

In addition to the River Sid, there are a number of other smaller streams that flow to the sea from low lying valleys along this section of coast, the largest of these being Branscombe Stream. Branscombe Stream is a small discharge whose mouth is largely enclosed by a shingle beach as a result of the net littoral drift of beach material eastwards. Other than this 'blocking' of the stream mouth, it is unlikely that this stream has a significant effect upon coastal processes.

The base of the cliffs along this section of coast is fronted by beaches that comprise a shingle berm on the upper part and a more gently sloping sandy foreshore. The upper beach berm is more developed in the eastern part of this section and provides some protection to the base of the cliffs from wave action. The sandy foreshore provides only a thin covering of sediment, which in some places is replaced by rocky reefs and boulders. This is particularly the case to the west of Green Point, where boulder aprons dominate the shoreline, being interspersed with very minor pocket beach embayments.

Movement

This section of coast has historically experienced erosion of the cliff toe and recession of sea cliffs, along with periodic large-scale failures of cliff tops, ultimately leading to the occurrence of intermittent cliff recession. On occasion cliff recession can occur on a very large scale. For example, in 1790 an area of 7 to 10 hectares of land slumped over a 70m length of shoreline, causing an advance of the shoreline of some 200m.

It is possible that similar large failures could occur in the future as many of the cliff tops along this section of coast have relict landslides present that have been inactive for 50 to 200 years. Futurecoast (Halcrow, 2002) reports that recent wet winters and toe erosion has resulted in signs that the cliff failure re-activation process is beginning.

The rate of cliff recession is largely governed by local geology of the cliffs and a range of sources for historic cliff recession are available to demonstrate this. Futurecoast (Halcrow, 2002) suggests that the cliffs at the eastern end of this section of shoreline have retreated at a mean annual rate of 0.06 to 0.14m/year, although SCOPAC (2004) suggests the mean annual rate of recession for this part of the shoreline is about 0.3m/year, with erosion in the western part (Chit Rocks and Otterton Ledge) occurring slightly slower at a mean annual rate of 0.2m/year.

The beach along much of this shoreline has been relatively stable over the long-term. However, the coast has experienced rapid short term losses during storms due to offshore sediment transport, which increases the exposure of the cliff toe to wave action before the beach is restored (Halcrow, 2002). Analysis presented in the Sidmouth Beach Management Plan (Royal Haskoning, 2007) shows that between 2001 and 2007, the beach volume over the entire Sidmouth frontage has been relatively stable, but with a slight erosion trend reducing the overall volume of material by 0.5% over this time period. During the same time span the beach volumes along discrete parts of the overall Sidmouth frontage have shown significant fluctuations.

The impact of periods of low beach levels is demonstrated in analysis undertaken by Royal Haskoning (2003), which states that between Pennington Point and Salcombe Hill there has been an increase in cliff face erosion to a rate of 1.2 to 1.7m/year. The increase has been associated with a reduction in the beach fronting this area over recent years. This area is to the east of the defences at Sidmouth and so is in the 'down-drift' area of these structures, given a net eastwards drift pattern and is partly within the area described in the Sidmouth Beach Management Plan (Royal Haskoning, 2007) as being more volatile than elsewhere on the Sidmouth frontage.

From a comparison of historic Ordnance Survey maps from the years 1890 and 1990 undertaken for this SMP2, it is apparent that the beach towards the eastern end of this section has shown a general trend of accretion over this period. Accumulation of material has occurred on the western side of Beer Head.

Existing Predictions of Shoreline Evolution

For an 'unconstrained' scenario, Futurecoast (Halcrow, 2002) predicted that there would be continued cliff toe erosion and intermittent cliff failures along this coast. Many of the cliff tops that have been inactive of the last 50 to 200 years would be re-activated as a result of future sea level rise increasing exposure of cliff toes to wave action, combined with predicted future increases in rainfall as a result of global climate change.

Cliff failures in the re-activated cliffs would lead to rapid landward retreat in some parts of the coast between Beer Head and Otterton Ledge. The retreat would be followed by the development of continued cyclic recession of the whole coastal slope, as occurs in the coastal slopes further to the east (see Section C.1.7). It is estimated that this cyclic recession process would occur with a periodicity of between 10 and 30 years.

The cliff erosion would allow the beaches along this section of coast to retain their overall size in the long term, though the short term fluctuations due to storm response would continue to occur. Short term changes in beach volume would also be likely to occur due to the formation of landslide lobes across the foreshore forming temporary headlands that disrupt longshore sediment transport processes.

At Sidmouth there would be re-activation of cliffs which are currently stable. The reactivation will lead to an increase in the supply of sediment to this part of the coast. The net eastward transport of sediment would increase sediment transport across the frontage towards Salcombe Hill. The increase in sediment influx could lead to the development of a permanent shingle barrier across the mouth of the River Sid and growth of the beach fronting Salcombe Hill to provide protection to the cliff toe from wave action in this area.

The Futurecoast (Halcrow, 2002) prediction for a 'with present management' scenario is for the continued presence of coastal defence structures at Sidmouth. The defences would continue to cause low beach levels and erosion of the cliff toe to the immediate east between Pennington Point and Salcombe Hill. This would lead to the wall along the River Sid and the Alma Bridge that crosses it becoming increasingly exposed to wave attack and eventually the bridge becoming outflanked (Royal Haskoning, 2003). Future sea level rise will also lead to the narrowing of the beach at Sidmouth as it is unable to roll-back due to the presence of the seawall. For the remainder of this section of shoreline, where there is little to no human intervention, this scenario will not be different to the unconstrained scenario.

C.1.9 Otterton Ledge to Straight Point

LARGE SCALE

Interactions

The evolution of this section of coast has been as a result of long-term differential erosion controlled by varying geological resistance. The geology has resulted in an embayment occupied by a pocket beach, lying between two significant headlands at Otterton Ledge and Straight Point. These headlands are formed from more resistant sandstones.

The formation of this shoreline followed the re-occupation and re-activation of an ancient shoreline during the Holocene marine transgression (c.10,000 years BP). The re-activation removed relict landslide toe debris and triggered the development of new failures, a process that continues to dominate this section of coast at the present time.

The erosion of the cliffs supplies sediment to the local beach that has formed in the embayment between the two headlands. The beach is almost continuous along much of this section, except at the eastern end where it is interrupted by the mouth of the Otter estuary, where the River Otter enters the sea by Otterton Ledge. The primary source of beach building material is from the erosion of the Budleigh Salterton Pebble Beds.

The southwards orientation of this section of coast means it is exposed to waves from the south-west to the south-east. The influence of Start Point does play some part in reducing the impact of the south-westerly swell waves from the Atlantic upon this area. The result of this wave influence is for there to be a net eastwards drift of material along the shoreline, as evidenced by the presence of a spit across the mouth of the Otter estuary that diverts the entrance about 500m to the east. However, it is probable that there is actually gross transport towards both the east and west with frequent reversals (Halcrow, 2002), which is supported by the relative symmetrical plan shape of the bay and the variable beach sediment grading along its length (SCOPAC, 2004).

The presence of the headlands at Straight Point and Otterton Ledge form a barrier to the longshore transport of sediment along the shoreline, and as such this section of coast is considered to be an effectively closed sediment cell in terms of coarse sediment. Finer sediment released from cliff erosion is transported offshore in suspension. There is also a significant, but local scale, sediment transport interaction between the Otter estuary and coastal processes.

Movement

The cliffs along the central and eastern parts of this section of coast are relatively soft and subject to failure by rock falls and simple landsliding. Complex landsliding occurs in the central to western part of the bay where the cliffs are comprised of mudstone (Halcrow, 2002). The beach fronting this part of the frontage has been relatively stable over the past 100-130 years (SCOPAC, 2004).

Modifications

There is very little in the way of human intervention along this section of coast, with only short lengths of seawall and gabions along the Budleigh Salterton frontage to prevent cliff toe erosion. There are also gabions along the landward (western) part of the ridge of the shingle spit, which extends across the mouth of the Otter estuary that serve to reduce the vulnerability of the spit to breaching during storm events. They also serve to prevent roll-back of the spit.

LOCAL SCALE: River Otter

Interactions

This part of the shoreline covers the entrance to the River Otter where it discharges to the sea. The section also includes the shingle spit that has formed across its mouth extending from the west to divert the mouth some 500m towards the east, squeezing the entrance to the estuary against the sandstone cliffs and rock platform (Otterton Ledge) that form the eastern side of the estuary mouth.

The spit across the mouth protects the Otter estuary from wave action from the sea. The estuary itself is a small ebb dominant estuary that has formed in the lower part of the Otter valley. It is a broad, shallow creek system similar in type to the Axe estuary to the east (refer to Section C.1.7). The spit is a shingle barrier beach that has developed as a result of eastwards transport of sediment derived from erosion of cliffs to the west. The beach comprises a steeply sloping berm that is dynamically stable over the long term, having maintained its overall form and integrity despite seasonal fluctuations for the past 100 years or so.

There is a significant, but local scale, interaction between the estuary and coastal processes. In the estuary mouth beach sediment is transported into the river channel as a result of wave action, this material is then transported a short distance offshore by a combination of ebb tidal currents and river flow. The beach sediment has formed an ebb tidal delta that has accumulated against Otterton Ledge (Halcrow, 2002). Further wave action then transports material from the ebb tidal delta back onshore to the beach to the west of the entrance of the Otter thus establishing a cyclic sediment transport pathway. This is primarily a circulation of existing beach sediments and not of newly derived materials. Otterton Ledge itself may be important to the stability of the delta for it acts as: (i) a barrier preventing eastward drift of shingle away from the delta and (ii) shelter against waves approaching from the south-east, which would otherwise tend to drive the deltas shoreward and westward (SCOPAC, 2004).

In addition to the sediment transport pathway, the discharge from the River Otter during major rainfall events (every 20 to 30 years) can cause sufficiently high river flow to breach a direct channel through the shingle barrier. During these flood events the ebb tidal delta becomes enlarged. The breach is often temporary and is soon re-sealed by the eastwards drift of beach sediment. This breaching by river flow only occurs during extreme events.

While there is clear evidence for the eastwards drift of sediment along the shoreline towards Otterton Ledge in the form of the shingle spit that has diverted the mouth of the Otter 500m to the east, there is no information available about the rate of longshore drift.

Movement

As stated in the section above, the shingle barrier spit has been relatively stable over the past century, having maintained its overall form and position during this time. The stability has been helped by the continued supply of sediment derived from cliff erosion to the west being transported to this area as well as the shelter afforded to the spit by the presence of Otterton Ledge. The beach itself consists of multiple berms, indicating probable short-term fluctuations in cross profile form and so suggesting a possible sediment exchange between the beach and nearshore zones, although this is unproven (SCOPAC, 2004).

Existing Predictions of Shoreline Evolution

For an 'unconstrained' scenario, Futurecoast (Halcrow, 2002) predicted that the continued erosion of the cliffs to the west of this area will supply sediment input to the shingle barrier sufficient for it to maintain its present size and form. Storm wave events could lead to the occurrence of breaching and overwash. The former would create temporary breaches that would be repaired by the eastward drift of sediment. The latter would lead to the gradual roll-back and landward migration of the barrier into the Otter estuary.

The frequency of the barrier breaching as a result of high rainfall leading to high river flows would also be likely to increase, given current predictions for higher rainfall to occur as a result of global climate change.

The Futurecoast (Halcrow, 2002) prediction for a 'with present management' scenario is for the maintenance of the gabions along the western part of the ridge of the shingle spit to continue to protect this part of the barrier from breaching. The gabions will limit the ability of the barrier to roll-back in response to future sea level rise, leading to the gradual narrowing of the beach fronting these gabions and in turn increasing the risk of a breach of the barrier occurring during storm wave events. The continued protection of the western end of the barrier could also give rise to the development of a discontinuity between the defended western end and the naturally functioning eastern end, which is more mobile and would be able to retreat landwards in response to future sea level rise.

LOCAL SCALE: Budleigh Salterton to Straight Point

Interactions

Extending from the western end of the spit that lies across the mouth of the Otter estuary to Straight Point, this section of frontage is dominated by steep cliffs that are fronted by a continuous shingle beach. The cliffs are up to 130m high at the western end of this section of frontage, reducing significantly towards the east at Budleigh Salterton.

The erosion of these cliffs is the only contemporary source of sediment input to the beaches along this shoreline, with no external material entering this shoreline from adjacent frontages to the west of Straight Point. The beach itself consists of a gently sloping sandy foreshore with a shingle bermed upper part that provides protection to the toe of the cliffs from wave action. Much of the cliff toe itself is actually comprised of debris slopes from recent cliff failure events. The foreshore sediments form only a thin layer and in some places rocky reefs are exposed.

The eastward drift of sediment along the shoreline once it has been released to the beaches from cliff erosion of the Budleigh Salterton Pebble Beds is important in the supply and maintenance of the shingle barrier that extends across the mouth of the Otter estuary.

Movement

The cliffs at the western end are subject to complex landslides whilst those towards the eastern end experience more simple landslide and rock fall type failures. Individual landslide events tend to be on a small scale, though major falls tend to occur every 2 to 3 years. The relative infrequency of cliff failures means that sediment input to the shoreline occurs as periodic pulses of shingle sediment.

The greatest cliff top retreat within this section since 1890 has been between Straight Point and The Floors. SCOPAC (2004) suggests that the rate of recession here may be as much as 5.0m/year. However, given the periodic nature of failures, this must be taken in context with the mean annual rate of recession for this entire section of coast between Budleigh Salterton and Straight Point, which is about 0.4m/year over the past century (SCOPAC, 2004).

Existing Predictions of Shoreline Evolution

For an 'unconstrained' scenario, Futurecoast (Halcrow, 2002) predicted that there would be continued cliff toe erosion and periodic landslide failures along the length of these cliffs, leading to the general retreat of the cliffs.

Overall the rate of recession would continue at a similar or slightly faster rate than occurs at present. However, The Floors section of cliffs could experience more rapid retreat of tens of metres in only a few events should relict landslides present here become reactivated in the future.

The ongoing cliff erosion would continue to supply sediment to the beaches along this shoreline, the supply would increase if the rate of cliff retreat increases in the future due to sea level rise. This will serve to maintain (and possibly increase) the overall size of the beaches along this section, although short term fluctuations as a result of storm wave events and periodic temporary interruption of longshore transport by landslide lodes would also occur.

The Futurecoast (Halcrow, 2002) prediction for a 'with present management' scenario is for the seawall and gabion defences at Budleigh Salterton to continue to prevent cliff erosion in this area providing any local input of sediment to the beach. The lack of human intervention along the shoreline to the west of Budleigh Salterton means that these undefended sections of shoreline will behave in a similar way to the unconstrained scenario. Thus the supply of sediment by littoral drift of material derived from cliff erosion to the west to the defended frontage at Budleigh Salterton would mean the localised prevention of cliff erosion will not be significant in terms of maintaining the beach in this area.

The erosion of cliffs to the west of the structures at Budleigh Salterton may start to cause outflanking of the defences leading to the increased exposure of this area to wave action as it becomes more of a promontory. It is not thought that this would occur over the course of the next 100 years.

C.1.10 Straight Point to Holcombe

LARGE SCALE

Interactions

This section of coast extends from Straight Point in the east to Holcombe in the west, and includes the highly dynamic entrance to the Exe estuary that dominates the coastal processes of this area, as well as the Exe estuary itself.

The evolution of this shoreline has occurred following inundation as a result of sea level rise during the Holocene marine transgression (c.10,000 years BP). The original River Exe exploited a dip in the geological beds to flow out to the sea through a wide low-lying valley that extended between Dawlish and Straight Point. At this time there would have been erosion of the flanks of the Exe valley as a result of sub-aerial processes.

During the marine transgression, channel and deltaic sediments that formed the mouth of the once wider (and further offshore) Exe estuary, along with those released from cliff erosion to the south were swept up by the rising sea levels and transported landwards to approximately the present shoreline configuration. Fine sediments were deposited within the Exe estuary whilst coarser sands and shingle were deposited at the entrance of the estuary, forming spits, tidal deltas and sandbanks.

Contemporary sediment supply to this area no longer occurs from the offshore source that formed the present estuary system. Any potential sediment source from cliff erosion between Dawlish Warren and Holcombe is prevented by the presence of defences along this section of coast.

At one time the entrance of the Exe consisted of two spits, one on either side of the mouth at Exmouth and Dawlish that oscillated in growth. Following development at Exmouth, the eastern spit is now largely fixed in position, leaving Dawlish Warren as the only active spit across the mouth of the Exe. Despite the 'entrapment' of sediment in Exmouth spit, both of these spits form part of a complex sediment transport system along with the flood (Bull Hill Bank) and ebb (Pole Sands) tidal deltas of the Exe (Halcrow, 2007c).

Cliff recession between Dawlish and Teignmouth has led to the emergence of the Parson and Clerk headland at Holcombe due to local variations in geological resistance, and around which very little (if any) sediment transport occurs. SCOPAC (2004) states that there is no evidence of sediment bypassing the headland at Holcombe, and postulates that this area may be a drift divide with material possibly moving offshore in this area.

To the east of the Exe estuary entrance, cliff erosion occurs at Orcombe Rocks and material derived drifts westwards towards the estuary to feed the beaches at Exmouth. No sediment is provided to the Exmouth frontage from east of Orcombe Rocks as there is a weak littoral drift divide in this area, with sediment transport occurring from west to east between Orcombe Rocks and Straight Point (SCOPAC, 2004).

Tidal currents in this area are generally weak except at the tidal inlet of the Exe estuary, where tidal exchange drives strong currents within an ebb dominant regime. In addition, the orientation of the shoreline means it is not directly exposed to waves from the Atlantic, other than those that are diffracted around Start Point. The exposure of this section of coast to waves from the east and south-east is more significant, although the effects on the entrance to the Exe estuary are greatly modified by the presence of Pole Sands.

Pole Sands has a significant impact upon the coastal processes of a wider area as a result, affecting wave climate and tidal flows and causing the clockwise circulation of sand at the mouth of the Exe estuary. The circulation pattern has a significant effect upon the adjacent shorelines, leading to local reversals in littoral drift from the general south-west to north-east along the Dawlish shoreline, to an east to west transport along the Exmouth shoreline.

The ebb tidal delta of the Exe is part of a dynamic sediment transport system that also includes the spit at Dawlish Warren and the flood tide delta of Bull Hill Bank. During storm events sand and shingle is driven from Pole Sands and the beaches at Dawlish Warren and Exmouth, which can experience significant depletion in beach levels and volumes as a result of storm wave activity, into the channels at the mouth of the Exe estuary. Following storm events, the clockwise sediment transport regime that is caused by the presence of Pole Sands, leads to the return of beach material to the shoreline, helping to restore the beaches to some extent (Halcrow, 2007c).

Movement

The cliffs along this section of coast consist of hard rock types such as limestones, which erode very slowly. Very little cliff recession has occurred over the past century in most areas.

Analysis of the historic beach trends presented in Halcrow (2007c) shows that the distal end of Dawlish Warren is accreting whilst the beaches along Exmouth are eroding.

Modifications

The majority of this section of coast has been affected by human intervention. The most notable intervention has been the construction of the Exeter to Plymouth main line railway in 1849, which runs along the cliff toe between Dawlish Warren and Teignmouth (Halcrow, 2002) and the east and west sides of the Exe estuary (Halcrow, 2007c). Along much of its length the railway is protected by seawalls and other defences, although in places the railway cuts through headlands via a series of tunnels. The railway artificially holds the shoreline in its present position and prevents the input of sediment from the cliffs.

The seawall (along the open coast) was constructed upon the upper part of the beach that occurs here, causing the impoundment of the upper beach sediment and ‘removing’ it from the coastal sediment system. The construction of the seawall, along with other groyne and breakwaters that have been built to retain beaches in front of the seawall prevent cliff erosion from supplying new inputs of sediment to the shoreline. The defences also interrupt the longshore sediment transport pathway which causes a reduction in beach volume of the beaches fronting the seawall (which are also affected by beach scour) as well as the spits and banks at the mouth of the Exe estuary.

In addition to the railway, other significant human interventions along this shoreline are as follows:

- The eastwards trending Exmouth spit at the mouth of the Exe estuary has been largely impounded by the development of the town of Exmouth, with coastal defences such as seawalls having been constructed around it to protect the town. This has effectively removed the sediment that forms the spit from otherwise contributing to the complex circulation of sediment at the mouth of the Exe estuary.
- A seawall was constructed along the Exmouth frontage behind Maer Rocks around 1915, and the upper cliff in this area was also re-profiled during the 1920s (SCOPAC, 2004).
- The navigation channel at the entrance to the Exe estuary was maintained by periodic dredging (SCOPAC, 2004), but this presently does not occur.

- At Dawlish Warren, the proximal end of the spit, where it connects to the land, has been stabilised by the construction of groynes and gabion mattresses (SCOPAC, 2004).
- In 1917 a breakwater was constructed at Langstone Rock, at the western end of Dawlish Warren spit. This has led to a realignment of the spit to its present position approximately 400m back from the cliff line to the south-west of Langstone Rock (Halcrow, 2007c).

LOCAL SCALE: Straight Point to Maer Rocks

Interactions

This section of coast between includes the headlands at Straight Point and Orcombe Rocks, and contains cliffs up to 55m in height. The sandstone and marl cliffs are fronted by sand and shingle beaches, although in places there are sections of rock platform exposed.

Orcombe Rocks is a partial drift divide, with east to west drift occurring along the Exmouth frontage from Orcombe Rocks towards the Exe estuary (SCOPAC, 2004). This is connected with the clockwise circulation of sediment that occurs at the mouth of the Exe estuary. East of Orcombe Rocks, there is some west to east littoral drift across Sandy Bay. The dominant transport in Sandy Bay due to cross-shore rather than longshore sediment transport processes, with a net offshore to onshore sediment transport occurring (SCOPAC, 2004).

The effect of the partial drift divide at Orcombe Rock is to limit sediment exchange occurring between the Exmouth and Sandy Bay frontages. With no transport of material around Straight Point to Sandy Bay occurring, this means Sandy Bay is a relatively self-contained section of coast.

Erosion of the cliffs along this section of coast provide some sediment input to the shoreline, although this input is reduced to the west of Orcombe Rocks by the presence of a seawall and groynes along the beach that provide protection to the cliff toe from the effects of wave action.

Movement

The cliffs along this section of coast are retreating at varying rates, dependent on their lithologies. Futurecoast (Halcrow, 2002) suggests that the cliffs between Straight Point and Orcombe Rocks have changed very little since 1890, with only occasional rock falls occurring. However, analysis presented in SCOPAC (2004) suggests that erosion of the cliffs within Sandy Bay has occurred at a mean annual rate of 0.4m/year, whilst the cliffs at Orcombe Rocks have retreated at a rate of between 0.5 to 0.6m/year.

The cliffs along the back of Maer Rocks have eroded very little since the construction of the seawall along the cliff toe around 1915.

Futurecoast (Halcrow, 2002) suggests that the extent of the rock platform exposures has reduced over the last century, it is unclear if this means erosion has occurred or if there has been an increase in the amount of sand material covering areas of rock platform.

Existing Predictions of Shoreline Evolution

For an ‘unconstrained’ scenario, Futurecoast (Halcrow, 2002) predicted that the cliffs along this section of coast would continue to erode slowly as a result of occasional rock falls which will provide sediment inputs to the local beaches. This continued sediment supply to the beaches will allow the present beach form and extent to be maintained. Without the seawall to protect the toe of the cliffs at Maer Rocks, there would be an increase in sediment supplied from cliff erosion in this area that in turn could be transported to the beaches at Exmouth and into the Exe estuary sediment transport system.

The Futurecoast (Halcrow, 2002) prediction for a ‘with present management’ scenario is for the seawall at Maer Rocks to continue to prevent sediment supply to the local beach from the erosion of the cliffs behind the beach. Eventually this would lead to the narrowing of the beach as sea levels rise, increasing the risk of failure of the defences. The evolution of the shoreline presently unprotected would not be unduly different to the unconstrained scenario.

LOCAL SCALE: River Exe

Interactions

This section of coast extends across the Exe estuary entrance between Maer Rocks and Langstone Rock, covering the beach at Exmouth, the spit at Dawlish Warren, and the tidal area of the Exe estuary where the River Exe enters the sea.

Dawlish Warren is a sand spit on the western side of the Exe estuary entrance that is about 500m wide along much of its length at present, although it narrows towards its distal end. It is largely unique within the region as most other bars and spits are comprised of shingle and not sand. The evolution of Dawlish Warren has been complex. There were once two spit features here, the inner and outer warren, separated by Greenland Lake. It is thought that erosion of the seaward face of the outer warren supplied sediment for the development of the inner warren. This double feature is no longer present as Greenland Lake was filled in during the 1940's (Halcrow, 2007c).

Over the longer term, Dawlish Warren spit has undergone recession and re-orientation, particularly since the construction of the breakwater at Langstone Rock which has also prevented the supply of sediment to the spit from the shoreline to the south-west. This process occurs as a result of the retreat of the seaward face of the spit, with periodic breaching and destruction of the distal end (during south-easterly storms) of the spit followed by recovery and growth (Halcrow, 2002). The current trend at Dawlish Warren is accretion of the re-curved distal end of the spit whilst the rate of retreat of the seaward face of the warren, towards the proximal end, is increasing (Halcrow, 2007c).

The beach at Exmouth is what remains of the former active second spit that was part of the double spit system at the mouth of the Exe estuary. The beach oscillates in size and position with the Dawlish Warren spit, but is now largely removed from this system by the impoundment of the spit that has occurred as a result of the development of the town of Exmouth. The contemporary evolution of these once linked features appears to now be unrelated, with the Exmouth frontage relatively stable in comparison to the highly variable Dawlish Warren spit.

Both Dawlish Warren spit and Exmouth Beach are part of the wider complex sediment transport system at the mouth of the Exe estuary. Dynamic sediment exchange occurs between the spit and beach with the flood and ebb tidal deltas, which presently act as sediment sinks in this regime. Accretion has occurred at both Bull Hill Bank and Pole Sands over the past century. In addition to the sandy beaches, the shorelines of both Dawlish Warren and Exmouth (extending to Maer Rocks) also have dune systems developed along them.

Within the Exe estuary there are sandbanks with flood and ebb channels that are backed by large areas of salt marsh and intertidal mudflats. These mudflats have accumulated as a result of the low energy environment that occurs within the estuary as a result of the shelter from wave action that is provided by the spit at Dawlish Warren (Halcrow, 2002). At the present time, marine sediments dominate within the Exe Estuary as human intervention upstream within the River Exe catchment has reduced the ability of fluvial sediments to reach the estuary. Fluvial sediment inputs at present are considered negligible (SCOPAC, 2004). The Exe estuary is in a state of sedimentary equilibrium despite large areas of the estuary having been reclaimed and its present form being constrained by human activities. It also remains a strong sink for fine sediment with continued deposition occurring on most mudflats (Halcrow, 2002). This is evidenced by the fact that the relative positions of the main channels have hardly changed over the past 130 years, suggesting that deposition is slowly raising mudflat elevation. Most of this input of fine sediment is via suspension transport by tidal currents, though internally generated wind waves may have an independent role in entraining sediment in shallow water areas (SCOPAC, 2004).

The linearity and length of the estuary between the mouth and Topsham is sufficient to allow the development of wind-driven waves to occur when the wind direction is from certain directions. The development of waves within the estuary is also highly dependent upon the water level, with waves being largely depth limited over the large expanses of intertidal mudflats. Analysis undertaken for the Exe Estuary Coastal Management Study (Halcrow, 2007d) included calculation of wind-driven waves within the estuary given extreme wind and water level conditions. This suggests that given the right extreme conditions, waves within the estuary of between 0.5 and 0.6m could develop.

Transport along both Exmouth and Dawlish Warren beaches is largely driven by wave action, particularly during storm events, which Futurecoast (Halcrow, 2002) suggests may cause 20% of the total annual wave-driven transport during a single storm event.

Movement

The movement of the shoreline in this area is greatly affected by the complex sediment circulation caused by the presence of Pole Sands at the mouth of the Exe estuary. Along the Exmouth frontage there is a westward transport of sediment due to the clockwise circulation, with material transported towards the estuary from Orcombe Rocks. The longshore transport at Dawlish Warren is from south-west to north-east, also moving sediment towards the estuary.

There has been no recorded retreat in position of the backshore at Exmouth, due to the presence of defences that prevent the natural adjustment of the beaches to storm events. However, beach volumes here have reduced over the recent past (Halcrow, 2007c). In contrast, the Dawlish Warren spit has been able to retreat and re-align over the decades and is presently about 400m behind the line of the cliffs where the spit once extended linearly from Langstone Rock. There have also been changes in the planform of the spit.

Existing Predictions of Shoreline Evolution

For an ‘unconstrained’ scenario, Futurecoast (Halcrow, 2002) predicted that cliff erosion to the south-west of Dawlish Warren would increase as a result of the removal of the present defences and this would increase the supply of sediment to the shoreline. This increased sediment supply would drift north-east towards Dawlish Warren and reduce, or even reverse, the present erosion at Dawlish Warren as well as providing new sediment to the ebb and flood tidal deltas. Interception of material by Langstone Rock could cause a delay between the release of sediment from cliff erosion and material actually reaching Dawlish Warren.

The removal of defences at the proximal end of the spit would assist natural ability of Dawlish Warren to roll-back in response to future sea level rise. An increase in the occurrence of temporary breaches of the spit could also be experienced as roll-back occurs. The breaches could become permanent if there is insufficient sediment to allow the breach to be re-sealed by longshore transport processes.

A similar situation would occur at Exmouth spit, where roll-back and breaching in response to future sea level rise would occur. However, sediment supplied from both cliff erosion to the east and the tidal deltas of the Exe estuary would result in the breaches in the Exmouth spit being re-sealed.

The Futurecoast (Halcrow, 2002) prediction for a ‘with present management’ scenario is for there to be continued erosion and narrowing of the spit and beaches of this section of coast. The impoundment of Exmouth spit would also prevent the shoreline from adjusting to future sea level rise and storm events, leading to an increased likelihood that the defences along the Exmouth frontage would fail and breach in the future.

At Dawlish Warren it is probable that a breach towards the distal end of the spit would occur, exposing the Exe estuary behind to increased wave attack. The continued defence of the proximal end could limit the degree of such exposure by helping to retain part of the spit.

LOCAL SCALE: Dawlish Warren to Holcombe

Interactions

Covering the area between the isolated cliff headland at Langstone Rock and The Parson and Clerk headland at Holcombe, this section of coast consists of cliffs fronted by shingle beaches. From Langstone Rock to Dawlish there is one continuous mixed sand-shingle beach, after which the shoreline is interrupted by the presence of a number of small headlands which contain small pocket beaches between them (e.g. Coryton’s Cove).

Beach sediment along this section of coast was historically transported north-eastwards towards the mouth of the Exe estuary, however this has largely ceased as a result of the construction of groynes and breakwaters along the shoreline that inhibit these longshore processes.

The only contemporary source of sediment input to the shoreline is from local cliff erosion, as there is no input of sediment around the headland at Holcombe from the beaches to the south-west.

Movement

Large parts of this shoreline have been affected by the construction of the railway line that runs along the cliff toe and through tunnels cut through the headlands. The seawall that protects the railway line prevents erosion of the cliff and has impounded the upper beach sediments upon which it was constructed in 1849. The presence of the defences associated with the railway, has resulted in the gradual narrowing of the beach in front of the seawall due to the effects of beach scouring by wave action. This narrowing occurs along the long section of beach between Langstone Rock and Dawlish Warren. The small pocket beaches between the minor headlands from Dawlish to Holcombe are more stable.

Cliff erosion only occurs where the railway line runs through tunnels cut through the headlands (i.e. where there are no cliff defences); SCOPAC (2004) suggests that along this section of coast the mean annual rate of recession is about 0.5m/year. However, review of historical mapping suggests that the rate of recession over the past century has been closer to 0.1m/year.

The construction of the railway line has prevented the erosion of the cliffs by the effects of wave action at the cliff toe, these cliffs are not completely stable and are subject to landsliding caused by weathering and high groundwater levels.

Existing Predictions of Shoreline Evolution

For an ‘unconstrained’ scenario, Futurecoast (Halcrow, 2002) predicted that cliff erosion would be renewed, supplying sediment to the shoreline that could then be transported north-eastwards towards the Exe estuary. These increased sediment supply would also allow the beaches along this section of coast to recover and respond to future sea level rise by retreating landwards at a rate controlled by the rate of cliff recession.

The Futurecoast (Halcrow, 2002) prediction for a ‘with present management’ scenario is for there to be a continued reduction in the beach fronting the seawall and other defences along this section of coast, gradually increasing the risk of the defences failing in the future. There would also be a continued risk of landslides caused by sub-aerial processes as occurs at present.

C.1.11 Holcombe to Hope’s Nose

LARGE SCALE

Interactions

The present form of this section of coast, particularly the area between the Teign estuary and Holcombe, shares a great deal of its evolution with that of the section of coast between Straight Point and Holcombe (see Section C.1.10). The River Teign was once a tributary of the once wider Exe estuary system that extended much further offshore than it does at present.

Inundation, as a result of sea level rise during the Holocene marine transgression (c.10,000 years BP), resulted in channel and deltaic sediments, which formed the mouth of the once wider (and further offshore) Exe estuary system, being swept up by the rising sea levels and transported landwards to approximately the present shoreline configuration. Fine sediments were deposited within the Teign estuary whilst coarser sands and shingle were deposited at the entrance of the estuary, forming spits, tidal deltas and sandbanks that have an important, local impact on coastal sediment transport processes.

The frontage between Holcombe and Teignmouth consists of cliffs that are fronted by sections of shingle beach whose sediment source is the erosion of the backing cliffs, although this process is largely prevented at the present time due to the construction of the railway line in the mid-19th century. The offshore area is generally gently sloping and featureless, except for the sedimentary features around the mouth of the Teign estuary.

The south side of the Teign estuary mouth is marked by The Ness at Shaldon, which is a cliffed headland (ABPmer, 2006). The section of coast that extends southwards from the Teign estuary to Hope’s Nose comprises steep cliffs that are indented by many small headlands and bays that are occupied by sandy pocket beaches. The reason for the large amount of indentation is due to the cliffs along this section of coast being comprised of a complex alternation of shales, limestones, slates and mudstones (SCOPAC, 2004) that all erode at slightly different rates.

Tidal currents in this area are generally weak except at the tidal inlet of the Teign estuary, where tidal exchange drives strong currents within an ebb dominant regime. In addition, the eastwards orientation of the shoreline means it is not directly exposed to waves from the Atlantic, other than those that are diffracted around Start Point. The exposure of this section of coast to waves from the east and south-east is more significant.

The southern limit of this section of cliff is the headland at Hope's Nose, a hard limestone headland. Hope's Nose provides a strong geological anchoring control to the evolution of the shoreline to the north, which consists of softer, more readily eroded rocks. There is no sediment transport around Hope's Nose, nor is there any around the northern headland at Holcombe, leading SCOPAC (2004) to suggest that this section of coast between Holcombe and Hope's Nose has a relatively independent shoreline transport and sediment budget system.

Within this system, there are variations in the direction of longshore transport. SCOPAC (2004) states that between Hope's Nose and Teignmouth, and from Sprey Point to Holcombe, net littoral drift is from south to north, while from Sprey Point southwards to the distal end of Den Spit, the drift is reversed and occurs from north to south. This reversal is associated with the complex anticlockwise circulation of sediment that occurs at the mouth of the Teign estuary that is driven by a combination of wave and tide processes.

The indented nature of the shoreline from the Teign estuary to Hope's Nose means there is no continuous sediment pathway and so material eroded from the cliffs is retained in the local pocket beaches.

Movement

Erosion of the backing cliffs is largely prevented at the present time due to the construction of the railway line in the mid-19th century. The presence of the seawall has also led to the gradual narrowing of the beach along the northern part of this section between north Teignmouth and Holcombe.

Beach levels at Teignmouth fluctuate in response to the complex cyclical sediment transport system that operates at the mouth of the Teign estuary.

Modifications

As with the majority of the section of shoreline around the Exe estuary and the open coast between Dawlish Warren and Holcombe (see Section C.1.10). The most significant human intervention along this section of coast has been the construction in 1849 of the Exeter to Plymouth railway which now runs along the toe of the cliff from Holcombe to northern Teignmouth, where it turns inland and continues westwards along the northern shoreline of the Teign estuary.

The railway is protected by a seawall, which was constructed on top of the upper beach, impounding these sediments and so removing them from the shoreline sediment system. There is also a seawall protecting the railway line along the shoreline of the Teign estuary (ABPmer, 2006). At Sprey Point this has included the building out of the seawall to reclaim land. A series of groynes have subsequently been constructed to retain beach levels in front of the seawall in order to reduce the risk of undermining of the seawall as a result of beach scour that occurs during storm wave events.

Other significant human interventions along this shoreline are as follows:

- As a result of the development of the town of Teignmouth, the sediments that form Den Spit are now largely impounded except for at the most distal end.
- Almost daily plough dredging of the Teign approach channel occurs to maintain a navigable channel into the port of Teignmouth which is located inside the estuary. The port itself contains a number of quay walls that have been constructed along the section of estuary shoreline that forms part of the Teignmouth Port estate (ABPmer, 2006).
- Along the south side of the Teign entrance channel, there is a small section of training wall that fronts Shaldon Beach and The Ness.
- Between Teignmouth and Hope's Nose, short sections of seawall have been constructed at Anstey's Cove and Oddicombe Beach, where there is also rock revetment present (SCOPAC, 2004). There are also

short sections of seawall at Maidencombe Beach, Watcombe Beach and Babbacombe Beach (ABPmer, 2006).

LOCAL SCALE: Holcombe to Teignmouth

Interactions

This section of coast extends from the headland at Holcombe to the northern end of Den Spit at Teignmouth. It consists of cliffs that have been stabilised by the construction of the railway line and associated defences, and is fronted by several stretches of shingle beach.

Wave driven longshore sediment transport occurs in both a northward and southward direction along this section of coast, with a drift divide at Sprey Point.

There is no evidence of sediment transport around the headland at Holcombe, and material that drifts northwards towards this location from Sprey Point may actually be transported offshore from Holcombe (SCOPAC, 2004).

Movement

The stabilisation of the cliff by the construction of the seawall and railway along the cliff toe has resulted in very little if any cliff recession since the mid-19th century. Despite the stabilisation of the cliffs by the reduction of wave action at the toe, the cliffs are still susceptible to landsliding due to weathering and high groundwater levels.

The presence of the seawall has led to the gradual narrowing of the beach width as sediment is not replaced along the shoreline by the erosion of the cliffs as would have occurred historically.

Existing Predictions of Shoreline Evolution

For an 'unconstrained' scenario, Futurecoast (Halcrow, 2002) predicted that cliff erosion would be renewed, supplying sediment to the shoreline that could then be transported along the shoreline by littoral drift processes. This increased sediment supply would also allow the beaches along this section of coast to recover and respond to future sea level rise by retreating landwards at a rate controlled by the rate of cliff recession.

The Futurecoast (Halcrow, 2002) prediction for a 'with present management' scenario is for there to be a continued reduction in the beach fronting the seawall and other defences along this section of coast, gradually increasing the risk of the defences failing in the future. There would also be a continued risk of landslides caused by sub-aerial processes as occurs at present.

LOCAL SCALE: River Teign

Interactions

This section of coast extends from the northern end of Den Spit at Teignmouth, across the mouth of the Teign estuary where the River Teign discharges to the sea, to The Ness headland at Shaldon on the south side of the Teign estuary mouth. Also present on the south side of the entrance is Shaldon Beach.

Den Spit is a sand spit that extends across the mouth of the Teign estuary from the northern shoreline and serves to both shelter the estuary from exposure to wave action and to divert the channel of the Teign towards the south, constricting its flow through the mouth between the end of the spit and the headland on its southern side. The spit has been largely impounded by the development of the town of Teignmouth, and is fringed by a sand beach. The southern tip of Den Spit is, however, unprotected and extends into the mouth of the estuary where it exhibits large changes in form over short time-scales (ABPmer, 2006).

In addition to the spit across the mouth of the estuary, there is also a very mobile ebb tidal delta seaward of the mouth that is in a cyclic sediment transport relationship with nearshore sand bars and the beach to the north of the mouth up to Sprey Point (SCOPAC, 2004). This cyclical sediment transport occurs with a periodicity of between 3 and 7 years and involves the growth and recession of the spit, ebb tidal delta, and beach. This latter relationship between the cyclical sediment transport pattern and the beach fronting Teignmouth between Sprey Point and Den Spit is also (in part) responsible for the fluctuation of beach levels along this part of the shoreline (Halcrow, 2002).

The presence of this complex sediment transport regime at the mouth of the Teign estuary is due to the effect of tide and waves and forms an interruption to net northwards drift of material derived from the erosion of cliffs to the south of the estuary. Despite this, the overall impact of this system upon coastal processes remains relatively localised to the area from Sprey Point to The Ness.

Within the estuary there is a well defined pattern of sediment sorting over the intertidal flats, from coarse sand and fine shingle near the entrance to finer silt and clay towards the head of the estuary. The coarser material at the mouth of the estuary is contained in a well defined sand and shingle bank known as The Salty as well as a number of minor sandbanks that occur immediately upstream of the entrance. The Salty is most likely a flood tide delta that owes its form to the clockwise tidal circulation inside the estuary mouth (SCOPAC, 2004).

The Teign estuary itself has evolved from a ria-type estuary and retains many of the ria-type characteristics, being fairly linear in form with steep hills on either side (Halcrow, 2002). However, this original form has been largely infilled with sediment over the Holocene (ABPmer, 2006). A process that has been accelerated by the growth of Den Spit across the mouth that has provided more sheltered conditions allowing settling of sediment to occur (SCOPAC, 2004). Over recent times the estuary has eroded, providing sediment back to the wider local sediment system in response to a combination of sea level rise and long-term natural tidal variations (ABPmer, 2006).

ABPmer (2002) suggests that there are two superimposed regimes at work within the Teign estuary. The outer estuary (up to about 2km landwards from the mouth) is approximately linear and may be dominated by the presence of Den Spit across the mouth that imposes a geomorphological constraint, whilst the inner estuary tends towards a more idealised estuary form.

Despite the limited fetch and shallow depth of the estuary, the linearity of the estuary allows small wind-driven waves to develop when the wind speed and directions are conducive to this. Under ideal storm conditions, a westerly gale at high water, waves of between 0.6 to 1.0m can form (ABPmer, 2006).

Movement

The stabilisation of the cliff to the north of Den Spit by the construction of the seawall and railway along the cliff toe has resulted in very little if any cliff recession since the mid-19th century. Despite the stabilisation of the cliffs by the reduction of wave action at the toe, the cliffs are still susceptible to landsliding due to weathering and high groundwater levels.

Limited analysis carried out by ABPmer (2007) suggests that Shaldon Beach on the south side of the entrance to the Teign estuary has remained relatively stable between 1998 and 2006, although erosion was observed between 2005 and 2006.

Existing Predictions of Shoreline Evolution

For an 'unconstrained' scenario, Futurecoast (Halcrow, 2002) predicted that cliff erosion to the north of this section of coast would provide sediment to feed and possibly increase the size of the spit and foreshore along the northern shoreline of Teignmouth. The seaward face of Den Spit would retreat in response to future sea level rise and could possibly breach in the future. Due to the presence of the river channel that flows behind the spit, there is a possibility that a breach could become permanent.

The cyclic sediment transport regime at the mouth of the Teign estuary would continue to occur, and may involve an increased volume of sediment as a result of an increased supply of sediment from erosion of the cliffs along the shorelines to both the north and south.

The Futurecoast (Halcrow, 2002) prediction for a 'with present management' scenario is for the continued presence of the defences along the seaward coast of Teignmouth. The management would lead to the gradual narrowing of the beach and foreshore as a result of future sea level rise and in turn increase the risk of failure of these defences over time.

LOCAL SCALE: River Teign to Hope's Nose

Interactions

The section of coast between The Ness at Shaldon and Hope's Nose consists of sandstone cliffs up to 130m high that reduce in size towards Teignmouth. The cliff line is indented by a large number of embayments that are separated by mainly small headlands. These embayments are occupied by sandy pocket beaches which are supplied by the gradual erosion of the cliffs behind. This beach material is retained on the local beaches due to the extensively indented nature of this shoreline, which inhibits the net northwards drift of sediment along this section of coast. Much of the frontage is fronted by either inter-tidal wave-cut platforms or no inter-tidal area at all.

The shoreline is largely unprotected, although there are some defences around Torquay located in the small bays along the north side of the town where the beaches are backed by seawalls and revetments that inhibit the supply of sediment to the beaches from localised cliff erosion.

Movement

Cliff erosion along this section of coast is generally slow and occurs as a result of rock falls due to stratigraphic faults and joints. Complex landslides do occur either side of Watcombe Head and in the high cliffs at Labrador Bay, where a distinct undercliff has formed (SCOPAC, 2004).

Analysis from Futurecoast (Halcrow, 2002) suggests that over the past century there has been very little (if any) cliff top recession between Shaldon and Oddicombe, a finding supported by SCOPAC (2004) which states a mean annual rate of recession of less than 0.2m/year occurs along this section. The area between Oddicombe and Hope's Nose has retreated at a mean rate of between 0.07 to 0.23m/year. This range of rates is broadly supported by analysis presented in SCOPAC (2004), which states that between Oddicombe and Hope's Nose, cliff recession has occurred historically at a rate of less than 0.2m/year.

From a comparison of historic Ordnance Survey maps from the years 1879 and 1990 undertaken for this SMP2, it is apparent that the beaches between Oddicombe and Hope's Nose have also experienced a general trend of erosion over the longer term.

Existing Predictions of Shoreline Evolution

For an 'unconstrained' scenario, Futurecoast (Halcrow, 2002) predicted that very slow erosion of the hard cliffs that form most of this coastline would continue. The many small pocket beaches that occur along the shoreline would retain their present form as a result of the limited retreat of the backing cliffs. The presently defended sections of the Torquay frontage would also follow this behaviour, with slow erosion of the cliffs, including some occurrences of landsliding.

The Futurecoast (Halcrow, 2002) prediction for a 'with present management' scenario for the largely undefended shoreline is similar to the unconstrained scenario. Where local defences are present, they would continue to prevent cliff erosion from providing sediment to the pocket beaches although there would not be any effect beyond these localised areas.

C.1.12 Tor Bay

LARGE SCALE

Interactions

Tor Bay is situated between the two dominant headlands at Hope's Nose to the north and Berry Head to the south. The headlands exert a strong geological control on the bay making Tor Bay relatively resistant to contemporary coastal processes which means the headlands shelter the bay from waves propagating from the offshore and so reduce wave driven transport within the bay. The bay has therefore remained largely inactive over the century timescale, as a result of the bay providing shelter from most wave directions, except for a narrow window between the north-east and south-east, meaning wave driven transport within the bay is limited.

The present configuration of Tor Bay is due to the inundation caused by sea level rise during the Holocene marine transgression (c.10,000 years BP). The transgression drove coarse sediment landwards as a barrier beach, leading to the enclosure of estuarine and lagoon environments that occupied a series of east-west orientated valleys.

As the barrier beach continued to move landwards it encountered a number of more resistant geological areas in the backing topography. These gradually emerged through the barrier beach as a series of secondary headlands within the bay, giving rise to the segmentation of the barrier beach into a number of smaller sections of beach.

The headlands at Hope's Nose and Berry Head are formed from hard, resistant Devonian limestone whilst the central part of Tor Bay consists of weaker breccias and mudstones that are prone to landsliding and retreat at a much more rapid rate than the limestones. The presence of the headlands at Hope's Nose and Berry Head that enclose Tor Bay, form an absolute barrier to bedload sediment transport (SCOPAC, 2004) as the cliffs at both headlands plunge directly into deep water.

Within Tor Bay, the presence of pockets of softer material located between areas of more resistant geology has resulted in localised erosion forming embayments occupied by small pocket beaches. These pocket beaches are themselves only thin layers of sediment overlaying sloping nearshore rock platforms that slope gently seawards towards Lyme Bay.

There is very little contemporary erosion and sediment supply from the cliffed headlands to the local sand beaches that line Tor Bay. Along the south side of Hope's Nose there are some ancient landslides present in the mudstone cliffs located here. Contemporary erosion of the toes of the coastal slopes in this area by marine action is leading to the gradual re-activation of these relict features and this may supply some sediment input in the future.

The presence of the small secondary headlands that have formed in Tor Bay is very significant, with beach material unable to be transported around these headlands between adjacent pocket beach embayments. This means that the shoreline of Tor Bay is effectively made up of several small closed sediment transport systems. This is due to the sheltering of the bay from wave action by the Hope's Nose and Berry Head headlands and means that wave driven longshore transport within the bay is limited, although there is a low net north to south littoral drift along the pocket beaches within individual embayments.

Movement

SCOPAC (2004) suggests that Tor Bay is slowly retreating, with about 70% of the cliffline around Tor Bay retreating at a long-term mean annual rate of 0.3m/year.

Beaches around the bay fluctuate in response to seasonal conditions but appear to be stable in the long-term (SCOPAC, 2004).

Modifications

The original estuarine and lagoon areas that were enclosed by the landward migration of the barrier beach during the evolution of the present Tor Bay configuration have been subject to significant reclamation. These sites are located behind each of the small pocket beaches within Tor Bay at Broad Sands, Goodrington Sands, Paignton and Torre Abbey. They are all now protected from the sea by hard defences such as seawalls and revetments, the presence of which have limited the ability of the fronting beach to adapt by landward migration, in response to sea level rise, and could result in future coastal squeeze.

In addition to this, the reclaimed land may also be susceptible to subsidence due to construction on top of poorly consolidated underlying sediment (SCOPAC, 2004).

Sediment input to the local pocket beaches was limited. The cliffs that were eroding have in places been subject to construction of revetments at their toe to prevent future toe erosion and subsequent cliff failures. This serves to reduce the supply of sediment to the local beaches from an already limited supply.

There is also a number of breakwater structures present associated with the marina at Torquay and the harbour at Brixham.

LOCAL SCALE: Hope's Nose to Livermead Head

Interactions

This section of coast consists mainly of hard rock with a range of cliffs and coastal slopes. In places the cliffs rise up to 60m in height, though the majority are low rock cliffs with degraded coastal slopes above. The shoreline itself is also mostly rocky with boulder beaches, wave cut platforms and vertical cliffs, though there are several small sandy pocket beaches present, such as at Torre Abbey Sands and Meadfoot Beach.

There are no significant interactions with other sections of Tor Bay, although the shelter provided by Hope's Nose headland is an important control upon the other sections within Tor Bay.

Movement

There is very little in the way of retreat of the cliffs due to the presence of seawalls and other structures (e.g. Torquay Marina) that have been constructed along large parts of this section of coast to protect property and infrastructure from coastal erosion and flooding. There has also been little erosion and retreat of the intertidal area (Halcrow, 2002).

On the sections of coast that are unprotected some landslide and rock fall activity occurs, although this is infrequent and at a small spatial scale. Analysis presented in Futurecoast (Halcrow, 2002) suggests that the London Bridge stretch has been the most active area of erosion over the past century or so, with a mean annual rate of recession of 0.27m/year along this localised section of coast. Review of historical mapping suggests that recession of the majority of this section, where it has occurred, has been at a rate of about 0.05m/year over the past century.

The beaches along this section have also been stable particularly over the last 50 years or so. As with the cliffs along this section of coast, this is largely due to construction of seawalls along the back of the beach restricting the landward movement of the beaches. However this recent beach stability has not always occurred. For example, in the first part of the 20th century, Torre Abbey Sands experienced significant depletion in foreshore levels.

Existing Predictions of Shoreline Evolution

For an 'unconstrained' scenario, Futurecoast (Halcrow, 2002) predicted that the present slow erosion of the hard rock cliffs and degraded slopes would continue to occur. Without the presence of structures along the shoreline this erosion could lead to the re-activation of relict landslides within the coastal slopes and this in turn would lead to an increased input of sediment to the local pocket beaches.

The Futurecoast (Halcrow, 2002) prediction for a 'with present management' scenario is for the continued presence of defences along much of this section of coast to prevent cliff erosion providing sediment input to the local pocket beaches. With future sea level rise, the lack of sediment input would lead to coastal squeeze having a significant effect on beach levels. For the undefended sections of shoreline, future evolution would not be unduly different to the unconstrained scenario.

LOCAL SCALE: Livermead Head to Goodrington Sands

Interactions

This part of the Tor Bay shoreline comprises a series of wide sandy barrier beaches that are backed by low lying land that has been reclaimed from marshes and lagoons that were once present here. These beaches are separated by several small headlands that have emerged through the beach as it has rolled-back and become segmented over the centuries. These headlands now inhibit any transport of material between the adjacent beaches with beach sediment retained within the individual bays along the shoreline.

Weak net northward drift occurs along each individual beach, but this is not sufficient to lead to the accumulation of large volumes of material on the southern sides of the intervening headlands.

Movement

Futurecoast (Halcrow, 2002) suggests that the beaches have been highly stable with little evidence of recent changes in level or shoreline retreat. The landward retreat of the beaches is also restricted by the presence of seawalls and promenades that have been constructed along the back of these beaches.

The small headlands along this section of coast show little recession, although SCOPAC (2004) suggests that a mean annual recession of 0.15m/year occurs at Hollicombe Head.

Existing Predictions of Shoreline Evolution

For an 'unconstrained' scenario, Futurecoast (Halcrow, 2002) predicted that the resistant headlands would continue to slowly erode with the barrier beaches set-back between these headlands. These beaches could roll-back onto the low-lying land behind in response to future sea level rise. These beaches could also breach during storm events, allowing small areas of low lying land behind to become flooded. However, it is unlikely that sufficient tidal flow would occur through these breaches for them to become permanent features of the shoreline. It is more probable that the occurrence of breaches would be an episodic event followed by a period of re-sealing of the breach by the recovery of the barrier beach.

The Futurecoast (Halcrow, 2002) prediction for a 'with present management' scenario is for the maintenance of the defences that line the shoreline to prevent any future roll-back and/or breaching of the barrier beaches in response to future sea level rise. This would also lead to the gradual narrowing and steepening of the beaches as a result of coastal squeeze.

LOCAL SCALE: Goodrington Sands to Berry Head

Interactions

This section of the Tor Bay shoreline consists of hard limestone cliffs and coastal slopes that are indented with several small pocket beaches. In places the cliff line is fronted by wave cut platforms, whilst in other places the cliffs descend directly into deep water with no intertidal area at all.

This section of shoreline has no significant interactions with the other parts of Tor Bay, other than to provide shelter from southerly and south-easterly waves to the rest of the bay.

Movement

This section of coast is largely undefended, with the exception of the structures around Brixham Harbour that include an 800m long breakwater. The hard rock geology of this section of coast has resulted in very little retreat of the cliffs or intertidal areas.

The pocket beaches that indent the cliffs along this part of the Tor Bay shoreline are also relatively stable, showing little evidence of recession. Indeed, from a comparison of historic Ordnance Survey maps from the years 1865 and 1984, it is apparent that the trend over this period was one of accretion within these local pocket beaches, such as at Elbury Cove and Churlston Cove.

Existing Predictions of Shoreline Evolution

For an 'unconstrained' scenario, Futurecoast (Halcrow, 2002) predicted that the present slow erosion of the hard rock cliffs would continue. The pocket beaches that indent the shoreline would retain their present form, although some may retreat in response to the retreat of the cliffs that back these beaches.

The Futurecoast (Halcrow, 2002) prediction for a 'with present management' scenario is for this section of coast to largely evolve in a way not unduly different from the unconstrained scenario as the majority of this shoreline is undefended at present. The continued presence of the defences at Brixham would prevent cliff erosion over this part of the shoreline from providing sediment input to local pocket beaches, although this is unlikely to have a significant effect on beach levels in this area.

C.1.13 Berry Head to Start Point

LARGE SCALE

Interactions

This section of coast covers the extent of Start Bay between the headlands of Berry Head in the north and Start Point in the south. These headlands exert a strong geological control over Start Bay, which has evolved since the Holocene marine transgression (c.10,000 years BP) when rising sea levels swept sediments landwards as a single barrier beach between the two headlands.

As the barrier migrated landwards it became segmented by the emergence of small headlands and coves to form the three shingle barrier beaches at Hallsands, Beesands and Slapton Sands that fringe the present bay (Halcrow, 2002). These barriers, particularly Slapton Sands, have been more or less in their present position since about 3,000 years BP (SCOPAC, 2004). The small confined beach at Blackpool Sands was probably segmented from the barrier beaches to the south by the emergence of the headland between Matthew's Point and Strete (SCOPAC, 2004).

The formation of the barrier beaches enclosed a number of small streams, leading to the formation of freshwater lagoons (or 'Leys') on the landward side of the barriers. These lagoons have gradually been infilling with sediment, a process that has been completed at Hallsands (Scott Wilson, 2006). Behind the lagoons of Higher Ley, Lower Ley and Slapton Ley are degraded coastal slopes that represent the former inter-glacial cliff line.

The bay is significantly affected by the presence of Skerries Bank off of the tip of Start Point, which partially encloses the gently sloping Start Bay, causing refraction of waves as they propagate inshore, tending to focus wave energy on the shoreline to the south of Slapton Beach. Skerries Bank itself has formed as a result of flow conditions within an anti-clockwise tidal circulation cell and is fed by sediment from the west of Start Point. While the bank has an important effect on the wave climate, it has no direct sediment interaction with the shingle beaches along the shoreline.

Along the northern part of Start Bay the shoreline is dominated by cliffs that are extensively indented due to the differential marine erosion of small scale variations in rock strength and planes of structural weakness. The erosion of these cliffs supplies fine to coarse sand sediment to local pocket beaches, which occupy some of the small indentations (SCOPAC, 2004). This section of coast is also interrupted by the entrance of the Dart estuary, a ria-type estuary that is separated from other parts of the shoreline by hard rock headlands on either side of the entrance.

There are no contemporary sediment inputs to much of this shoreline, with the exception of localised cliff erosion supplying some material to local pocket beaches.

Start Point at the southern end of the bay is a major headland that exerts a significant control not only on this section of coast, but also for the rest of Lyme Bay as well. It serves to cause refraction and diffraction of south-westerly waves around the point that influences longshore sediment transport processes, whilst also preventing the transport of material around the point and into Start Bay.

Movement

Longshore sediment transport within Start Bay is variable, with drift occurring in both a northward and southward direction in response to waves from the east-north-east and south-east (Halcrow, 2002). In places, such as in the area around Torcross, cross-shore sediment may be a more important sediment transport process for beaches than longshore transport. Occasional storms from the east and south-east can have a significant short-term impact along the beaches of Start Bay, causing loss of beach material of large sections of the shoreline.

Modifications

There has been human intervention along many parts of this section of coast, including the construction of seawalls and revetments at Beesands, Torcross, Slapton Sands, and Blackpool Sands, all of which serve to constrain the natural evolution of the shingle barriers at these locations (Halcrow, 2002). In addition to the seawall, the A379 coast road also runs along the shingle ridge of Slapton Sands (Scott Wilson, 2006).

At Hallsands to the south of Slapton Sands, the village that once existed here was destroyed by a storm in 1917. This event has been attributed to the dredging of an estimated 400,000m^3 of shingle from the intertidal area offshore of Hallsands between 1887 and 1902 that led to the reduction in beach levels at Hallsands of about 6m, which did not recover due to the lack of new sediment inputs to the shoreline.

The north cliff that encloses Blackpool Sands has historically been unstable with a tendency for recurrent slips and falls. This process was driven by wave action at the toe, however this has been reduced by the construction of a revetment along the cliff toe in 1992 (SCOPAC, 2004).

At Man Sands beach material has been extracted in the past, however there appears not to have been any large scale impacts of this activity.

Defences at Beesands were constructed in 1992 and formed a rock revetment backed by a wave-return wall for much of its length, except at the southern end of the village. The wave return wall has recently been extended to cover this southern area (Halcrow, 2006).

LOCAL SCALE: Berry Head to Strete

Interactions

This section of coast is largely cliffed with isolated pocket beaches (fed from local, slow cliff erosion) which are separated by rocky headlands. Some of these beaches are significant deposits of sediment and tend to front low slopes where small river valleys open on to the coast, such as at Man Sands and Blackpool Sands.

The cliffs are up to 130m in height, and are generally fronted by boulder beaches. They are punctuated by the mouth of the Dart estuary that discharges to the sea between two high rock headlands at Inner Froward and Blackstone Points.

The Dart estuary is a ria-type estuary with a deep channel that extends for a long distance inland, flanked by high rocky cliffs. The estuary is fed by a number of branching creeks and small tributaries, including Bow Creek. Despite its size, the Dart estuary has a very low sediment input to the coast and has no spit or other sedimentary features at its mouth (Halcrow, 2002). The reason for this is the high, resistant rock headlands that form the mouth of the estuary, which create a stable form that, together with the lack of coarse sediment around the mouth, exclude any interaction between the estuarine and littoral sediment environments (SCOPAC, 2004).

The southerly orientation of the Dart estuary mouth, along with its deep water channel, suggests that waves propagating from offshore could diffract into the outer reaches of the estuary. Also, the long linear form of the Dart estuary away from the mouth would lend itself to the development of wind-driven waves under the right wind conditions, particularly as there are limited inter-tidal areas within the estuary that could hinder wave development. However, no specific information regarding waves within the Dart estuary has been identified as part of this study, so this is purely speculation.

Movement

Landslips occur on the south side of Berry Head in the shale cliffs that occur between the limestone headlands of Durl Head and Sharkham Point. This erosion occurs as a result of marine erosion at the toe of the cliffs leading to oversteepening of the coastal slope, which is then susceptible to shallow slides that are promoted by heavy rain, high tides and easterly storms. Despite these landslides, net erosion here is not large with analysis presented in Futurecoast (Halcrow, 2002) suggesting a mean annual rate of recession for the St Mary's Bay cliffs of 0.15m/year. However SCOPAC (2004) suggest the rate of recession along this section of coast may range between 0.2 to 1.0m/year.

From Sharkham Point to Blackstone Point SCOPAC (2004) states that the shoreline has been virtually static over the past century. However, Futurecoast (Halcrow, 2002) suggests a mean annual rate of 0.05m/year for parts of this shoreline has occurred.

The section of this shoreline south of Blackstone Point to Strete has been retreating at a slightly faster rate, with Futurecoast (Halcrow, 2002) suggesting mean annual erosion of the cliffs has been at a rate of between 0.18 to 0.24m/year, whilst SCOPAC (2004) suggests this may be as much as 0.3m/year.

The beach levels along this section of coast experience short term fluctuations in response to storm events, but their long-term movement is closely associated with the slow retreat of the backing cliffs that supply sediment to them. From a comparison of historic Ordnance Survey maps from the years 1889 and 1990, it is apparent that there has been a slight narrowing of Blackpool Beach over this period, indicating a general trend of erosion.

Existing Predictions of Shoreline Evolution

For an 'unconstrained' scenario, Futurecoast (Halcrow, 2002) predicted that the slow rates of cliff erosion experienced along this section of coast would continue. Beach levels would also continue to fluctuate in response to short term storm events. With future sea level rise, this could eventually lead to increased exposure and erosion of backing slopes.

The Futurecoast (Halcrow, 2002) prediction for a 'with present management' scenario is for the defences present at Blackpool Sands to continue to protect the cliff toe from erosion. The continued defence would reduce the amount of material supplied to the local beach from future erosion. The majority of this section of coast is undefended and as such would evolve in a way not unduly different to that of the unconstrained scenario.

LOCAL SCALE: Slapton Sands

Interactions

Extending between Strete and Torcross, Slapton Sands is a shingle barrier beach that extends in a more or less north-south orientation along this section of coast. There is no significant input or output of sediment from this section of coast and as such it is largely a self-contained sediment cell.

For much of its length, Slapton Sands fronts lagoons at Slapton Ley, Higher Ley and Lower Ley. These lagoons formed as a result of past sea level rise that impounded the drainage of small rivers that continue to flow into the back of the Leys. The Higher Ley has been largely in-filled with sediment and supports rich fen vegetation and wet willow woodland, whilst the Lower Ley continues to be a perched, freshwater lake with a maximum depth of –4.0m OD (Scott Wilson, 2006).

The lagoons have no direct interaction with the sea, as they are enclosed by the shingle barrier beach. There is seepage from Slapton Ley through the barrier beach seaward. This causes the water level within the lagoon to be maintained at an artificially high level above mean sea level (SCOPAC, 2004), a process that is also managed by the presence of a culvert and weir at Torcross (Scott Wilson, 2006).

Along Slapton Sands, the beach widens towards Strete in the north whilst the beach width and crest level both reduce towards the southern end of the beach (SCOPAC, 2004). This suggests a net northward drift along this section of coast. However, if this drift direction was a permanent long-term occurrence it would likely lead to the breakdown of the barrier. As this has not happened it is suggested in Futurecoast (Halcrow, 2002) that this net northward drift is possibly a recent phenomena that may be a short-term feature, with large gross drift occurring along the frontage but negligible net drift overall.

Movement

Storms from the east and south-east can cause significant reductions in the beach along Slapton Sands. Scott Wilson (2006) reports that in 2000 and 2001, a series of storms caused a loss of 5m of beach over a 1000m length of shoreline. This in turn led to the undermining of a 200m section of the coast road that runs along the back of the beach. As a result of this undermining the road was re-aligned 20m landward over the affected length.

From a comparison of historic Ordnance Survey maps from the years 1889 and 1990 undertaken for this SMP2, it is apparent that there has been a longer term trend of accretion of the northern part of Slapton Sands and erosion of the southern part, indicating the dominance of net northerly littoral drift.

Existing Predictions of Shoreline Evolution

For an 'unconstrained' scenario, Futurecoast (Halcrow, 2002) predicted that the barrier beach will retreat in response to future sea level rise by the process of roll-over in a manner similar to that predicted to occur at Chesil Beach to the east (refer to Section C.1.6). This would encroach further into the lagoons and low-lying land behind the beach. Whilst there would be no net loss of material from the system as a result of this retreat, the beach plan form would become elongated and increasingly curved (due to no new inputs of sediment). The beach would be increasingly at risk of breaching as a result of storms, such as those that have caused damage to this section of coast in the recent past. The lack of new sediment may mean that any breaches could become permanent. However, it is more likely that any breaches would be re-sealed by longshore sediment transport processes prior to further episodic breach and re-sealing events.

The Futurecoast (Halcrow, 2002) prediction for a 'with present management' scenario is for defences along the southern and central parts of this section of coast to prevent these parts of the shingle barrier from rolling back in response to future sea level rise. This would lead to a discontinuity in the beach plan form developing which would increase the risk of these defences being outflanked and eventually failing as wave energy would become increasingly focussed on these exposed ends of the defences. The undefended parts of the beach would also be susceptible to breaching as per the unconstrained scenario.

Further to the Futurecoast (Halcrow, 2002) study, the Scott Wilson (2006) study predicts that breaching of Slapton Sands is likely to occur between 50 and 100 years time in both the 'unconstrained' and 'with present management' scenarios.

LOCAL SCALE: Beesands

Interactions

This section of coast includes a shingle barrier beach situated between the small headlands at Limpet Rocks and Tinsey Head that extends across Widdicombe Ley, a small lagoon that formed in a similar way to the lagoons behind Slapton Sands to the north. The north and south sides of the Ley consist of low sloping land that extend up to high cliffs.

The barrier beach is a relict feature with limited new sediment inputs. It is largely isolated between its two bounding headlands, with little or no sediment exchange with the beaches of Slapton Sands. Its overall evolution is controlled by the retreat of adjacent cliffs.

Movement

The barrier beach levels fluctuate in response to seasonal variations in wave climate, with winter storms removing material from the high water area of the beach. Overall the beach is experiencing retreat of the low water mark whilst the high water mark has remained stable. This process is leading to the narrowing and steepening of the beach and foreshore and is likely significantly affected by the presence of the seawall and revetment that back the beach at Beesands village.

Analysis presented in SCOPAC (2004) suggests that erosion of the cliffs at Limpet Rocks and Tinsey Head occurs at a rate of between 0.2 to 0.3m/year.

Existing Predictions of Shoreline Evolution

For an 'unconstrained' scenario, Futurecoast (Halcrow, 2002) predicted that in the short term, the barrier beach could roll-back into the low lying ley behind. This roll-back could lead to a shorter length of beach with an increased height. The beach plan form could also become more curved between its bounding headlands. This roll-back could lead to erosion of the beach fronting Beesands village, exposing the backing coastal slopes to wave action at the toe that may in turn lead to a limited supply of sediment to the local beach.

The barrier's integrity would be largely retained, though breaches could occur during storm events and could become permanent due to the effect of the tidal prism that would be created by tidal exchange between the lagoon and the sea.

The Futurecoast (Halcrow, 2002) prediction for a 'with present management' scenario is for the defences along the southern part of this section of coast to continue to cause beach and foreshore steepening. The northern part of this section of coast is undefended and would roll-back into the low-lying Ley, causing a discontinuity in the beach plan form. The area where the defences end would become a focal point for wave energy and this could become a weak point with increased risk of failing in the future.

LOCAL SCALE: Beesands to Start Point

Interactions

This section of coast extends from Tinsey Head to Start Point and consists of resistant cliffs fronted for much of its length by shingle beach. Towards Start Point the beach disappears and the cliffs plunge directly into deep water.

There is one small section of this coast that is low-lying. This is at Greenstraight, where a valley intersects the coast. The village of Hallsands is also located in this area. This village was destroyed during a storm in 1917 due to the loss of beach that occurred in this area as a result of nearshore sediment dredging.

Movement

The cliffs along this frontage are very resistant and have remained relatively stable (Halcrow, 2002).

Existing Predictions of Shoreline Evolution

For an 'unconstrained' scenario, Futurecoast (Halcrow, 2002) predicted that the shingle beaches along this section of coast would maintain their present levels and form, and would retreat slowly in association with backing cliff retreat. This would eventually lead to the increasing influence of headlands along the frontage as they emerge further as adjacent cliffs retreat. The cliffs between Hare Stone and Start Point would remain stable.

The Futurecoast (Halcrow, 2002) prediction for a 'with present management' scenario is for the evolution of the shoreline to be largely as per the unconstrained scenario. The exception being at Greenstraight where the presence of a rock revetment would limit local cliff retreat, although the retreat of adjacent, undefended cliffs would mean this effect would not be significant.

C.1.14 Start Point to Rame Head

LARGE SCALE

Interactions

This section of the coast extends between the two headlands at Start Point in the east, and Rame Head in the west. In Futurecoast (Halcrow, 2002) this section of coast forms part of a wider shoreline behaviour unit that actually extends further west to Gribbin Head in Cornwall. However for the purposes of this SMP, only the information up to Rame Head has been considered.

The defining characteristics of this section of coast are long sections of cliffed shoreline that are indented with numerous small coves and pocket beaches, along with five ria-type estuaries that intersect the cliffs which formed as a result of rising sea levels during the Holocene marine transgression (c.10,000 years BP).

The dominant control on the evolution and behaviour of this section of coast is the resistance of the underlying geology. This geological resistance varies along the coast, with weaker rocks subject to ongoing cliff erosion supplying sediment to local pocket beaches at their toe, whilst harder more resistant rocks erode much more slowly, supplying very little sediment to the shoreline, and are fronted by rock platforms.

Along much of this section of coast, there are raised beach deposits consisting of pebbly sand and shingle, which were created during periods of higher sea levels in the past. As a result of the last glaciation, many of these raised beaches have been overlain by 'head' deposits. These raised beach and head deposits, where they are located above eroding cliffs, serve to supply larger amounts of beach building material to local pocket beaches than would occur by cliff erosion alone.

The estuaries that break up the cliff lines along this section of coast all have deep water at their mouths and most estuaries have rock headlands either side of their mouths. There is a small supply of sediment from the estuaries to local beaches that occur adjacent to the estuary mouths, the most notable being the tombolo that has developed at the mouth of the Avon estuary in the lee of Burgh Island. There is insufficient material to cause large sedimentary deposits such as spits or tidal deltas around the estuary mouths, or to affect coastal processes further a field than the very local beaches adjacent to the mouths. The upper reaches of these estuaries have infilled with fine grained fluvial material, resulting in the development of large inter-tidal deposits in these areas.

The orientation of this section of coast means it is exposed to the full force of south-westerly waves from the Atlantic. The dominance of these south-westerly waves and the high energy environment this creates, results in most of this hard rock coast being swept clear of sediment. Any accumulations of sediment tend to be in the sheltered embayments.

The south-westerly waves that dominate this section of coast give rise to a potential eastward transport of sediment. The relative lack of sediment in the coastal system, along with the presence of extensive rock platforms and headlands, means that actual longshore transport of sediment from west to east is very limited.

The offshore area is also steeply sloping, and so there is also a minimal area in which any sediment transport could occur along the seabed that could affect the shoreline.

Movement

The cliffs along this section of coast are all eroding slowly, although slight variations in geological resistance affect the rates of erosion that occur.

In the small embayments are small pocket beaches, where sediment moves only locally both alongshore and cross-shore in response to wave conditions, with very little loss of sediment from these systems.

Modifications

There are a number of discrete hard defence structures present along this section of coast, mostly in the form of cliff-toe protection structures associated with slope stabilisation works aimed at preventing cliff top retreat. The cliffs affected by these structures tend to be the softer, more erodible cliffs, and so the effect of these structures has also been to reduce the supply of sediment input to the local beaches along the shoreline.

Examples of such structures include seawalls and revetments behind the beaches at Inner and Outer Hope, Thurlestone, Bigbury and Challaborough.

The most significant structure along this section of coast is the Plymouth Sound Breakwater, which provides shelter to the inner Plymouth Sound from open water wave conditions. The breakwater causes a significant reduction in the amount of wave energy arriving along the shoreline of the Sound than would occur otherwise. The shoreline of Plymouth Sound is in any case largely defended by seawalls such as those at Kingsand, Cawsand, Picklecombe Point, Mount Batten Point and along the Plymouth City frontage as well.

LOCAL SCALE: Start Point to Bigbury-on-Sea

Interactions

Extending from Start Point to the eastern side of the Avon estuary at Thurlestone, this section of coast is dominated by sea cliffs fronted by rocky nearshore platforms. Between Start Point and Bolt Head, the cliffs that back the shoreline platform are head-deposit cliff slopes. From Bolt Head to the Avon estuary, the shoreline platform is backed by near vertical bed-rock cliffs that are overlain with head deposits, except at Thurlestone, where there is an area of low-lying land situated behind a small pocket beach.

Most of the cliffs fail as a result of debris slides within the soft overlying deposits, these events occur with a low periodicity. In the areas where there are steep cliffs, these are also subject to rock fall failures as a result of wave undercutting at the toe.

In a few places there are small pocket beaches located in embayments at the mouths of small streams that discharge to the shoreline through low points in the cliff line. These bays are generally small and flanked by cliffs with gently sloping land behind sand/shingle beaches. The exception to this is at Thurlestone, where the pocket beaches present are backed by low-lying land.

These small pocket beaches are largely independent of the adjacent shoreline with only localised longshore transport within the bays occurring, but no sediment exchange between the bays. The reason for this is the small volumes of sediment available for transport along with the highly indented shoreline that inhibits longshore transport processes. In addition to the cliffs, rock platforms and pocket beaches dominate the open coast shoreline.

Between Prawle Point and Bolt Head there lays the mouth of the Kingsbridge estuary. This estuary is a largely natural (undeveloped except for areas around Salcombe and Kingsbridge), sheltered, dendritic ria-type estuary that has many creeks and tributaries flowing into it including Bowcombe Creek, Frogmore Creek, Southpool Creek, Waterhead Creek, Collapit Creek, Blannksmill Creek and Batson Creek.

The estuary is cut into relatively high land and as a result its slopes are steep and in the outer reach extend to the high water mark as there is little inter-tidal area in the outer estuary. The main sediment input to the estuary is from fluvial sources and so it tends to be mud and silt that is deposited preferentially in the heads of the creeks, forming large areas of intertidal mudflats and salt marsh in the middle and upper estuary.

The mouth of the estuary is narrow and bounded by steep rocky cliffs, although a number of small sandy pocket beaches are present near the mouth and there is a small sand bar seaward of the mouth.

Movement

The cliffs along this section of coast are eroding slowly, with any notable retreat confined to the overlying head deposits rather than the harder, more resistant bed rock. The rate of erosion is dependent upon the specific local geology, with Futurecoast (Halcrow, 2002) suggesting that where erosion does occur, the mean annual rate of recession is about 0.1m/year.

The small pocket beaches that occur along this coast have been relatively stable over the past century, although they do experience short term variations in response to storm events.

Existing Predictions of Shoreline Evolution

For an 'unconstrained' scenario, Futurecoast (Halcrow, 2002) predicted that the present slow rates of cliff and nearshore rock platform recession would continue. Where these cliffs flank small pocket beaches, this erosion would maintain the supply of material to the beaches, which would also retreat slowly whilst retaining more or less their present form.

The low-lying land behind the pocket beaches at Thurlestone would be likely to experience an increased risk of flooding under storm conditions in the future due to sea level rise.

The Futurecoast (Halcrow, 2002) prediction for a 'with present management' scenario is for there to be a small reduction in the supply of sediment to the pocket beaches along the shoreline due to the reduction in erosion of the flanking cliffs as a result of cliff toe protection structures. The exception to this would be at Lannacombe which is presently undefended. Where there is a reduction in beach sediment supply, there would be some narrowing and steepening of the beaches in response to future sea level rise.

The continued presence of defences at Thurlestone would continue to provide protection against flooding of the backing low-lying land during storm events.

LOCAL SCALE: Bigbury-on-Sea

Interactions

This small section of coast extends from the eastern side of the mouth of the Avon estuary to Challaborough just to the west of Bigbury-on-Sea. The section includes the Avon estuary where the River Avon discharges to the sea, as well as Burgh Island which is located at the western side of the estuary mouth.

The presence of Burgh Island provides shelter to the estuary mouth from the dominant south-westerly waves that affect this coast, which has led to the development of a tombolo in the lee of the island. The sediment transport is also likely to have lead to the Avon estuary having large accumulations of sand sediment around its mouth at Cockleridge and Bantham Beach (Halcrow, 2002). These sand accumulations in the mouth of the Avon estuary are not entirely depositional features, with Bantham Beach representing a raised inter-glacial shore platform that is capped by sand dunes and fronted by only a thin layer of beach deposits (Blake *et al*, 2007).

Behind the beaches, the shoreline consists mostly of low, very resistant, cliffs, except at Challaborough, where the cliff line is interrupted by the discharge from a small stream that flows out to sea from a low-lying point between the flanking cliffs.

The Avon estuary itself is a small ria-type estuary that is mostly natural and undeveloped and which largely empties at low water. Its mouth is protected from south-westerly waves by Burgh Island, but is relatively more exposed to south-easterly waves. Sand deposits have however accumulated at the mouth of the estuary as a result of effect of Burgh Island (Halcrow, 2002). Within the estuary (upstream from the mouth) there are areas of accreting mudflats and salt marshes forming sizeable inter-tidal areas, with accretion of the salt marsh areas occurring at a rate of 3-7mm/year since the 1960's (Blake *et al*, 2007).

Whilst there is no specific information relating to waves within the Avon estuary, it is unlikely that waves are important within the estuary as it is relatively small and shallow compared to other estuaries in the region. The only impact of waves occurs at the mouth of the estuary, where wave and tidal induced movements of the sand deposits cause short term fluctuations.

Movement

The cliffs along this section of coast show little or no movement over the past century due to the resistant geology that forms them. The tombolo behind Burgh Island and the beach at Challaborough also appear to have been stable over the past century.

Despite responding to short term tide and wave conditions, the sand deposits in the mouth of the Avon estuary have retained their form and volume over the longer term (Halcrow, 2002). The position of the channel at the mouth of the estuary has migrated from west to east between 1890 and present (Blake *et al*, 2007).

Existing Predictions of Shoreline Evolution

For an 'unconstrained' scenario, Futurecoast (Halcrow, 2002) predicted that the cliffs that back the majority of this section of coast, as well as Burgh Island, will continue to be largely resistant to erosion over the next century. As a result the cliffs would continue to provide shelter to the estuary mouth such that conditions favourable to the retention of the beach in the lee of the island would be maintained. The beaches along this frontage would likely experience some narrowing in response to future sea level rise due to a limited supply of new sediment input from the River Avon.

The low-lying section of this frontage at Challaborough would by likely to experience some inundation into the stream that flows out here, although this would not form a significant tidal inlet as a result.

The Futurecoast (Halcrow, 2002) prediction for a 'with present management' scenario is for much of the frontage to respond in a way that is not unduly different to the unconstrained scenario, as there are few defences along this section of coast.

The exception is at Challaborough, where the continued presence of defences to reduce the risk of flooding of the backing low-lying land would lead to the possible narrowing of the beach width in response to future sea level rise and the coastal squeeze that this would cause.

LOCAL SCALE: Bigbury-on-Sea to Rame Head

Interactions

This section of coast extends from west of Bigbury-on-Sea westwards to Rame Head, it is dominated by open sea cliffs that are fronted by rock nearshore platforms. The form of these cliffs varies from head slopes to near vertical bed rock cliffs. The varying form of these cliffs gives rise to different methods of failure, with debris slides occurring within the head/raised beach deposits that overlie solid bed rock, while rock falls caused by undercutting due to wave action leading to failures in the hard vertical cliffs.

The cliff line is highly indented with small embayments, some of which are occupied by small pocket beaches. These mainly occur in relatively low-lying sections of the coast, such as at Wembury, Bovisand, Kingsand and Cawsand, and a flanked by cliffs with gently sloping land behind sand and shingle beaches. The shoreline is also interrupted by several estuaries of varying sizes.

The Erme estuary is a small ria-type estuary which is very exposed to south-westerly waves. It has similar characteristics with the neighbouring Avon estuary, with sand deposits at the mouth and mudflats and salt marshes towards the head. The estuary sides consist of a predominantly steep, natural shoreline.

The River Yealm discharges to the sea via the Yealm estuary. This is a ria-type estuary with a mainly steep, rocky shoreline and several small tributaries, such as Cofflete Creek, draining in to it. The mouth of the estuary is flanked by high, rocky cliffs and is exposed to south-westerly waves, although it is partially sheltered by Great Mew Stone, a small island situated at the entrance to Wembury Bay. River flows in the Yealm are relatively low and carry little in the way of suspended sediment. There are some small areas of sand flats around the mouth (though not as extensive as those located at the mouths of the Avon and Erme estuaries to the east). Small areas of intertidal mudflats are also present near the head of the estuary.

The largest estuary along this section of coast is the Plymouth estuary, which is a ria-type estuary that comprises the combined discharge of three large rivers; the River Tamar, the River Tavy and the River Plym. A number of smaller streams and creeks including the Rivers Tiddy and Lynher, and Tamerton Lake (which feeds into the River Lynher) also discharge into the estuary. Plymouth Sound forms the mouth of the Plymouth estuary. This mouth is flanked by steep, rocky cliffs, and is partially protected by the Plymouth Sound Breakwater, which limits the wave exposure of the shoreline on its landward side. The presence of Drake's Island within the Sound also provides a wave sheltering affect to parts of the shoreline. Waves within the estuary are, as a result of these human and natural features, largely limited to being wind generated.

No information about the extent to which waves generated within Plymouth Sound affect the three contributing 'sub' estuaries has been identified. However it is unlikely that any effects are very limited due to the narrowness of the mouths of the Tamar and Plym. The length of the Tamar estuary could be, under the right conditions, subject to some limited wind-driven waves, although it is unlikely that they would reach any great height.

The sediments of the Plymouth estuary system are dominated by fine muds and silts, although there are some sands and shingles in the lower parts of the estuaries. As a result of this mud dominated sediment system, there are extensive intertidal areas consisting of mudflats within the three contributing 'sub' estuaries. These tend to be deposited in the middle and upper estuaries and in the tributaries, such as at St. John's Lake in the Tamar. There are also some areas of salt marsh present in parts of the Plymouth estuary system, though these show signs of erosion.

The city of Plymouth dominates the lower parts of the Tamar and Plym estuaries and as such confine the estuaries in these areas. The Tamar in particular is also extensively modified by dredging and port development in the lower reaches, up to the Tamar Bridge that crosses the River at Saltash. Above this bridge the estuary is largely natural and less affected by human development.

The Plymouth estuary system, and the Tamar estuary in particular, has been extensively studied over the past 30 years, and this has determined that there is very little sediment exchange between the estuary and the open sea. As such, and despite its large size, the Plymouth estuary has little impact upon the nearby coast.

Movement

The cliffs and fronting rock platforms are comprised of relatively resistant bed rock that erodes only very slowly. Analysis undertaken for Futurecoast (Halcrow, 2002) suggests that erosion along much of this section of coast over the past century has been negligible. The only notable retreat observed in the Futurecoast (Halcrow, 2002) analysis occurs in the overlying head and raised beach deposits, which show a mean annual rate of retreat of up to 0.1m/year around Hilsea Point (to the south-east of Wembury).

The small pocket beaches located along this section of coast have also been very stable over the past century, with no significant change in width or position over this time. Seasonal fluctuations do occur in response to storm events.

Existing Predictions of Shoreline Evolution

For an ‘unconstrained’ scenario, Futurecoast (Halcrow, 2002) predicted that there would be a continuation of the present low rates of cliff and nearshore platform retreat. Without the presence of the breakwater, the shoreline around the inner Plymouth Sound would experience a significant increase in wave energy at the coast. An increase in wave energy would increase erosion rates from the present sheltered Sound, it would not have a significant impact on the morphology of the inner Sound due to the resistant geology of the shoreline. Instead erosion rates would be likely to increase to the same as those occurring in the presently unprotected outer Sound leading to indentation of the shoreline of the inner Sound in much the same way as the outer Sound.

There could be some re-activation of currently protected cliffs along the rest of the frontage, leading to cliff top retreat and possibly some additional sediment input to the local pocket beaches.

The Futurecoast (Halcrow, 2002) prediction for a ‘with present management’ scenario is for the continued presence of the Plymouth Sound Breakwater. The maintenance of the breakwater would shelter the inner Sound from exposure to the dominant south-westerly waves from the Atlantic, which in turn would significantly limit the erosion of the shoreline of the inner Sound. Other presently defended parts of this section of coast would also continue to limit localised cliff recession and subsequent sediment inputs to local beaches.

The areas where there are no defences, such as the cliffs of the outer Plymouth Sound, would behave in a way not unduly different from the unconstrained scenario.

C.2 Defence Assessment

C.2.1 Overview

The Table below provides a summary of the existing defences along the SMP2 frontage together with an assessment of residual life. The information in this table is based upon the information that has been collected as part of the National Flood and Coastal Defence Database (NFCDD) update, which Halcrow was commissioned by the Environment Agency to undertake in parallel to the SMP2. This update involved surveying defence levels along the shoreline, noting the type of defence structures present and assessing the condition of the defences. It ensures that the most current information has been utilised in the development of this SMP2. The reference date of the information contained in this report is October 2008.

Additional information contained in both of the two first round shoreline management plans for (1) Portland Bill to Durlston Head, and (2) Portland Bill to Rame Head has also been utilised to supplement the NFCDD update data in the appraisals of 'No Active Intervention' and 'With Present Management' presented in Sections C.4 and C.5 of this report, to cover areas of private defences or other non-coastal defence structures. In these cases, the SMP1 data was used to identify areas where NFCDD data was not present and so guide where site visits were required to appraise the current condition of those defences.

For all defences assessed the 'overall condition' and 'residual life' have been defined.

Overall condition is a description of the state of the defences and has appraised been using the Environment Agency's National Sea and River Defence Survey's Condition Assessment Manual (1998), which is summarised in Table C.2.1 below.

This condition assessment, along with the type of defence, has then been used to determine an estimate of when defences are most likely to fail under a 'no active intervention' scenario (i.e. in the short, medium or long term), using Table C.2.2 below as a guide[1].

Rating	Condition	Description	Extent of Defect and Estimated Life
1	**Very Good**	Good condition. Fully serviceable. Maintenance to continue as present. No remedial work required.	No significant defect. Estimated life typically more than 30 years.
2	**Good**	In reasonable condition. Minor defects. Minor routine or increase in routine maintenance required.	Not more than 5% of area, length or height affected by defect. Estimated life typically 15 to 30 years.
3	**Fair**	Average Condition. Requires careful monitoring. Some minor repairs needed and significant improvements in maintenance.	Moderate defects affecting 5% to 20% of area, length, or height. Replacement typically likely within 5 to 15 years.
4	**Poor**	Some major repairs needed but not urgent. Structurally unsound now or in the near future.	Extensive defects affecting 20% to 50% of area, length or height. Replacement typically needed within the next 1 to 5 years.
5	**Very Poor**	Complete failure or derelict. Major urgent repairs or replacement without delay.	Severe and/or extensive defects over 50% of area, length or height. Replacement typically likely to be required within the next year.

Table C.2.1 Guide to assessing condition grade (based upon Environment Agency, 1998)

[1] *Note, that the values in Table C.2.2 differ from those presented within the NFCDD summary table below due to different requirements on how this information is stored in the NFCDD.*

Defence Description	Estimate of residual life (years) under NAI policy				
	Existing Defence Condition Grade:				
	Grade 1	**Grade 2**	**Grade 3**	**Grade 4**	**Grade 5**
Seawall (concrete/ masonry)	40 to 50	25 to 35	15 to 25	10 to 15	5 to 7
Revetment (rock)	40 to 50	25 to 35	15 to 25	10 to 15	5 to 7
Timber structures	20 to 30	15 to 25	10 to 20	8 to 12	2 to 7
Gabions	15 to 25	10 to 15	6 to 10	4 to 7	1 to 3

Table C.2.2 Guide to estimating residual life of defences

NFCDD Reference Number	Location	Primary Defence	Secondary (seaward)	Secondary (landward)	Foreshore Type	Overall Condition	Residual Life (years) assuming no active intervention
111EGS2151001C02	Kimmeridge	Masonry Seawall	Boulders		beach - cobble	3	11-20
111EGS2151001C01	Kimmeridge	Boulders			beach - cobble	3	11-20
	Lulworth Cove	Seawall			beach - gravel	3	11-20
	Ringstead Bay	Rock Groyne			beach - mixed	2	>20
	Ringstead Bay	Clay Embankment			beach - mixed	4	1-5
111EGS2501001C05	Bowleaze	Gabions	Boulders		beach - mixed	3	11-20
111EGS2501001C04	Bowleaze	Boulders			beach - mixed	3	11-20
111EGS2501001C03	Bowleaze	Rock Armour			beach - sandy	3	11-20
111EGS2501001C02	Bowleaze	Concrete Seawall			beach - sandy	3	11-20
111EGS2501001C01	Bowleaze	Rock Armour			beach - sandy	3	11-20
111EGS2502001C03	Overcombe	Concrete Seawall with Recurve	Armourflex Revetment		beach - gravel	2	>20
111EGS2502001C01	Weymouth - Seafront	Concrete Seawall		Concrete Splash Wall	beach - gravel	2	>20
111EGS2502501C01	Weymouth Seafront (Splash Wall)	Concrete Splash Wall			beach - mixed	2	>20
111EGS2502501C01	Weymouth - Seafront	Concrete Seawall			beach - mixed	2	>20
111EGS2502501C02	Weymouth - Ferry Terminal	Steel Sheet Piling			beach - sandy	2	>20
	Weymouth – harbour walls (north side)	Concrete capped steel piling				2	>20
	Weymouth – harbour walls (west side)	Masonry Seawall				4	6-10
	Weymouth – harbour walls (south side)	Concrete capped steel and timber piling				2	>20
	Weymouth – harbour walls (Nothe Parade)	Masonry Seawall				3	11-20
111EGS2550501C01	Weymouth - South Pier	Masonry Harbour Arm				2	>20
111EGS2600501C05	Weymouth - Nothe Fort				shore platform	3	11-20

NFCDD Reference Number	Location	Primary Defence	Secondary (seaward)	Secondary (landward)	Foreshore Type	Overall Condition	Residual Life (years) assuming no active intervention
111EGS2600501C04	Weymouth - Nothe Gardens	Rock Armour			shore platform	2	>20
	Weymouth – Jubilee Walk (eastern end)	Masonry Seawall			shore platform	4	1-5
111EGS2600501C03	Weymouth - Jubilee Walk	Concrete Seawall with Recurve		Concrete Splash Wall	shore platform	1	>20
111EGS2600501C02	Weymouth - Newton's Cove	Masonry Seawall	Rock Armour		beach - mixed	1	>20
111EGS2600501C01	Weymouth - DERA Bincleaves	Rock Armour				1	>20
111EGS2650501C04	Weymouth - Wyke Regis	Boulders			beach - sandy	4	1-5
111EGS2650501C03	Weymouth - Wyke Regis	Boulders			beach - sandy	4	1-5
111EGS2650501C02	Weymouth - Wyke Regis	Masonry Seawall			beach - sandy	2	11-20
111EGS2650501C01	Weymouth - Wyke Regis	Boulders			beach - sandy	2	11-20
111EGS2651501C04	Portland - Dismantled Railway	Clay Embankment			beach - gravel	2	11-20
111EGS2652001C04	Portland - Marina	Rock Armour				2	>20
111EGS2652001C02	Portland - Flood Embankment	Clay Embankment				2	>20
111FAS3100501C06	Portland - Flood Wall	Concrete Floodwall				2	>20
111EGS2652001C03	Portland - Flood Embankment	Clay Embankment				2	>20
111FAS3100501C09	Portland - Flood Embankment	Clay Embankment				2	>20
111EGS2652501C05	Portland Port	Concrete Revetment				2	>20
111EGS2652501C04	Portland Port	Steel Sheet Piling				2	>20
111EGS2652501C03	Portland Port	Concrete Piling				3	11-20
111EGS2652501C02	Portland Port	Masonry Seawall	Rock Armour			2	>20

NFCDD Reference Number	Location	Primary Defence	Secondary (seaward)	Secondary (landward)	Foreshore Type	Overall Condition	Residual Life (years) assuming no active intervention
111EGS2652501C01	Portland Port	Masonry Seawall				2	>20
111EGS2700501C01	East Portland	Masonry Seawall	Rock Armour			3	>20
111EGS2700501C02	East Portland	Rock Armour				3	>20
111FAS3100501C01	Portland - Chesil Cove	Concrete Seawall with Recurve	Rock Revetment		beach - gravel	2	>20
	Portland - Chesil Cove	Concrete Seawall with Recurve	Splash Wall with Recurve		beach - gravel	2	>20
111FAS3101502C03	West Bay - Eastern Harbour Arm	Steel Sheet Piling				1	>20
111FAS3101502C01	West Bay - Inner Harbour	Masonry Harbour Wall				2	>20
111FAS3101502C04	West Bay - Central Harbour Arm	Steel Sheet Piling				1	>20
111FAS3101503C02	West Bay - Harbour Slipway	Rock Armour				1	>20
111FAS3101503C03	West Bay - Western Harbour Arm	Steel Sheet Piling	Rock Armour			1	>20
111FAS3101503C01	West Bay - West Beach	Concrete Seawall with Recurve			beach - gravel	2	>20
111FAS3150501C01	West Bay - West Beach	Masonry Seawall with Parapet	Rock Armour		beach - gravel	2	>20
111FAS3150501C03	Seatown	Masonry Seawall			beach - gravel	4	1-5
111FAS3150501C02	Seatown	Rock Armour			beach - gravel	2	11-20
111FAS3150502C02	Charmouth	Concrete Seawall with Parapet			beach - gravel	2	>20
111FAS3150502C03	Charmouth	Concrete Stepped Revetment			beach - gravel	2	>20
111FAS3151001C02	Lyme Regis - East	Concrete Seawall with Parapet			shore platform	3	11-20
111FAS3151001C01	Lyme Regis - East	Concrete Seawall with Recurve			shore platform	3	11-20
113FAS3200501C05	Lyme Regis - Church	Masonry Seawall			beach - gravel	2	>20

NFCDD Reference Number	Location	Primary Defence	Secondary (seaward)	Secondary (landward)	Foreshore Type	Overall Condition	Residual Life (years) assuming no active intervention
	Cliffs						
113FAS3200501C11	Lyme Regis - Marine Parade	Concrete Seawall with Recurve			shingle ridge	1	>20
113FAS3200501C12	Lyme Regis - Marine Parade	Masonry Seawall			beach - sandy	1	>20
113FAS3200501C13	Lyme Regis - Slipway	Concrete Slipway			beach - sandy	1	>20
113FAS3200501C02	Lyme Regis - The Cobb	Masonry Harbour Wall			beach - sandy	2	>20
113FAS3200501C20	Lyme Regis - The Cobb	Masonry Harbour Arm			beach - sandy	2	>20
113FAS3200501C17	Lyme Regis - The Cobb	Masonry Harbour Arm				2	>20
	Seaton – Axe Estuary mouth	Masonry Harbour Arm			beach - gravel	2	>20
113FAS3201002C02	Seaton, Esplanade	Concrete Seawall with Parapet		Concrete Splash wall with Recurve	shingle ridge	2	>20
113FAS3201003C01	Seaton, West Walk	Masonry Seawall with Parapet			shingle ridge	2	11-20
113FAS3201004C01	Seaton, West Walk	Concrete Seawall			shingle ridge	2	11-20
NEW ASSET	Seaton, West Walk to Seaton Hole				beach - gravel	3	6-10
113FAS3201004C03	Seaton Hole	Concrete Revetment			beach - mixed	3	6-10
	Beer	Concrete Groyne			beach - gravel	4	1-5
113FAS3251001C01	SIDMOUTH SEA FRONT					1	>20
113FAS3251001C02	SIDMOUTH SEA FRONT	Concrete Seawall with Parapet	Masonry Apron	Concrete Splash wall			
113FAS3251001C11							
113FAS3251001C03	SIDMOUTH SEA FRONT					3	>20
	Budleigh Salterton	Gabions			beach - gravel	3	11-20

NFCDD Reference Number	Location	Primary Defence	Secondary (seaward)	Secondary (landward)	Foreshore Type	Overall Condition	Residual Life (years) assuming no active intervention
113FAS3351002C01	Exmouth, Queens Drive	Masonry Seawall			beach - sandy	3	11-20
NEW ASSET	Exmouth, The Maer				beach - sandy	2	>20
113FAS3351002C02	Exmouth, Queens Drive	Masonry Seawall	Rock Armour		beach - sandy	2	>20
113FAS3351002C03	Exmouth, Queens Drive	Concrete Seawall			beach - sandy	2	>20
113FAS3351002C04	Exmouth, Esplanade	Masonry Seawall with Recurve			beach - sandy	2	>20
113FAS3351002C05	Exmouth, Esplanade	Masonry Seawall	Masonry Apron		beach - sandy	2	11-20
113FAS3351003C01	Exmouth, The Point, Harbour	Masonry Seawall with Recurve	Masonry Apron			3	>20
113FAS3351003C02	Exmouth Point, Harbour	Steel Sheet Piling				3	>20
NEW ASSET	Exmouth Point				beach - sandy	2	>20
113FAS3351003C03	Exmouth Point	Concrete Seawall			beach - sandy	2	>20
113FAS3351003C04	Exmouth, Exe Sailing Club	Timber Piling			beach - mixed	3	11-20
113FAS3351003C05	Exmouth, Exe Sailing Club	Concrete & Brickwork Seawall			beach - mixed	3	11-20
113FAS3351003C06	Exmouth, Exe Sailing Club	Gabions			beach - mixed	3	6-10
113FAS3351003C07	Exmouth, Camperdown Terrace	Masonry Revetment			beach - mixed	2	>20
113FAS3351003C08	Exmouth, Camperdown Terrace	Complex wall			beach - mixed	2	11 - 20
113FAS3351003C09	Exmouth, Camperdown Terrace	Complex wall			beach - mixed	2	11 - 20
113FAS3351003C10	Exmouth, Camperdown Terrace					2	11 - 20
113FAS3351004C01	EXMOUTH, Lavis Boat Yard					3	>20

NFCDD Reference Number	Location	Primary Defence	Secondary (seaward)	Secondary (landward)	Foreshore Type	Overall Condition	Residual Life (years) assuming no active intervention
113FAS3351004C02	Exmouth, Imperial Recreation Ground	Gabions			beach - mixed	2	11 - 20
113FAS3351004C03	Exmouth, Playing Field	Concrete Block Revetment			beach - mixed	3	6-10
113FAS3351014C03	Dawlish Warren	Concrete Block Revetment			beach - mixed	2	11-20
113FAS3351015C01	Dawlish Warren	Concrete Seawall with Recurve	Rock Armoured Revetment		beach - sandy	2	>20
113FAS3351015C02	Dawlish Warren	Masonry Seawall	Rock Armoured Revetment		beach - sandy	3	11-20
113FBS3351501C02	Dawlish Warren to Dawlish	Masonry Seawall with Recurve	Concrete Apron	Masonry Splash wall	beach - mixed	3	11-20
113FBS3351501C03	Dawlish Warren to Dawlish	Masonry Seawall with Recurve	Concrete Apron	Masonry Splash wall	beach - mixed	3	11-20
113FBS3351501C04	Dawlish, Train Station	Masonry Seawall		Masonry Seawall	beach - mixed	2	>20
113FBS3351501C05	Dawlish, King's Walk	Masonry Seawall			beach - mixed	2	>20
113FBS3351501C06	Dawlish, Cowhole Rocks	Masonry Seawall with Parapet			shore platform	3	11-20
113FBS3351501C07	Dawlish, Coryton's Cove	Masonry Seawall with Parapet			beach - mixed	3	11-20
113FBS3351502C01							
113FBS3351502C02	Horse Rocks				beach - sandy		
113FBS3351502C03							
113FBS3400501C05	Teignmouth North				beach - sandy		
113FBS3400501C01	North Teignmouth to Sprey Point	Masonry Seawall with Recurve	Concrete Apron	Masonry Splash wall	beach - sandy	2	>20
113FBS3400501C06	Teignmouth, Sprey Point	Masonry Seawall with Recurve	Masonry Apron	Masonry Splash wall	beach - mixed	2	11-20
113FBS3400501C03	Teignmouth, Sprey Point to Promenade	Masonry Seawall with Recurve	Masonry Apron	Masonry Splash wall	beach - sandy	3	>20
113FBS3400502C01	Teignmouth, North Promenade	Masonry Seawall with Parapet		Masonry Splash wall	beach - sandy	3	11-20

NFCDD Reference Number	Location	Primary Defence	Secondary (seaward)	Secondary (landward)	Foreshore Type	Overall Condition	Residual Life (years) assuming no active intervention
113FBS3400502C02	Teignmouth, Promenade	Concrete Seawall with Recurve		Concrete Splash wall	beach - sandy	3	>20
113FBS3400502C03	Teignmouth, Promenade	Concrete Seawall with Recurve		Masonry Splash wall	beach - sandy	2	>20
113FBS3400502C04	Teignmouth, The Point	Masonry Seawall	Concrete Apron		beach - sandy	3	>20
113FBS3400502C05	Teignmouth (Estuary), The Point	Masonry wall			beach - mixed	2	>20
113FBS3400502C06	Teignmouth (Estuary), The Point	Complex wall			beach - sandy	2	>20
113FBS3400502C07	Teignmouth (Estuary)	Masonry wall			beach - sandy	2	>20
113FBS3400502C08	Teignmouth (Estuary)	Complex wall			beach - sandy	3	11 - 20
113FBS3400502C09	Teignmouth, New Quay	Concrete Flood wall			beach - mixed	3	11 - 20
113FBS3400502C14	Shaldon Bridge				mudflat	2	>20
113FBS3400502C16	Shaldon, The Embankment	Masonry Seawall			beach - sandy	2	>20
113FBS3400502C17		Masonry Seawall with Parapet			beach - mixed	2	>20
113FBS3400503C01	Shaldon, Albion Street	Masonry Seawall			beach - mixed	3	11 - 20
113FBS3400503C05	Shaldon, Albion Street	Concrete Seawall			beach - mixed	2	>20
113FBS3400503C02	Shaldon, Riverside	Masonry wall			beach - mixed	3	6-10
113FBS3400503C04	Shaldon, Riverside	Masonry wall			beach - mixed	2	>20
113FBS3400503C06	Shaldon, Riverside	Masonry wall			beach - sandy	2	>20
113FBS3400503C07	Shaldon, Quay	Concrete Quay wall			beach - sandy	2	>20
113FBS3400503C09	Shaldon, Strand	Masonry wall			beach - sandy	2	>20
113FBS3400503C11	Shaldon, Strand	Masonry wall			beach - sandy	2	>20
113FBS3400503C13	Shaldon, Marine Parade	Masonry wall			beach - sandy	2	>20
113FBS3400503C15	Shaldon, Marine Parade	Masonry Seawall			beach - sandy	3	>20
113FBS3400503C16	Shaldon, Marine	Masonry Seawall	Concrete Apron		beach - mixed	2	>20

NFCDD Reference Number	Location	Primary Defence	Secondary (seaward)	Secondary (landward)	Foreshore Type	Overall Condition	Residual Life (years) assuming no active intervention
	Parade						
113FBS3400503C18		Concrete Seawall		Masonry Splash wall	beach - mixed	2	>20
113FBS3401501C02	Oddicombe Beach	Concrete Stepped Revetment			shingle ridge	5	<1
113FBS3401501C03	Blackball Rocks	Rock Armoured Revetment			beach - mixed	2	11-20
113FBS3401501C18						2	
113FBS3401501C05	Babbacombe Beach	Masonry Seawall	Concrete Apron		beach - mixed	2	11-20
113FBS3401501C19	Babbacombe Beach	Masonry Seawall		Splash wall	beach - mixed	2	>20
113FBS3401501C06	Babbacombe Beach	Masonry Seawall			shore platform	2	>20
113FBS3401501C07	Babbacombe Beach	Concrete Breakwater			beach - mixed	2	
113FBS3401501C20						2	
113FBS3401501C08	Babbacombe Breakwater to Withy Point	Concrete Seawall			beach - cobble	2	>20
113FBS3401501C13	Anstey's Cove	Masonry Seawall with Recurve			shore platform	3	11-20
113FBS3450201C04	Meadfoot Beach	Masonry Seawall			beach - mixed	3	11-20
113FBS3450201C05	Meadfoot Beach	Concrete Seawall with Parapet			beach - gravel	2	>20
113FBS3450501C01	Torquay, Torre Abbey Sands	Masonry Seawall			beach - sandy	2	>20
113FBS3450501C02	Torquay, Torre Abbey Sands	Masonry Seawall	Concrete Stepped Revetment		beach - sandy	2	>20
113FBS3450501C03	Torquay, Corbyn's Beach	Masonry Seawall			beach - sandy	2	>20
113FBS3450502C02	Torquay, Livermead Sands	Masonry Seawall	Concrete Apron		beach - sandy	3	11-20
113FBS3450502C03	Torquay, Livermead Head	Masonry Seawall			shore platform	3	>20
113FBS3450502C06	Hollicombe Beach				beach - sandy	2	>20

NFCDD Reference Number	Location	Primary Defence	Secondary (seaward)	Secondary (landward)	Foreshore Type	Overall Condition	Residual Life (years) assuming no active intervention
113FBS3450502C08	Paignton, Marine Parade	Masonry Seawall with Recurve	Concrete Apron		beach - sandy	3	>20
113FBS3450503C13	Paignton, Preston Sands	Masonry Seawall	Masonry Revetment + Concrete Apron		beach - sandy	2	>20
113FBS3450503C12	Paignton, Preston Sands	Concrete Splash wall	Concrete Apron		beach - sandy	2	>20
113FBS3450503C14	Paignton, Preston Sands	Masonry Seawall	Masonry Revetment + Concrete Apron		beach - sandy	2	>20
113FBS3450503C02	Paignton, Redcliffe Hotel	Masonry Seawall	Masonry Apron		beach - sandy	3	>20
113FBS3450503C03	Paignton, Paignton Sands	Masonry Seawall	Concrete Apron	Splash wall	beach - sandy	2	>20
113FBS3450503C06	Paignton, Paignton Sands	Masonry Seawall	Masonry Revetment + Concrete Apron		beach - sandy	3	>20
113FBS3450503C07	Paignton, Paignton Sands	Masonry Seawall	Masonry Revetment + Concrete Apron		beach - sandy	2	>20
113FBS3450503C08	Paignton, Paignton Sands	Masonry Seawall with Concrete Parpapet			beach - sandy	2	>20
113FBS3450504C01	Paignton Harbour, North Quay	Masonry Quay wall				2	>20
113FBS3450504C10	Paignton Harbour, North Quay	Concrete Quay wall				2	>20
113FBS3450504C11	Paignton Harbour, Inner Harbour	Masonry Quay wall				2	>20
113FBS3450504C12	Paignton Harbour, Inner Harbour	Masonry Quay wall				2	>20
113FBS3450504C14	Paignton Harbour, South Quay	Masonry Quay wall				2	>20

NFCDD Reference Number	Location	Primary Defence	Secondary (seaward)	Secondary (landward)	Foreshore Type	Overall Condition	Residual Life (years) assuming no active intervention
113FBS3450504C15	Paignton Harbour, East Quay	Masonry Quay wall				2	>20
113FBS3450504C16	Paignton Harbour, East Quay	Masonry Quay wall				2	>20
113FBS3450505C01	Goodrington Sands North, Cliff Gardens	Concrete Seawall with Recurve				2	>20
113FBS3450505C02	Goodrington Sands North	Masonry Seawall	Concrete Apron		beach - sandy	2	>20
113FBS3450505C03	Goodrington Sands	Masonry Seawall	Concrete Apron		beach - sandy	2	>20
113FBS3450505C04	Goodrington Sands	Concrete Seawall with Recurve + Masonry Seawall	Concrete Apron		beach - sandy	2	>20
113FBS3450505C05	Goodrington Sands	Masonry Seawall	Concrete Apron		beach - sandy	3	11-20
113FBS3450505C06	Goodrington Sands South	Concrete Seawall with Recurve	Concrete Apron		beach - sandy	3	>20
113FBS3450505C07	Goodrington Sands South	Masonry Seawall	Concrete Apron		beach - sandy	3	>20
113FBS3450507C01	Broad Sands	Concrete Seawall	Concrete Apron		beach - sandy	4	1-5
113FBS3450507C02	Broad Sands	Concrete Seawall			beach - sandy	2	>20
113FBS3450507C03	Broad Sands	Concrete Seawall	Concrete Apron + Steel Sheet Piling		beach - sandy	3	11-20
113FBS3450507C04	Broad Sands	Concrete/Masonry Seawall	Concrete Apron		beach - sandy	2	11-20
113FBS3450507C11	Broad Sands	Concrete Seawall			beach - cobble	3	11-20
113FBS3450508C10	Brixham, Oxen Cove	Concrete Seawall		Earth Embankment	beach - sandy	2	>20
113FBS3450508C11	Brixham, Oxen Cove	Concrete Seawall	Rock Armoured Revetment		beach - sandy	2	>20
113FBS3450508C12	Brixham, Oxen Cove	Concrete Seawall			beach - sandy	2	
113FBS3450509C01	BRIXHAM HARBOUR					2	
113FBS3450509C07	Brixham, Eastern Quay	Masonry Quay wall				2	>20

NFCDD Reference Number	Location	Primary Defence	Secondary (seaward)	Secondary (landward)	Foreshore Type	Overall Condition	Residual Life (years) assuming no active intervention
113FBS3450509C08	Brixham, Eastern Quay	Masonry Harbour Arm				2	>20
113FBS3450509C09	Brixham, Southern Quay	Masonry Quay wall				2	>20
113FBS3450509C10	Brixham, Southern Quay	Masonry Quay wall				2	>20
113FBS3450509C11	Brixham, Southern Quay	Masonry Quay wall				2	>20
113FBS3450509C13	Brixham, Southern Quay to Marina	Masonry Quay wall				2	>20
113FBS3450509C14	Brixham, Marina Slipway	Concrete Slipway				2	>20
113FBS3450508C10	Brixham, Oxen Cove	Concrete Seawall		Earth Embankment	beach - sandy	2	>20
113FBS3450509C18	Brixham, Oxen Cove	Concrete Seawall		Masonry Splash wall	beach - gravel	3	11-20
113FBS3450510C03	Brixham, Shoalstone Beach	Concrete Seawall		Concrete Splash wall	shore platform	2	>20
113FBS3450510C04	Brixham, Shoalstone Beach	Concrete Seawall			shore platform	2	>20
113FBS3450510C05	Brixham, Shoalstone Beach	Masonry Seawall		Masonry Seawall	shore platform	2	>20
113FBS3501503C04	Dartmouth North	Concrete Seawall			estuarine mudflat	2	>20
113FBS3501503C01	DARTMOUTH SOUTH					2	>20
113FBS3501503C02	Dartmouth Centre	Steel Sheet Piling + Concrete Capping			estuarine mudflat	2	>20
113FBS3501503C03	DARTMOUTH SOUTH					2	>20
113FBS3501505C01	Dartmouth South				estuarine mudflat	2	>20
113FBS3501505C02	Dartmouth South to					2	>20

NFCDD Reference Number	Location	Primary Defence	Secondary (seaward)	Secondary (landward)	Foreshore Type	Overall Condition	Residual Life (years) assuming no active intervention
	Halftide Rock						
113FBS3501505C04	Warfleet Creek to Castle Point					2	>20
113FBS3501502C01	Kingswear				beach - sandy	2	>20
113FBS3550501C09	Blackpool Sands				shingle ridge	2	>20
113FBS3550502C01	Blackpool Sands	Concrete Seawall			shingle ridge	2	>20
113FBS3550502C02	Blackpool Sands	Rock Armour			shingle ridge	2	>20
113FBS3550502C03	Blackpool Sands	Armour-flex Revetment			shingle ridge	2	>20
113FBS3551002C02	Torcross North	Concrete Seawall with Recurve			shingle ridge	3	11-20
113FBS3551002C03	Torcross	Concrete Seawall with Recurve	Rock Armour		shingle ridge	2	11-20
113FBS3551002C05		Concrete Seawall with Parapet			shingle ridge	2	11-20
113FBS3551004C01	Beesands North	Gabions			shingle ridge	2	11 - 20
113FBS3551004C02	Beesands North	Gabions			shingle ridge	2	>20
113FBS3551004C03	Beesands South	Concrete Seawall with Recurve	Rock Armoured Revetment		shingle ridge	2	>20
113FBS3551004C04	Beesands South	Concrete Seawall with Recurve	Rock Armoured Revetment		shingle ridge	2	>20
113FBS3551004C05	Beesands South	Concrete Seawall	Rock Armoured Revetment		shingle ridge	2	11-20
113FBS3551005C04	Greenstraight, Hallsands					2	>20
113FBS3551005C05	Hallsands				shingle ridge	2	>20
113FBS3551005C06	Hallsands				shingle ridge	2	>20
113FCS3650501C11	Hope Cove South	Masonry Seawall	Concrete Apron		beach - sandy	2	>20
113FCS3650501C21	Hope Cove South	Masonry Seawall	Concrete/Masonry Apron		beach - sandy	2	>20
113FCS3650501C22		Masonry Seawall			shore platform	2	>20

NFCDD Reference Number	Location	Primary Defence	Secondary (seaward)	Secondary (landward)	Foreshore Type	Overall Condition	Residual Life (years) assuming no active intervention
113FCS3650501C28	Hope Cove North	Concrete Breakwater			shore platform	3	11-20
113FCS3650501C29	Hope Cove North	Concrete Breakwater			shore platform	3	11-20
113FCS3650501C14	Hope Cove North	Concrete Breakwater			shore platform	3	11-20
113FCS3650501C23	Hope Cove North	Concrete Seawall			beach - sandy	3	11-20
113FCS3650501C24	Hope Cove North	Masonry Seawall			beach - sandy	2	>20
113FCS3650501C25	Hope Cove North	Masonry Seawall			beach - sandy	2	>20
113FCS3650501C13	Hope Cove North	Masonry Seawall			beach - sandy	2	>20
113FCS3650501C27						2	
113FCS3650501C31	Outer Hope, Mouthwell	Masonry Seawall			beach - sandy	4	6-10
113FCS3650501C05	Outer Hope, Mouthwell	Masonry Seawall			beach - sandy	2	>20
113FCS3650501C32	Outer Hope, Mouthwell	Masonry Seawall			beach - sandy	2	>20
113FCS3650501C15	Grand View Road					2	>20
113FCS3650501C33	Thurlestone Rock	Masonry Seawall			beach - sandy	2	>20
113FCS3650501C34	Thurlestone Rock	Concrete Seawall	Rock Armoured Revetment		beach - sandy	2	>20
113FCS3650501C16	Thurlestone Rock	Concrete Seawall	Rock Armoured Revetment	Armour-flex Revetment	beach - sandy	2	>20
113FCS3650501C35	Thurlestone Rock	Concrete Seawall	Rock Armoured Revetment	Splash wall	beach - sandy	2	>20
113FCS3651003C04	Fryer Tucks, Challaborough	Masonry Seawall	Rock Armoured Revetment		beach - sandy	2	>20
113FCS3651003C01	Regatta Restaurant, Challaborough	Rock Armoured Revetment			beach - sandy	2	11 - 20
113FCS3651003C02	Challaborough					2	>20
113FCS3651003C05	Challaborough					2	>20
113FCS3651003C06	Beach Car Park & Bungalows, Challaborough	Blockwork Wall		Earth Embankment	beach - sandy	2	>20

NFCDD Reference Number	Location	Primary Defence	Secondary (seaward)	Secondary (landward)	Foreshore Type	Overall Condition	Residual Life (years) assuming no active intervention
113FCS3651003C07	Challaborough					2	>20
113FCS3651003C03	Slipway, Challaborough	Slipway			beach - sandy	2	>20
113FCS3651503C02	Wrinkle Wood					2	>20
113FCS3651502C01	Wonwell Beach, River Erme					3	11 - 20
113FCS3651505C01	Coastguards, Mothercombe					2	>20
113FCS3651505C02	Meadowsfoot Beach					2	>20
114FCS3700501C02	Breakwater, Mount Batten, Plymouth	Concrete Seawall	Rock Armoured Revetment		n/a - sub merged	3	6 - 10
NEW_ASSET_41_1	The Quay Flats, Oreston, Plymouth	Masonry Seawall			n/a - submerged	1	
NEW_ASSET_41_2	The Quay, Oreston, Plymouth	Masonry Seawall			n/a - submerged	2	
NEW_ASSET_41_3	Baylys Road Houses, Plymouth					3	
NEW_ASSET_41_4	Waterside Village, Oreston, Plymouth	Masonry Seawall			n/a - submerged	4	
NEW_ASSET_41_5	The Castle, Oreston, Plymouth	Masonry Seawall			beach - gravel	4	
NEW_ASSET_41_6	Hooe Quay, Plymouth	Masonry Seawall			beach - mixed	4	
NEW_ASSET_41_7	Hooe Sluice, Plymouth	Gabion Basket Revetment			beach - mixed	2	
NEW_ASSET_41_8	Barton Road, Hooe, Plymouth	Earth Embankment			beach - mixed	4	
NEW_ASSET_41_9	Barton Road Seawall, Hooe, Plymouth	Masonry Seawall			beach - mixed	3	
NEW_ASSET_41_10	Plymouth Yacht Haven, Mountbatten, Plymouth	Masonry Seawall	Gabion Apron	Concrete Splash Wall	beach - mixed	2	
NEW_ASSET_41_11	Boat Storage Yard,	Rock Armoured			n/a - submerged	3	

NFCDD Reference Number	Location	Primary Defence	Secondary (seaward)	Secondary (landward)	Foreshore Type	Overall Condition	Residual Life (years) assuming no active intervention
	Plymouth Yacht Haven, Mountbatten, Plymouth	Revetment					
NEW_ASSET_41_12	Mount Batten Centre, Mount Batten, Plymouth	Concrete Seawall			beach - mixed	2	
NEW_ASSET_41_13	Mount Batten Centre - Mount Batten North Slipway, Plymouth	Concrete Seawall			beach - mixed	2	
NEW_ASSET_41_14	Mount Batten North Slipway - Hotel Mount Batten, Plymouth	Complex Foreshore			beach - cobble	3	
NEW_ASSET_41_15	Hotel Mount Batten - Breakwater , Plymouth	Masonry Seawall			shore platform	2	
NEW_ASSET_42_1	Laira Bridge - Pomphlett Lake, Plymouth	Masonry Seawall			n/a - submerged	3	
114FCS3701001C01	Mount Batten - Laira Bridge				mudflat	3	6 - 10
NEW_ASSET_42_2	Pomphlett Lake, Plymouth	Masonry Seawall			n/a - submerged	4	
NEW_ASSET_42_3	Yacht Haven Quay Ltd, Plymouth					0	
114FCS3701001C02	Laira Bridge To Neptune Park, Plymouth	Sheet Piling Quay Wall			n/a - submerged	3	6 - 10
NEW_ASSET_43_1	North Of University Of Plymouth Diving Centre, Plymouth	Masonry Seawall			beach - mixed	3	
NEW_ASSET_43_2	University Of Plymouth Diving Centre, Plymouth	Concrete Seawall	Concrete Apron		beach - mixed	3	
NEW_ASSET_43_3	Queen Anne's Battery	Concrete Slipway			beach - mixed	2	

NFCDD Reference Number	Location	Primary Defence	Secondary (seaward)	Secondary (landward)	Foreshore Type	Overall Condition	Residual Life (years) assuming no active intervention
	Slipway, Plymouth						
NEW_ASSET_43_4	Seawall Alongside Queen Anne's Battery Slipway, Plymouth	Concrete Seawall			beach - mixed	4	
NEW_ASSET_43_5	Queen Anne's Battery Marina, Plymouth	Rock Armoured Revetment			n/a - submerged	3	
NEW_ASSET_43_6	Queen Anne's Battery Seawall, Plymouth	Concrete Seawall	Rock Armoured Revetment		n/a - submerged	1	
NEW_ASSET_43_7	Victoria Pier To Cattedown Wharves, Plymouth	Masonry Seawall			n/a - submerged	3	
NEW_ASSET_43_8	Neptune Park, Plymouth	Rock Armoured Revetment			estuarine mudflat	1	
114FCS3701001C03	Plymouth Marine Aquarium, West, Plymouth	Masonry Seawall			beach - mixed	2	>20
114FCS3701001C04	Outer Harbour East Wall, Barbican, Plymouth	Masonry Seawall			n/a - submerged	2	>20
114FCS3701002C03	Sutton Harbour Tidal Gates Central Arm, West, Plymouth	Blockwork Seawall			n/a - submerged	2	11 - 20
114FCS3701002C02	Sutton Harbour Tidal Gates Central Arm, East, Plymouth	Blockwork Seawall			n/a - submerged	2	1 - 5
114FCS3701001C05	Sutton Harbour Tidal Gates East Arm, Plymouth	Blockwork Seawall			n/a - submerged	2	>20
114FCS3701001C06	Plymouth Barbican - Sutton Harbour Tidal Gates					2	>20
114FCS3701002C01	Sutton Harbour Quay, Plymouth	Masonry Seawall			n/a - submerged	3	6 - 10

NFCDD Reference Number	Location	Primary Defence	Secondary (seaward)	Secondary (landward)	Foreshore Type	Overall Condition	Residual Life (years) assuming no active intervention
114FCS3701003C01	West Pier South Wall, Barbican, Plymouth	Masonry Seawall			n/a - submerged	2	11 - 20
NEW_ASSET_44_1	Plymouth Fish Market, Barbican, Plymouth	Masonry Seawall			n/a - submerged	1	
NEW_ASSET_44_2	Plymouth Marine Aquarium, East, Plymouth	Blockwork Seawall			Beach - mixed	1	
114FCS3701003C02	Commercial Wharf - Fishers Nose, Plymouth	Masonry Seawall			n/a - submerged	3	
114FCS3701004C01	The Hoe, Plymouth	Masonry Seawall			shore platform	3	
114FCS3701004C02	Inner Basin, Millbay Docks, Plymouth	Masonry Quay wall			n/a - submerged	3	
NEW_ASSET_46_1	Admiralty Way, Stonehouse, Plymouth	Masonry Seawall	Masonry Revetment		n/a - submerged	2	
NEW_ASSET_46_2	Admiralty Way - Easton King Point, Stonehouse, Plymouth	Masonry Seawall			n/a - submerged	3	
NEW_ASSET_46_2a	West Wharf, Millbay Docks, Plymouth	Concrete Quay Wall			n/a - submerged	2	
NEW_ASSET_46_2b	Ferry Terminal, West Wharf, Millbay Docks, Plymouth	Rock Armoured Revetment			n/a - submerged	3	
NEW_ASSET_46_3	Trinity Pier, Millbay Docks, Plymouth	Concrete Quay Wall			n/a - submerged	3	
NEW_ASSET_46_4	Millbay Marina Village, West Hoe, Plymouth	Masonry Quay wall			n/a - submerged	2	
NEW_ASSET_46_5	Millbay Pier, West Hoe, Plymouth	Concrete Seawall			n/a - submerged	2	
NEW_ASSET_46_6	Rusty Anchor, West Hoe, Plymouth	Masonry Seawall			shore platform	2	

NFCDD Reference Number	Location	Primary Defence	Secondary (seaward)	Secondary (landward)	Foreshore Type	Overall Condition	Residual Life (years) assuming no active intervention
114FCS3702002C01	North Rock Cottage, Kingsand				shore platform	3	11 - 20
114FCS3702003C01	North Beach, Kingsand				shore platform	3	11 - 20
114FCS3702004C01	Rock House South, Kingsand	Masonry Seawall			beach - gravel	3	11 - 20
114FCS3702005C01	Kingsand Beach, Kingsand	Masonry Seawall			beach - mixed	3	11 - 20
114FCS3702006C01	The Cleave, Kingsand	Masonry Seawall			beach - mixed	3	11 - 20
114FCS3702007C01	Market Street North, Kingsand	Masonry Seawall			beach - mixed	2	11 - 20
114FCS3702008C01	Kingsand - Market Street South					3	11 - 20
114FCS3702009C01	Garrett Street - Market Street, Kingsand	Concrete Seawall			beach - mixed	3	11 - 20
114FCS3702010C01	Garrett Street, Cawsand	Concrete Seawall			shore platform	3	
114FCS3702011C01	Cawsand Beach, Cawsand	Concrete Seawall			beach - sandy	3	11 - 20
NEW_ASSET_48_1	Cawsand Bay Hotel, Cawsand	Masonry Seawall			beach - sandy	2	

C.3 Climate Change and Sea Level Rise

C.3.1 Introduction

The global climate is constantly changing, but it is generally recognised that we are entering a period of change. The anticipated implications of climate change, and in particular sea level rise, present a significant challenge to future coastal management. Over the last few decades there have been numerous studies into the potential impact of future changes. However, there remains considerable uncertainty in future climate modelling science and future global development patterns.

The UK Climate Impacts Programme (UKCIP) was established in 1997 to co-ordinate scientific research into the impacts of climate change. UKCIP publishes (on behalf of the UK Government) predictions of how the UK climate may change this century for a range of scenarios. UKCP09, the most recent predictions, were released in June 2009. This is the fifth generation of climate information for the UK, and provides probabilistic projections of climate change. UKCP09 comprises a package of information including, publications, key findings, user support and customisable output: this is primarily available on-line at: http://ukclimateprojections.defra.gov.uk/.

It should be noted, that although UKCP09 presents the latest and most accurate projections, for the purpose of land use planning, planning applications in areas prone to flood risk, shoreline management planning and the design of coastal defences, predictions for future rates of sea level rise, wave heights, river flow, rainfall should be sourced from Policy Planning Statement 25 (PPS25), or Defra's Supplementary Note to Operating Authorities October 2006 (Defra, 2006) until new guidance on the use and application of the UKCP09 scenarios is released. It is recommended that the UKCP09 website is consulted for more detailed information and guidance on how the projections data should be used.

However, although climate change projections may differ, the nature of shoreline change and response to management policies remain valid, it is simply the precise magnitude and timing of such changes that remain uncertain. This is recognised in the assessments made throughout the rest of the SMP.

The text below provides a summary of latest climate change projections relevant to shoreline management along the SMP frontage.

C.3.2 Sea level rise

The South coast is believed to be still responding to changes during the last 10,000 years when sea levels rose rapidly, flooding the North Sea Basin and Solent area, but there is now concern over human-induced acceleration in sea level rise due to climate change. Relative sea level change depends upon changes in global sea level (eustatic change) and in land level (isostatic change).

Isostatic change is the change in land level as the crust slowly readjusts to unloading of the weight of the ice since the last Ice Age c.12,500 years BP (this phenomenon is also known as crustal forebulge). Therefore, areas which were covered by ice, i.e. northern England and Scotland, have been experiencing a rise in land levels over the last few thousand years, whereas the south-west coast of England has been subsiding at a rate of between 0.5 to 1.2mm/year (UKCIP, 2005).

Eustatic change can be influenced by climatic changes (e.g. increased temperature causes an increased volume of water through thermal expansion and melting ice). Evidence suggests that global-average sea level rose by about 1.5mm/year during the twentieth century; this is believed to be due to a number of factors including thermal expansion of warming ocean waters and the melting of land (alpine) glaciers (Hulme *et al*, 2002), but after adjustment for natural land movements, it has been calculated that the average rate of sea-level rise during the last century around the UK coastline was approximately 1 mm/year[2].

Over the last 2,000 years sea level rise has continued but at much lower rates, resulting in ongoing, but less dramatic, changes at the shoreline. However, we are now entering a period of accelerating sea level rise, which will result in changes to the present coastal systems.

Defra and Environment Agency (2002) predicted that sea level rise would increase from the present rate of 2mm/yr to 6mm/yr by 2105. Following the Third Assessment Report from the Intergovernmental Panel on Climate Change (IPCC) the figures have been revised (Defra, 2006). The new allowances are highlighted in Table 3.1.

Administrative or Devolved Region	Assumed Vertical Land Movement (mm/yr)	Net Sea-Level Rise (mm/yr)				Previous allowances
		1990 - 2025	2025 - 2055	2055 - 2085	2085 - 2115	
South West and Wales	-0.5	3.5	8.0	11.5	14.5	5mm/yr constant*

Table 3.1 Sea level rise predictions from the latest Defra guidance on climate change (Defra, 2006). **Updated figures now reflect an exponential curve and replaces the previous straight line graph.*

More recently, UKCP09 have updated the UKCIP02 projections in a number of ways, primarily through using results from the most recent IPCC Fourth Assessment Report and newer estimates of UK vertical land movement.

The methodologies used to generate sea level ranges for the UK in the UKCP09 report differ from current Defra guidance, using improved methods to estimate vertical land movement and models constrained by a range of observations, informed by the most recent IPCC Fourth Assessment Report (IPCC, 2007). The IPCC Fourth Assessment Report estimates that approximately 70% of global sea level rise over the 21st century will be due to thermal expansion, with the remainder due to melting of glaciers, ice caps and a combined contribution from the Greenland and Antarctic ice sheets. Outputs from UKCP09 are available from the website and include:

- Absolute sea level rise time series for the UK for high, medium and low emissions scenarios (central estimate, and 5th and 95th percentile).
- Relative sea level rise around the UK, combining absolute sea level rise and vertical land movement, at user specified coastal locations.

One component of future sea level rise is from the melting of large ice sheets; however, there is a lack of current scientific understanding of some aspects of ice sheet behaviour and as such there are known limitations to including this component in sea level projections. UKCIP02 did not take any account of catastrophic changes, such as the collapse of the Thermohaline Circulation or the collapse of the West Antarctic Ice Sheet, whereas UKCP09 provides a low probability, high impact range for sea level rise around the UK, known as the High-plus-plus (H++) scenario, in addition to their main scenarios. This provides some indication of the impact of large-scale ice sheet melting on sea level rise. The scenario takes its bottom value from the maximum global mean sea level rise given by the IPCC Fourth Assessment Report, and its top value is derived from indirect observations of sea level rise during the last interglacial period, where the climate was comparable in some ways to today, and from estimates of maximum glacial flow rate. The H++ scenario prediction of sea level rise around the UK coast is between 0.93m and approximately 1.9m by 2100. UKCP09 state that the top of this range is very unlikely to occur in the 21st century and that improvements in models and continued monitoring may, in the future, help to estimate the likelihood of this type of event, or rule it out completely.

The above projections of future sea level rise also do not take any account of catastrophic changes, such as the collapse of the Thermohaline Circulation (THC) which UKCIP02 did not consider. The Thermohaline Circulation is a massive circulation of water in the world's oceans, which brings considerable amounts of heat to Western Europe; the Gulf Stream is one element of the circulation. This circulation is primarily driven by changes in water density, but other process, such as winds and tides, also contribute. It is frequently referred to in scientific literature as the meridional overturning circulation (MOC) particularly when focussing on the component of the THC which takes place in the North Atlantic. Any change is this circulation could result in cooling in North West Europe even whilst most of the world experiences warming.

There has been some concern that climate change could trigger this circulation to shut down, which in turn could lead to significant cooling in north-west Europe, even whilst most of the world warms up. Over the next century, total collapse of the Thermohaline Circulation is considered unlikely (IPCC Fourth Assessment Report 4, Working Group I); and even under a scenario of the circulation weakening over the next 100 years, which would mean that the Gulf Stream would bring less heat to the UK, increased greenhouse gas heating would greatly exceed this cooling effect (UKCIP02 report: Hulme et al., 2002). The effects of the gradually weakening MOC on UK climate are included in the UKCP09 climate projections.

C.3.3 Storminess and storm surge

Along much of this shoreline, a key risk will be future changes in tidal surges, winds and storms. The combination of high tides and strong westerly and south-westerly winds, increasing wave height and tidal surges, is a significant threat in terms of future coastal erosion and flooding.

Wind climate is a particularly important variable in the evolution of sand dune systems. As well as affecting frontal dunes, wind speed and direction also affects the stability of the system, affecting dune migration rates and the effect of wind stress on vegetation cover (Pye and Saye, 2005). UKCP09 has not, however, provided probabilistic projections for future changes in wind speed or direction.

A report by UKCIP (2009) (available from the UKCP09 website), which reviewed historical trends, stated that whilst severe wind storms around the UK have increased in recent decades, they are not above those observed in the 1920s. This report concluded that although there is considerable interest in possible trends in severe wind storms around the UK, these are difficult to identify, due to low numbers of such storms, their decadal variability, and by the unreliability and lack of representation of direct wind speed observations. The report also stated that there continues to be little evidence that the recent increase in storminess over the UK is related to man-made climate change.

As part of UKCP09, changes in storm surge levels for return periods of 2, 10, 20 and 50 years (the level predicted to be exceeded on average once during the return period) were examined. The trends found were physically small everywhere around the UK, with projections suggesting that the surge level expected to be exceeded on average once every 2, 10, 20 or 50 years would not increase by more than 9cm by 2100 anywhere around the UK coast (not including mean sea level rise). This suggests that the surge component of extreme sea level will be much less important than was implied by the previous projections presented in UKCIP02. Further information can be obtained from the UKCP09 website.

The UKCP09 report concludes that in most locations the trend in storm surge levels cannot be clearly distinguished from natural variability; therefore, although this is recognised as an uncertainty within the predictions, no detailed analysis of potential impacts has been undertaken. It is not within the remit of the SMP to undertake an analysis of extreme still water levels; which should be undertaken when assessing defences during strategy or scheme development. A joint Defra/ EA flood and coastal erosion risk management research and development project entitled 'Development and Dissemination of Information on Coastal and Estuary Extremes (SC060064)' is currently underway, due to be completed in spring 2010. This will provide a consistent set of extreme still water levels around the coast of England, Wales and Scotland, replacing POL Report 112.

UKCP09 projections suggest some significant changes in the UK wave climate by 2100. The main statistically significant result, based on a mid climate sensitivity version of the Met Office wind forcing for a medium emissions scenario, is a projected increase in winter wave heights along the south and south-west coast of the UK for both mean and extreme wave heights. Changes in the winter mean wave height are projected to be between –35cm and +5cm. Changes in the annual maxima are projected to be between –1.5m and +1m. Changes in wave period and direction are rather small and more difficult to interpret. Further work is needed to fully interpret the wave projections in the light of predicted changes in weather patterns.

C.3.4 Precipitation

In addition to sea level rise and storminess, another factor of climate change that is important to coastal evolution is precipitation. Analysis of existing UK precipitation records presented in UKCIP08 (2007) indicated that all regions of the UK have experienced an increase in winter rainfall contribution from heavy precipitation events, although the rainfall seasonality experienced across the UK has changed little over the past 50 years.

UKCP09 concluded that there was unlikely to be a significant change in annual mean precipitation by the 2050s, with the central estimate of change being 0% under medium emissions (with an uncertainty range of -5% to +6%). Under medium emissions, it was suggested that there could be an increase in winter rainfall (with a central estimate of +14%; and uncertainty range of 0% to +31%). Conversely a decrease in summer mean rainfall was proposed (with a central estimate of -16%; and uncertainty range of -38% to +13%). Further information can be obtained from the UKCP09 website.

Although many of the cliffs along this frontage are relatively resistant there are a few locations where the cliffs are more susceptible, due to either their geology or structure. Along these sections, any change in precipitation patterns could have an impact through potentially increasing the likelihood of slope failures. Dunes systems are also potentially susceptible to changes in precipitation through limiting sand transport through wetting of beach and dune surface and influencing dune vegetation growth (Pye and Saye, 2005). However, due to uncertainty in the exact impact of precipitation change and due to the fact that it is the intensity of the rainfall, rather than the total amount of rainfall that is the key factor, for which there is no information, although precipitation changes are recognised as an uncertainty this has not been directly taken into account in the shoreline evolution predictions. Given the nature of this coastline, any effects are also likely to be localised.

Changes in precipitation patterns could also have implications for river flows, which in turn could affect meandering patterns, alignment of intertidal channels, development and breaching of sand spits, fluvial discharge and flood risks within the inner estuaries. Although this is recognised as an uncertainty and a potential risk, no further analysis has been undertaken as part of this SMP.

C.4 Baseline Case 1 – No Active Intervention (NAI)

C.4.1 Introduction

This section of the report provides analysis of shoreline response conducted for the scenario of 'No Active Intervention'. This has considered that there is no expenditure on maintaining or improving defences and that therefore defences will fail at a time dependent upon their residual life (see Defence Assessment, Section C.2) and the condition of the beaches.

The analysis has been developed using the understanding of coastal behaviour from the baseline processes understanding (see Section C.1), existing coastal change data (see Section C.4.4) and information on the nature and condition of existing coastal defences.

Maps illustrating potential flood and erosion risk are included at the end of the appendix.

C.4.2 Summary

The following text provides a summary of the analysis of shoreline response, with details specific to each location and epoch contained within the Scenario Assessment Table.

C.4.2.1 Short Term (to 2025)

Large stretches of this shoreline are undefended or contain only very localised, short stretches of defence and here there would be a continuation of current trends. In places, this would mean that beaches would continue to narrow due to the lack of new sediment inputs and there would be continued cliff erosion at a range of rates, dependent upon the local geology. Where cliffs are clay-rich there would be a risk of large scale landslide events occurring, which could impact on local sediment littoral drift.

Where the coast is defended by hard defences, such as seawalls, rock revetments and reefs, these would remain along the majority of frontages, but there could be failure of a number of short lengths of defence that are in poor condition or are at risk from undermining, during this period. At these locations, where defences have tended to slow erosion, there could be an initial acceleration in retreat rates as they fail, although this would depend upon the local geology. Where defences remain, beaches would continue to narrow as exposure increases due to continued transgression of the coastal system and deeper nearshore areas.

Under this scenario it is assumed that beach management activities would cease and wooden groynes could fail during this period. The impact of this could start to be seen during this period under this scenario, but in most places it is likely that beach would remain in place. However, any beach narrowing would increase exposure of any backing defences and could accelerate their failure.

There is unlikely to be any significant changes to the sediment regime during this period as this is generally a poorly connected coast, in terms of littoral drift, due to natural barriers.

The estuaries along the SMP area would not be expected to change significantly and so would maintain their current form during this period.

C.4.2.2 Medium Term (to 2055)

There would be increased pressure on the coastal system due to accelerating sea level rise. During this period many of the remaining defences will fail, accelerated by narrow beaches and increased exposure. This could result in an initial acceleration in retreat rates as defences fail at these locations, where shoreline position has been held in place for over 120 years in some cases. The erosion is likely to remain rapid for 5 to 10 years before returning to rates more similar to those pre-defences, commensurate with shoreline energy.

At a limited number of locations the defences may remain. Here beaches and shore platforms are likely to narrow and may disappear in places (particularly given the lack of beach management assumed under this scenario), due to rising sea levels and therefore greater exposure to wave action. These conditions would not be conducive to beach retention and any sediment arriving on these frontages could be rapidly transported offshore again.

Along undefended sections of coastline, erosion of the softer cliffs will accelerate in response to sea level rise, periodic cliff failures and landslides occurring to form new temporary barriers to longshore sediment transport as existing lobes are removed by wave action. Harder, more resistant rock cliffs would be unaffected by sea level rise and would continue to retreat at historical rates, failing only as a result of infrequent, geologically controlled event. Where beaches front cliffs that contain sufficient coarse sediment they would be maintained as narrow beaches despite sea level rise. Where there is insufficient coarse sediment supply to beaches from local cliff erosion, then beaches would narrow further as sea levels rise and could disappear in places along with shore platforms. The fact that many of the beaches along the eastern portion of this SMP area are relict would therefore become increasingly important during this period as there would be very limited input of comparable material and therefore the features may not be able to keep pace with sea level rise, particularly where retreat is prevented either by defences or the backing natural topography. Where beaches are unable to roll landwards there would be an increased tendency for sediment to be drawn-down the beach during storms and through this process the beaches could gradually become denuded of sediment.

Breaches and tidal inundation of defended flood risk areas would occur under this scenario as the defences fail during this period. Natural defences are likely to be (more) frequently breached, but many of the barriers along this shoreline are relatively resilient due to their volume and therefore any breaches would be likely to naturally repair.

The estuaries along the SMP area would be affected by sea level rise in a number of ways. Where estuaries are largely natural and undeveloped, they are likely to respond by transgressing landwards and so conserving inter-tidal areas, although where there is high ground this may not be possible and inter-tidal areas could narrow and disappear. In estuaries that have been extensively developed, landward transgression would gradually be able to occur as defences that previously constrained such behaviour are lost. In some areas the loss of defences would result in the tidal limit extending further upriver, to positions that existed prior to being constrained by defences.

C.4.2.3 Long Term (to 2105)

All defences will have failed or deteriorated by the end of this period, and so the influence and impacts of human intervention upon the natural system would be largely diminished.

As a result there would be reactivation of previously defended cliffs. The rate of retreat of both these and undefended cliffs will be dependent upon the local geology, which controls both the response of the cliff to wave action and also whether sediment would be supplied to the system which could potentially reduce the rate of erosion. Harder, more resistant rock cliffs would be unaffected by sea level rise and continue to retreat at historical rates, failing only as a result of infrequent, geologically controlled event. Any fronting beaches could be lost or significantly diminished during this period due to rising sea levels.

Erosion of the softer cliffs will accelerate in response to sea level rise, periodic cliff failures and landslides occurring to form new temporary barriers to longshore sediment transport as existing lobes are removed by wave action. Along these frontages, there could be a supply of sediment to the beaches as the cliffs erode, but along the eastern section of coast, this would not contribute to the relict shingle beaches, although sand sized sediments could be retained on the lower beaches. If the cliffs erode back at a sufficient rate beaches could be retained in front.

Any sediments released from cliff erosion would tend to remain fairly local due to the poor littoral linkages along this coast. Emergence of headlands (both permanent and temporary, in the form of debris lobes) during this period, as beaches retreat could further reduce the connectivity of this coastline.

Barrier beaches and spits would continue to adapt and retreat in response to sea level rise. If not already happened in the medium term, then the risk of a significant storm event causing substantial rollback of these features onto low-lying land would increase throughout this period. A number of these natural defences are also likely to be frequently breached and may or may not be naturally repaired by littoral sediment transport, depending upon the availability of sufficient sediment.

Along areas which front low-lying land there will be an increased risk of inundation with rising sea levels.

The largely natural, undeveloped estuaries along the SMP area would be likely to continue to respond by transgressing landwards and so conserving inter-tidal areas, although where there is high ground this may not be possible and there could be further losses of inter-tidal areas in some parts. In estuaries where defences have failed by this period, a similar patter of landward transgression to keep pace with sea level rise would occur.

C.4.3 NAI Scenario Assessment Table

Location	Predicted Change for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
Durlston Head to St Alban's Head	There are no defences present along this section.	No defences.	No defences.
	Continued very slow erosion of the resistant limestone cliffs, confined to joint planes or as a result of wave undercutting. Negligible cliffline movement is predicted.	Very slow erosion of the cliffs would continue at the same rates as today, therefore negligible change in cliffline position is predicted. Under accelerated sea level rise any beaches could become submerged.	Very slow erosion of the cliffs would continue at the same rates as today, therefore negligible change in cliffline position is predicted. No beaches would be expected to remain at the toe of the cliff due to higher sea levels.
St Alban's Head to Worbarrow Tout	A largely undefended section except for a short section of sea wall along the eastern part of Kimmeridge Bay, which is protecting a small car park and facilities.	No defences over majority of frontage. The short section of sea wall within Kimmeridge Bay is expected to fail during this period.	No defences over the length of this section.
	The complex, clay-dominated cliffs that make up the majority of this section, such as at Gadd Cliff, Honnstant Cliff and St. Alban's Head, will continue to erode landwards as a result of episodic complex landslide events at a frequency of between 1 to 10 (majority of this section) and 10 to 100 years (on the western side of St Alban's Head). It is assumed that one such event could occur at anytime, and so total erosion of 0 to 50m is predicted over this period. Along Kimmeridge Ledges, where there has been very slow erosion historically, only about 1m of recession is predicted. Coarser material derived from this erosion will be retained within local pocket beaches at Brandy Bay, Hobarrow Bay, Kimmeridge Bay, Egmont	The clay rich cliffs that dominate much of this section are very sensitive to climate change and the rate of erosion could increase both due to sea level rise and an increase in rainfall. Due to uncertainty in the possible future changes in precipitation, no direct account has been taken of this in the predictions. Sea level rise will also result in the submergence of shore platforms, resulting in more rapid erosion of the cliffs behind where the cliffs are of simple type such as at Kimmeridge Ledges. Here total recession of 2 to 4m is predicted by 2055. Cliff failure through complex landslide events would continue elsewhere along this section. These would be less affected by sea level rise as they are controlled more by groundwater. Total	Total erosion by 2105 is predicted to be between 10 and 100m between Worbarrow Tout and Hobarrow Bay, and 30-100m between Kimmeridge Bay and Broad Bench. Between St. Alban's Head and Egmont Point there may be a large landslide event during this period, and so total erosion of 0 to 50m may occur in this area. The simple cliffs along Kimmeridge Ledges are more likely to be affected by sea level rise than the complex cliffs along the rest of this section. Here recession of 5 to 12m by 2105 is predicted. As a result of high sea levels beaches are expected to narrow and in places may disappear as the rock platforms become submerged.

Location	Predicted Change for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	Bight and Chapman's Pool. Finer material will be transported offshore in suspension. It is predicted that erosion of between 2 and 20m will occur over this period between Worbarrow Tout and Hobarrow Bay. Between Kimmeridge Bay and Broad Bench, erosion in the region of between 5 and 20m is predicted. The short stretch of sea wall at Kimmeridge is only likely to have a localised impact.	erosion by 2055 is predicted to be between 5 and 50m between Worbarrow Tout and Hobarrow Bay, and 14 to 50m between Kimmeridge Bay and Broad Bench. Between St. Alban's Head and Egmont Point there may be a large landslide event during this period, and so total erosion of 0 to 50m may occur. The short section of defence is expected to fail during this period, so its very localised impact would be removed and there would be a return to natural behaviour by 2055. There would therefore be a loss of the car park facility are re-exposure of the cliffs behind. During any landslide events a lobe of debris will be released, which could temporarily affect the longshore transport of sediment before being gradually eroded by wave action. Any sediment released through cliff erosion will tend to be either retained very locally in the pocket beaches (in the case of sand and shingle), or washed offshore (in the case of fines).	
Worbarrow Tout to Lulworth Cove (East)	There are no defences present along this section.	No defences.	No defences.
	The geology of the cliffs changes significantly along this stretch. Within Worbarrow and Mupe Bays, the clay-rich cliffs will continue to erode landwards as a result of episodic landslide events with a frequency of 1 to 10 years. It is predicted that underlying erosion of 1 to 2m will occur in this area over this period.	Erosion of the cliffs will continue as observed historically at a rate of about 0.1m/yr. Erosion of the chalk cliffs in the western part of this section tends to be geologically controlled so there is not expected to be a noticeable increase in erosion rates due to sea level rise. Therefore erosion of between 0 and 1m is expected by the end of this	Erosion of the cliffs will continue as observed historically at a rate of about 0.1m/yr along the western part of this section, but rates could increase along the clay-rich cliffs due to accelerated sea level rise. This would be exacerbated in areas that are currently protected by shore platforms, as submergence of these

Location	Predicted Change for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	Erosion of the chalk cliffs that extend from Mupe Bay to Lulworth Cove (East) would continue to be negligible, but infrequent cliff falls resulting from wave undercutting could occur, resulting in the loss of 10 to 50m of land in one go. The frequency of these events sizeable events is likely to be 10 to 100 years, although smaller scale events occur every 1 to 10 years, with events as recent as 2001. These events will tend to affect very localised areas, but it is not possible to predict where the next events will occur. During these landslide events a lobe of chalk debris will be released, which could temporarily affect the longshore transport of sediment. These lobes will gradually be eroded by wave action, with material eventually being lost offshore rather than being retained on the beaches.	period, although there could be localised cliff falls resulting in the loss of 10 to 50m in a single event. This will release sediment, which will be gradually removed offshore by wave action, but could affect longshore drift temporarily. Ultimately these cliff failures are unlikely to be a significant contribution to the beach budget. Within Worbarrow and Mupe Bays, the clay-rich cliffs are expected to be more sensitive to sea level rise, particularly those cliffs in the western part of the bay, and any increased in precipitation. Total erosion by 2055 within Worbarrow and Mupe Bays is predicted to be between 5 and 6m, although along localised sections cliff falls could occur resulting in several tens of metres of erosion. Erosion of these cliffs will provide some sediment to the beaches, but the majority is fine sediment which will be lost offshore. Therefore beaches remain within the pocket bays, but are unlikely to increase in volume. Cliffs in the eastern part of Worbarrow Bay are less likely to be affected by sea level rise and so total erosion of 0 to 5m is predicted by 2055.	platforms would result in increased wave exposure. Total erosion by 2105 within Worbarrow and Mupe Bays is predicted to be between 10 and 17m in the western part of the bay, but 0 to 10m in the eastern part of the bay. Towards Lulworth Cove (East), total erosion by 2105 is predicted to be between 0 and 8m. Very narrow beaches may remain as local pocket beaches, particularly where cliff erosion contributed to the beach budget.
Lulworth Cove	A largely undefended section except for a short length of seawall at the pedestrian entrance to the cove.	Short section of sea wall would fail during this period.	No defences.
	Small scale cliff failure events occur every 1 to 10 years, causing the loss of less than 10m per event. Underlying erosion of the softer clays, marls and sandstones that lie within Lulworth Cove is	The short section of sea wall along the back of the beach would fail during this period. It currently has limited impact on the adjacent cliffs, so this would not change. It does, however,	As for the medium term, an acceleration in sea level rise may result in a very small increase in the rate of erosion, but the net erosion will remain

Location	Predicted Change for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	predicted to continue at a rate of about 0.12m/yr as observed historically, resulting in total erosion of about 2m during this period. The beach will remain as at present.	protect the pedestrian entrance and immediate properties from marine intrusion and therefore there would be a very localised increase in flood risk. The low rates of cliff retreat would continue as observed historically at about 0.12m/yr. The rate of erosion could increase slightly due to accelerated sea level rise but the net effect is likely to be negligible due to the resistant nature of the cliffs. Total erosion within Lulworth Cove is predicted to be about 4m between 2025 and 2055. Beaches are expected to remain, but may narrow due to high sea levels.	small due to the resistance of the cliffs. Total erosion within Lulworth Cove is predicted to be about 6m between 2055 and 2105. Beaches are expected to remain, but may narrow due to high sea levels There would no longer be any defences along this stretch, therefore there could be localised flooding during high tide at the pedestrian entrance to the Bay.
Lulworth Cove (West) to White Nothe	There are no defences present along this section.	No defences.	No defences.
	The vertical chalk cliffs that dominate this section are receding at varying rates, with infrequent cliff failure events causing loss of less than 10m per event typically occurring every 1 to 10 years, although towards White Nothe this frequency is more like 10 to 100 years. This trend is expected to continue during this period. Underlying erosion of between 2 and 10m is predicted between White Nothe and Bat's Head during this period. Between Bat's Head and Lulworth Cove erosion of between 0 and 6m is predicted over the same period.	Erosion of the chalk cliffs is expected to continue as observed historically at between 0.05 and 0.3m/yr (with the higher rate only likely to occur as a result of localised cliff failure events). The net rate of retreat is not expected to increase significantly as a result of sea level rise, due to the natural resistance of the cliffs. Total erosion by 2055 of 7 to 10m is predicted between White Nothe and Bat's Head, whilst between Bat's Head and Lulworth Cove erosion of between 0 and 16m is predicted. Beaches may narrow along the more exposed sections due to higher sea levels, but pocket	Erosion of the chalk cliffs is expected to continue as observed historically at between 0.05 and 0.3m/yr (with the higher rate only likely to occur as a result of localised cliff failure events). The net rate of retreat is not expected to increase significantly as a result of sea level rise, due to the natural resistance of the cliffs. Total erosion by 2105 of 14 to 20m is predicted between White Nothe and Bat's Head, whilst between Bat's Head and Lulworth Cove erosion of between 0 and 32m is predicted. High sea levels may result in the loss of beaches along some sections, but cliff erosion will

Location	Predicted Change for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
		beaches will remain in the more sheltered bays.	contribute and maintain some narrow beaches, particularly in the more sheltered locations.
White Nothe to Redcliff Point	Mainly undefended coastline, but a short length of rock revetment and rock groyne present within Ringstead Bay.	Failure of the defences within Ringstead Bay likely to occur during this period, although the effect on local shoreline processes would gradually reduce as the rock revetment and groyne would remain partially effective for a period after failure.	No defences.
	The clay cliffs that dominate this section experience episodic landslide events including mudflows and rotational land slips as a result of groundwater conditions, with instability being maintained by ongoing toe erosion by marine action. This trend is expected to continue in the future, with an average retreat of approximately 8.5m predicted to occur over this period. Episodic events occur about every 10 to100 years, with a significant event having occurred at Black Head between 1910 and 1914. It is possible that another significant event could occur during this period, resulting in the erosion of 10 to 50m of land in a single event. It is difficult, without further, more detailed technical appraisal, however, to predict where a landslip could occur. Such landslides can impact locally by interrupting sediment drift, which is predominately from east to west. The rock groyne and revetment in Ringstead Bay will reduce the frequency of cliff failure events	Along the majority of the shoreline, the cliff erosion trend is likely to continue as historically up to a rate of about 0.5m/yr. The simple cliffs at Ringstead Bay are more likely to be affected by sea level rise and so total erosion of about 25 to 30m is predicted by 2055 in this area. There is also the risk of a large scale event occurring along the Osmington to Redcliff Point section, which could result in a localised loss of cliff top in the region of 10 to 50m. These cliffs are also sensitive to climate change and in particular increased precipitation, although due to uncertainty in the prediction of future precipitation, this has not been included in calculation of erosion rates. Total recession by 2055 in this area is predicted to be between 25 and 50m. There could be beach narrowing as a result of sea level rise, particularly as shore platforms become submerged. Although any material released from the cliffs would be likely to remain locally, this would tend to be mainly fines, which will be	By this period the existing defences would have deteriorated sufficiently to have negligible impact on coastal change. Therefore, the cliff erosion trend along the whole of this frontage is likely to continue as historically up to a rate of about 0.5m/yr. The simple cliffs within Ringstead Bay would be likely to be affected by sea level rise and total erosion in this area by 2105 of 50 to 70m is predicted. There is also the risk of a large scale event occurring along the Osmington to Redcliff Point section, which could result in a localised loss of cliff top in the region of 10 to 50m. These cliffs are also sensitive to climate change and in particular increased precipitation, although due to uncertainty in the prediction of future precipitation, this has not been included in calculation of erosion rates. Total recession by 2105 in this area is predicted to be between 50 and 100m. There could be further beach narrowing during this period as sea levels rise. Sediment transport

Location	Predicted Change for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	locally by preventing erosion of the cliff toe by marine action and so delaying on-set of instability within the clay cliffs, which is largely controlled by groundwater. Average retreat in this area will be less than the 8.5m predicted over this period for the undefended cliffs. Although the cliffs are unlikely to be a significant contributor of sediment to the beaches due to them being low in height and their composition, the rock groyne could impact on adjacent beaches by interrupting sediment drift.	moved offshore. With sea level rise the influence of the offshore ledges could also be reduced, which could increase exposure along this section. However, Redcliff Point will continue to interrupt sediment transfer towards Weymouth. Currently there is a rock revetment and groyne within Ringstead Bay, which is designed to stabilise the beach and to reduce cliff erosion locally. Under this scenario the defences would be expected to start to fail during this period and become less effective. This would result in both beach loss and an increase in cliff erosion rates locally. Initially the rock revetment will continue to affect the rate of erosion, but this is likely to become less effective both due to failure and increased sea levels. Similar rate of recession to adjacent cliffs of upto 0.5m/yr is expected towards the end of this period.	longshore would become reduced as a result of loss of beach sediment, however this impact would not extend beyond Redcliff Point to the west.
Redcliff Point to Preston Beach (Rock Groyne)	The rock revetments and gabions at Bowleaze Cove are likely to fail around the middle of this period. The seawall backing Preston Beach would probably remain, although it is assumed that management of the beaches would cease along this frontage.	The defences along Preston beach would fail during the early to middle part of this period.	No defences.
	The clay cliffs at Redcliff and Furzy Cliff erode as a result of episodic events every 10 to 100 years, eroding between 10 and 50m of cliff per event. This trend is expected to continue in the future,	Along the undefended section of coast, cliff erosion would be likely to occur as historically, with total erosion of Furzy Cliff by 2055 predicted to be between 35 to 50m, whilst at Redcliff it is	Cliff erosion is likely to occur as historically, with total erosion of Furzy Cliff by 2105 predicted to be between 70 and 100m, whilst at Redcliff it is predicted to be between 60 and 100m. Redcliff

Location	Predicted Change for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	with an average recession of 13 to 50m of Furzy Cliff and 11 to 50m of Redcliff over this period. Cessation of beach management activities along Preston Beach would lead to the reduction in beach volume along the northern part of the beach as material is moved north-east and south-west. This will increase the risk of flooding to the low-lying land behind by 2025. This would accelerate the rate of which the gabions and rock revetments within Bowleaze Cove would fail. The main mechanism of failure would be through dropping beach levels and resultant toe scour and undermining. The gabions along the coast towards Redcliff may also be affected by cliff slumping and undermining at the ends of the defence. Although the rocks would remain along the foreshore and would therefore have a slight impact on coastal processes, it is likely that the backing cliff could become reactivated. Rates of erosion would be as for the adjacent cliffs of around 0.62m/yr. Within Bowleaze Cove, failure of the revetments would result in erosion of the low slope behind. This would be unlikely to supply significant sediment to the beach therefore erosion would continue. There would also be a localised risk of flooding. Beach lowering along this frontage would also threaten the integrity of the pier.	predicted to be between 30 to 50m. These cliffs would mainly contribute fines to the system therefore would not build beaches along this section. The remaining defences along Bowleaze Cove would be having very little impact by this period, but lowering beach levels would have probably resulted in failure of the pier structure. This could improve sediment connectivity along this section. Preston Beach would be a particularly vulnerable section of coast due to the divide in littoral transport along this stretch and the lack of significant new inputs of coarse sediment to the beach system. Without maintenance of the 1995/6 scheme, this would result in beach narrowing and put pressure on the seawall backing the beach. The southern end of this frontage would also be affected by the failure of defences along the adjacent section of coast at Weymouth, therefore this section of seawall would be at risk of failing first, probably toward the middle to end of this period, due to the current width of beach. Failure of the seawall and breach of the beach would result in inundation of the low-lying Lodmoor Nature Reserve. It is thought unlikely that a permanent inlet would form, although this area is likely to subject to frequent inundation. Following failure of the first section of wall, the remaining defences would probably fail fairly	will therefore continue to interrupt any sediment exchange between this and the stretch of coast to the east. Cliff erosion, would not, however, significantly contribute to the beach budget therefore there would be a continued trend of beach steepening and narrowing, with the area around Lodmoor becoming increasingly vulnerable due to the apparent drift divide at this location. The lack of defences along this section would allow the shoreline to behave naturally. This would include the rollback of Preston Beach onto the low-lying land behind, which would also experience periodic breaching during large wave events followed by gradual breach closure by longshore sediment transport processes, assuming sufficient sediment remains available for this purpose (otherwise the breach may become permanent). Therefore the low-lying Lodmoor region would be subject to frequent inundation. This area could be affected by any change in the Portland Harbour Breakwaters, which are believed to have a sheltering effect and also influence sediment circulation within Weymouth Bay. However, for this appraisal, these are assumed to remain during this period, although there is a risk of their failure due to a lack of maintenance during this period.

Location	Predicted Change for 'No Active Intervention'		
	Short Term (to 2025)	**Medium Term (to 2055)**	**Long Term (to 2105)**
	Along the Preston Beach, the seawall would be expected to remain, but narrowing beaches would put increased pressure on the structure. This area could be affected by any change in the Portland Harbour Breakwaters, which are believed to have a sheltering effect and also influence sediment circulation within Weymouth Bay. However, for this appraisal, these are assumed to remain during this period.	rapidly. It is thought likely that a low, narrow shingle beach would remain along this frontage. Under continued sea level rise the rock groyne would start to become redundant. This area could be affected by any change in the Portland Harbour Breakwaters, which are believed to have a sheltering effect and also influence sediment circulation within Weymouth Bay. However, for this appraisal, these are assumed to remain during this period, although there is a risk of their failure due to a lack of maintenance during this period.	
Preston Beach (Rock Groyne) to Weymouth Harbour (Stone Pier)	Parts of the sea wall and promenade, as well as part of the inner harbour defences would fail by the end of this period.	Remaining defences along both the sea front and around Weymouth Harbour would fail during the first half of this period.	No defences.
	The coastal defences comprise a sea wall and promenade constructed some 100 years ago. It is anticipated that parts of this would fail towards the end of this period, resulting in an increased risk of flooding of the low-lying hinterland. This defence failure would also impact on defences along the adjacent section of Preston Beach. Within Weymouth Harbour, a section of the inner harbour wall will also fail during the middle to latter part of this period, again increasing the risk of flooding as sea levels rise. The shingle beach at the northern end of this section would be likely to undergo gradual erosion, whilst sand would be likely to continue	Sea level rise could continue to cause coastal squeeze, with the narrowing of the beach and an increase in flood risk along this section. The section to the immediate south of the rock groyne at Greenhill would be an area of key risk as there is believed to be a drift divide at this location. The loss of remaining defences both along the sea front and within Weymouth Harbour during this period would lead to an increased risk flooding of the low-lying hinterland as sea levels rise. Within Weymouth Harbour the loss of the defence at Westham Bridge would result in the tidal limit of the estuary extending into Radipole	Sea level rise could continue to cause coastal squeeze, with the narrowing of the beach and an increase in flood risk throughout this section. The stretch in the vicinity of Greenhill is a key hot spot. A beach is still likely to exist at Weymouth, but would be much narrower as the ability of the beach to rollback and adjust as sea levels rise would remain inhibited by the presence of the urban extent of the town of Weymouth. Assuming there are no improvements to defences, there would be an increased risk of overtopping along the Esplanade, due to increase

Location	Predicted Change for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	to accumulate in the southern end of Weymouth Bay due to the presence of the northern harbour pier. Where the beach is eroded, coastal squeeze could become increasingly significant as sea levels rise, particularly in areas where the sea wall and promenade remain during this period, as there is very little new sediment input to the beach. This would accelerate failure of remaining defences. This area could be affected by any change in the Portland Harbour Breakwaters, which are believed to have a sheltering effect and also influence sediment circulation within Weymouth Bay. However, for this appraisal, these are assumed to remain during this period.	Lake, as it was prior to being dammed in the 19th century. A beach at Weymouth should still be retained, due to sediment feed from the north, but this will start to diminish during this period as the stretch in front of Lodmoor becomes increasingly exposed. The ability of the beach to rollback and adjust as sea levels rise would remain inhibited by the presence of the urban extent of the town of Weymouth, therefore beaches would continue to narrow. Assuming there are no improvements to defences, there would be an increased risk of overtopping along the Esplanade, due to increase water levels. This area could be affected by any change in the Portland Harbour Breakwaters, which are believed to have a sheltering effect and also influence sediment circulation within Weymouth Bay. However, for this appraisal, these are assumed to remain during this period, although there is a risk of their failure due to a lack of maintenance during this period.	water levels. This area could be affected by any change in the Portland Harbour Breakwaters, which are believed to have a sheltering effect and also influence sediment circulation within Weymouth Bay. However, for this appraisal, these are assumed to remain during this period, although there is a risk of their failure due to a lack of maintenance during this period.
Weymouth Harbour (Stone Pier) to Portland Harbour (North Breakwater)	The short section of defence between the 2002 Newton's Cove Scheme and the rock armour around the Nothe Fort will fail in the middle to end of this period. The rest of the defences will remain.	The majority of the defences would remain during this period, although those adjacent the failure in the short term period would be weaker and further defence failures would gradually spread away from this weak point.	The defences along this section would be further weakened during this period, with the majority of the defences badly deteriorated and/or lost by 2105.
	Clay-rich cliffs that are located behind the	The rate of erosion of the cliff top due to	The rate of erosion due to groundwater

Location	Predicted Change for 'No Active Intervention'		
	Short Term (to 2025)	**Medium Term (to 2055)**	**Long Term (to 2105)**
	defences along this section are susceptible to landsliding as a result of groundwater conditions. Landslide events occur with a frequency of 10 to 100 years and can cause loss of less than 10m of land per event. The last significant event occurred in the late 1980s and it is possible that another significant event could occur during this period, most likely in the area behind the section of defences that are in a poor condition and which are expected to fail during the middle to end of this period. Failure of these defences would only expose a small part of the cliff toe to wave action, but would be a weak point from which failure of adjacent defences would gradually occur as the defences 'un-zip'. It is estimated that the rate of cliff recession would be about 0.5m/yr following the loss of defence.	groundwater conditions could increase due to an increase in rainfall resulting from future climate change. However, due to uncertainty in the possible future changes in precipitation, no direct account has been taken of this in the predictions. The accelerated loss of defences at the cliff toe away from the section that would fail in the short term, would lead to a greater length of cliff toe being exposed to wave action by 2055. This would, in turn, be likely to promote a greater frequency of landslide events and a higher mean annual rate of recession observed in recent history, possibly around 0.5m/yr. Sea level rise will also result in the submergence of shore platforms that front this section, and a narrowing of the small pocket beach at Newton's Cove, resulting in increased exposure of the defences that remain in this area to wave action.	conditions could increase due to an increase in rainfall resulting from future climate change. Due to uncertainty in the possible future changes in precipitation, no direct account has been taken of this in the predictions. The further loss of defences at the cliff toe will lead to ever greater lengths of cliff toe being exposed to wave action by 2105. This will be likely to promote a greater frequency of landslide events and a higher mean annual rate of recession observed in recent history, possibly around 0.5m/yr. As a result of high sea levels beaches are expected to narrow and in places may disappear as the rock platforms become submerged, resulting in increased exposure of the cliff toe to wave action, with resultant loss of any remaining areas of defences.
Portland Harbour (North Breakwater) to Small Mouth	Short sections of low-level rock revetment along the cliff toe in localised areas would fail by the end of this period, with the exception of the two areas at Castle Cove Sailing Club and Bincleaves. It is assumed that Portland Harbour Breakwaters would remain as present.	No defences will be present along the majority of this section, with the exception of the two areas of rock revetment at Castle Cove Sailing Club and Bincleaves. It is assumed that Portland Harbour Breakwaters would remain as present, although there is a risk of failure due to a lack of maintenance during this period.	No defences will be present along the majority of this section, with the exception of the two areas of at Castle Cove Sailing Club and Bincleaves. It is assumed that Portland Harbour Breakwaters would remain as present, although the risk of failure due to a lack of maintenance increases during this period.
	The cliffs along this section include actively landsliding clay-rich cliffs that are primarily controlled by groundwater levels, and more	Despite the loss of defences, erosion of the cliffs would continue as observed historically at a rate between 0.05 and 0.5m/yr, with total erosion by	Despite the loss of defences, cliff erosion would continue as observed historically at a rate between 0.05 and 0.5m/yr, with total erosion by

Location	Predicted Change for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	resistant sandstones that form headlands and which are more geologically controlled and fail as a result of wave undercutting at the base. The cliff toe along this section is defended in places by ad hoc structures that offer varying degrees of protection to the cliff toe from wave action. These serve to reduce the rate of instability in the clay-rich cliffs by preventing cliff toe erosion, although failures do still occur due to the groundwater conditions being the controlling factor. These ad hoc structures would fail by the end of this period and so their effect would be largely lost by 2025. Wave action at the cliff toe becomes increasingly important in maintaining cliff instability towards the Small Mouth end of this section, where fetch lengths across Portland Harbour are greatest. Total erosion along this section is predicted to be between 5 and 10m during this period, inclusive of episodic landslide events, which occur between 1-10 years in the more active cliff areas, and between 10-100 years in the slightly more resistant cliff areas. This assumes that the Portland Harbour breakwaters are retained, as these prevent significant wave action at the toe of the cliffs from causing greater rates of erosion.	2055 predicted to be between 15 and 25m, although along localised sections cliff falls could occur resulting in several tens of metres of erosion. The loss of defences is not sufficient to trigger greater recession as the primary control is groundwater and not toe erosion (due to the presence of the Portland Harbour Breakwaters). Erosion of the more resistant sandstone cliffs tends to be geologically controlled so there is not expected to be a noticeable increase in erosion rates due to sea level rise. However, the clay-rich cliffs are expected to be more sensitive to sea level rise and any increased in precipitation. The rate of erosion due to groundwater conditions within the clay-rich cliffs could increase due to an increase in rainfall resulting from future climate change. Due to uncertainty in the possible future changes in precipitation, no direct account has been taken of this in the predictions. Sea level rise would also result in the submergence of shore platforms that front this section, and a possible narrowing of the small pocket beaches, although this effect may be reduced by sand sediment released from the cliffs tending to remain locally within the pocket beaches, whilst fines would be lost offshore. This assumes that the Portland Harbour breakwaters are retained, as these prevent significant wave action at the toe of the cliffs from	2105 predicted to be between 30 and 50m, although along localised sections cliff falls could occur resulting in several tens of metres of erosion. The rate of erosion due to groundwater conditions could increase due to an increase in rainfall resulting from future climate change. Due to uncertainty in the possible future changes in precipitation, no direct account has been taken of this in the predictions. As a result of high sea levels beaches are expected to narrow and in places may disappear as the rock platforms become submerged, resulting in increased exposure of the defences and cliff toe to wave action. This assumes that the Portland Harbour breakwaters are retained, as these prevent significant wave action at the toe of the cliffs from causing greater rates of erosion. However, the lack of maintenance to these structures could lead to an increasing risk of them failing towards 2105.

Location	Predicted Change for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
		causing greater rates of erosion. However, the lack of maintenance to these structures could lead to an increasing risk of them failing towards 2055.	
Small Mouth to Osprey Quay (Portland Harbour)	Some parts of the short lengths of low-level rock revetment along this section that prevent erosion leading to an increased risk of flooding to low-lying land behind would be likely to fail towards the end of this period, It is assumed that Portland Harbour Breakwaters would remain as present.	The remaining short lengths of low-level rock revetment along this section that prevent erosion leading to an increased risk of flooding to low-lying land behind would be likely to fail during this period, It is assumed that Portland Harbour Breakwaters would remain as present, although there is a risk of failure due to a lack of maintenance during this period.	No defences present along the shoreline of this section. It is assumed that Portland Harbour Breakwaters would remain as present, although the risk of failure due to a lack of maintenance increases during this period.
	There is likely to be little change in the shingle barrier Ham Beach that dominates the central part of this section, as there has been little change over the past century. This is as a result of reduced wave exposure along the beach during this time resulting from the presence of the Portland Harbour breakwaters. This situation is expected to remain during this period. The failure of some of the low-level rock revetment along this section could result in increased erosion (at a rate of around 0.1m/yr) and flooding of low-lying land behind during high water level and wave events.	Assuming the continued presence of the Portland Harbour breakwaters is retained despite gradual deterioration from lack of maintenance, Ham Beach would remain largely stable as it has done historically. Sea level rise combined with a lack of new sediment input could begin to result in the narrowing of the beach and an increased risk of flooding to the low-lying land behind. The loss of all low-level rock revetment along this section could result in increased erosion and flooding of low-lying land behind during high water level and wave events. This in turn could affect the entrance to The Fleet, with debris possibly partially blocking the mouth for a period of time before it is removed by high current	As a result of high sea levels and a lack of new sediment input, Ham Beach could become narrower and in places may disappear as it becomes submerged, resulting in increased risk of flooding to the low-lying land behind. In places, Ham Beach may roll-back onto the low-lying land in response to sea level rise. If this were to occur then it would bolster the eastern edge of Chesil Beach and could lead to the entrance to The Fleet becoming closed at Ferrybridge, which in turn may cause to entrance to The Fleet to migrate to a new position as it has done in the past.

<table>
<tr><th rowspan="2">Location</th><th colspan="3">Predicted Change for 'No Active Intervention'</th></tr>
<tr><th>Short Term (to 2025)</th><th>Medium Term (to 2055)</th><th>Long Term (to 2105)</th></tr>
<tr><td></td><td></td><td>flows.</td><td></td></tr>
<tr><td rowspan="2">Osprey Quay (Portland Harbour) to Grove Point</td><td>Defences along this section include rock revetment and quay walls associated with Portland Port, as well as the Portland Harbour breakwaters, which it is assumed would remain as present.</td><td>The defences along this section would gradually fail during this period and have no effect by 2055.

It is assumed that Portland Harbour Breakwaters would remain as present, although there is a risk of failure due to a lack of maintenance during this period.</td><td>No defences along the shoreline.

It is assumed that Portland Harbour Breakwaters would remain as present, although there is a risk of failure due to a lack of maintenance during this period.</td></tr>
<tr><td>The existing defences along this section would continue to prevent any discernable erosion of the cliffs that back them, with the historical trend of negligible recession expected to continue to be the case over this period.</td><td>The gradual loss of defences along this section would not directly lead to the resumption of pre-defence recession conditions, rather during this period it is anticipated that there would be a continuation of negligible cliff recession as has occurred in the past century.

Sea level rise could result in an increased risk of flooding to the low-lying land behind some of the defences, a risk that would increase further as defences fail towards 2055.</td><td>The loss of defences by the start of this period would lead to cliffed areas returning to pre-defence behaviour by the end of this period (i.e. cliff failures that cause the loss of 10-50m of cliff per event with a frequency of more than 250 years). It is uncertain if such a cliff failure event would occur during this period without more detailed investigation of ground conditions.

Sea level rise would result in an increased risk of flooding to the low-lying land behind as a result of the loss of defences.</td></tr>
<tr><td rowspan="2">Grove Point to West Weare</td><td>There are no defences present along this section.</td><td>No defences.</td><td>No defences.</td></tr>
<tr><td>The majority of this section is dominated by very resistant limestone cliffs that experience only infrequent localised cliff failures. Continued very slow erosion of these resistant limestone cliffs, confined to joint planes or as a result of wave undercutting would occur during this period. Negligible cliffline movement is predicted for these areas.

The north-west part of this section (around West</td><td>Cliff recession as has occurred historically will continue during this period for the resistant limestone cliffs. Negligible cliffline movement is predicted for these areas. Localised rock falls may occur although it is not possible to predict where these may occur. These are geologically controlled events and are unlikely to be affected by sea level rise.

Erosion of the more erodible West Weare cliffs</td><td>Very slow erosion of the resistant limestone cliffs would continue at the same rates as today, therefore negligible change in cliffline position is predicted.

The more erodible West Weare cliffs would be predicted to erode between 10 and 15m by 2105, although these cliffs are very sensitive to climate change and the rate of erosion could increase both due to sea level rise and an increase in</td></tr>
</table>

Location	Predicted Change for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	Weare) the lower part of the cliffs are formed of clay, capped by limestone, and these experience landslide events with a frequency of about 100 years or so, although the underlying erosion in this area is predicted to be between 2 and 10m during this period. Any sediment released through cliff erosion will tend to be either retained very locally in the pocket beaches that indent the limestone cliffs (in the case of sand and shingle), or washed offshore (in the case of fines).	by 2055 is predicted to be between 5 and 10m at a rate of about 0.11m/yr as has occurred historically. However, these clay rich West Weare cliffs are very sensitive to climate change and the rate of erosion could increase both due to sea level rise and an increase in rainfall. Due to uncertainty in the possible future changes in precipitation, no direct account has been taken of this in the predictions. Sea level rise would also result in the submergence of shore platforms that front this section, and a possible narrowing of the small pocket beaches.	rainfall. As a result of high sea levels beaches are expected to narrow and in places may disappear as the rock platforms become submerged, resulting in increased exposure of the cliff toe to wave action.
Chiswell to Chesil Beach (Northern end of Osprey Quay)	Seawalls and revetments protect the toe of the cliff at the eastern end of this section, and also provide flood defence to the low-lying land located behind Chesil Beach. The crest of Chesil Beach is also protected for a short length by gabions, whilst behind the beach there is an interceptor drain that diverts water coming over and through Chesil Beach into Portland Harbour. This also forms part of the sea defence along with the seawall. Parts of the defences along the eastern end that front the cliffs by West Weare would fail towards the end of this period.	The remaining defences along this section would fail in the early to middle part of this period.	There would be no defences present along this section during this period.
	Along this frontage, the short section of undefended Chesil Beach that extends north-west	The crest of Chesil Beach is predicted to move towards Portland Harbour by 2 and 4m between	The formerly defended part of this section would behave as the adjacent natural beach during this

Location	Predicted Change for 'No Active Intervention'		
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	from the gabions, which stabilise the crest at Chiswell, is able to respond naturally to storm events. Along this section, it is predicted that the crest of the beach could migrate towards Portland Harbour by between 1 and 2m by 2025 assuming a rate of about 0.1m/yr as has been observed historically. The section of seawall and revetment at the south-eastern end of the defences, fronting part of West Weare would fail towards the middle or end of this period. Here the defences lie seaward of the natural shoreline position, the fronting beach is also narrower and steeper than the adjacent stretch. This would result in the gradual exposure of the cliff toe to wave action. It is, however, unlikely that significant cliff recession would occur by 2025 due to remains of the defences and promenade. The probability of a significant storm/swell wave event occurring that could cause more extensive rollback of the beach is low. However, should such an event occur during this period, then the beach could roll-back further and affect the defences and low-lying land behind, as well as cause the remaining defended part of the beach at Chiswell to become more prominent and so increasingly exposed to wave action.	2025 and 2055 assuming a rate of about 0.1m/yr as has been observed historically. The defences along this section would fail during this period, allowing the beach to respond and adapt to wave conditions and sea level rise in a similar way to the natural beach to the north-west. This would increase the risk of flooding to the low-lying land at Chiswell during this period. At the south-eastern end, beach narrowing would be expected as the natural landward movement of the shingle barrier would continue to be inhibited due to the infrastructure of Chesil. The probability of a significant storm/swell wave event occurring that could cause more extensive rollback of the beach would increase during this period as a result of climate change impacts.	period, with the crest of Chesil Beach predicted to move towards Portland Harbour by between 3 and 6m between 2055 and 2105 assuming a rate of about 0.1m/yr as has been observed historically. There would be an increased risk of flooding to low-lying land at Chiswell during this period. There would be some inhibition to shingle migration due to remaining infrastructure at the south-eastern end, at Chesil, which could result in barrier narrowing along this stretch. The probability of a significant storm/swell wave event occurring that could cause more extensive rollback of the beach would increase during this period as a result of climate change impacts.
Chesil Beach (Northern end of Osprey Quay)	There are no defences present along this section.	No defences.	No defences.
	It is predicted that the crest of the beach could	The crest of Chesil Beach is predicted to move	The crest of Chesil Beach is predicted to move

Location	Predicted Change for 'No Active Intervention'		
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and The Fleet	migrate towards The Fleet by between 1 and 2m by 2025 assuming a rate of about 0.1m/yr as has been observed historically. The probability of a significant storm/swell wave event occurring that could cause more extensive rollback of the beach is low. However, should such an event occur during this period, then the beach could roll-back further and encroach upon The Fleet, and possibly (although unlikely during this period) become attached to the mainland in the vicinity of Wyke Narrows, effectively cutting off The Fleet to tidal influence from Portland Harbour. The coastal slopes that are located on the landward side of The Fleet experience only small scale, very infrequent landslides, thought likely to be the result of groundwater conditions. These events would continue to occur at similar frequencies and scales as has occurred historically, with total erosion of 0 to 10m predicted to occur in localised areas by 2025. The eastern side of Chesil Beach that lines Portland Harbour would remain stable due to the continued effect of the Portland Harbour breakwaters that are assumed will remain during this period and which protect this side of the shingle barrier from exposure to large wave events.	towards The Fleet by 2 and 4m between 2025 and 2055 assuming a rate of about 0.1m/yr as has been observed historically. The probability of a significant storm/swell wave event occurring that could cause more extensive rollback of the beach would increase during this period. As such, the risk of The Fleet being cut-off at Wyke Narrows increases slightly during this period. The coastal slopes that are located on the landward side of The Fleet experience only small scale, very infrequent landslides, thought likely to be the result of groundwater conditions. These events would continue to occur at similar frequencies and scales as has occurred historically, although possible future changes in precipitation could cause an increase in the frequency of event. However, due to uncertainty about future precipitation, no direct account has been taken of this in the predictions. Total erosion of 0 to 10m predicted to occur in localised areas by 2055. The eastern side of Chesil Beach that lines Portland Harbour would remain stable due to the continued effect of the Portland Harbour breakwaters that are assumed will remain during this period and which protect this side of the shingle barrier from exposure to large wave events.	towards The Fleet by 3 and 6m between 2055 and 2105 assuming a rate of about 0.1m/yr as has been observed historically. The probability of a significant storm/swell wave event occurring that could cause more extensive rollback of the beach would increase during this period. As such, the risk of The Fleet being cut-off at Wyke Narrows increases further during this period. The coastal slopes that are located on the landward side of The Fleet experience only small scale, very infrequent landslides, thought likely to be the result of groundwater conditions. These events would continue to occur at similar frequencies and scales as has occurred historically, although possible future changes in precipitation could cause an increase in the frequency of event. However, due to uncertainty about future precipitation, no direct account has been taken of this in the predictions. Total erosion of 0 to 10m predicted to occur in localised areas by 2105. The eastern side of Chesil Beach that lines Portland Harbour would remain stable due to the continued effect of the Portland Harbour breakwaters that are assumed will remain during this period and which protect this side of the shingle barrier from exposure to large wave events. The eastern side of Chesil Beach could also be bolstered during this period by the roll-

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			back of Ham Beach onto the Chesil barrier during this period in response to rising sea levels.
Abbotsbury to Cogden Beach	There are no defences present along this section.	No defences.	No defences.
	This section has remained largely unchanged over the past century, and it is predicted that this will remain the case during this period to 2025. The extensive shingle barrier beach will continue to prevent erosion and flooding of the low cliffs, slopes and lowlands behind. The probability of a significant storm/swell wave event occurring that could cause more extensive rollback of the beach is low. However, should such an event occur during this period, then the beach could roll-back further and encroach upon the low-lying land, although the extent of roll-back would be restricted by the gradual rising of the coastal slopes that are located behind the beach.	This section has remained largely unchanged over the past century due to a net balance of longshore sediment transport, and it is predicted that this will remain the case during this period to 2055, although at the same time the beach could also retreat slightly over this period. The probability of a significant storm/swell wave event occurring that could cause more extensive rollback of the beach would increase during this period as a result of climate change impacts.	This section has remained largely unchanged over the past century due to a net balance of longshore sediment transport, and it is predicted that this will remain the case during this period to 2105. The effect of sea level rise could lead to an acceleration in the rate of retreat during this period, as well as an increased risk of flooding of the lowland marshes and lagoons, such as Burton Mere, that back this section of beach. The probability of a significant storm/swell wave event occurring that could cause more extensive rollback of the beach would increase during this period as a result of climate change impacts.
Cogden Beach to Burton Cliff (West)	There are no defences present along this section.	No defences.	No defences.
	This section is dominated in its western part by bedded sandstone cliffs up to 40m high. These sandstone cliffs fail as a result of wave undercutting at the toe about every 10 years. These cause localised small scale losses. It is predicted that between 2 and 3m of sandstone cliff could be lost to erosion by 2025. The simple low clay cliffs at the eastern end of this section would retreat a similar amount during	Erosion of the sandstone cliffs is expected to continue as observed historically at a rate of about 0.14m/yr as a minimum, although this could accelerate in response to rising sea levels, with total erosion by 2055 predicted to be between 7 and 10m. The simple clay cliffs at the eastern end of this section would be expected to erode between 7 and 13m by 2055.	Erosion of the sandstone cliffs is expected to continue as observed historically at a rate of about 0.14m/yr as a minimum, although this could accelerate in response to rising sea levels, with total erosion by 2105 predicted to be between 14 and 35m. The simple clay cliffs at the eastern end of this section would be expected to erode between 14 and 53m by 2105.

Location	Predicted Change for 'No Active Intervention'		
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	this period. The section is fronted by Chesil Beach which narrows in front of the sandstone cliffs compared to the much wider beach that fronts the low-lying area at Burton Bradstock in the east of this section. The beach has shown negligible change over the past 100 years, although short-term fluctuations as a result of storms do occur. It is predicted that the beach will continue to experience similar stability during this period to 2025. The probability of a significant storm/swell wave event occurring that could cause more extensive rollback of the beach on to the low-lying part of this section is low.	As a result of accelerated sea level rise, the historical trend of stability could change to one of erosion. Where the beaches are backed by cliffs, the beaches would be unable to retreat in response to the sea level rise therefore there could be beach steepening and narrowing along this section. This, in turn, could slightly increase the rate of cliff toe erosion and therefore failure. Along the low-lying sections of coast, the natural trend would be for barrier roll-back and the probability of a significant storm/swell wave event occurring that could cause more extensive rollback of the beach on to the low-lying part of this section would increase during this period.	As a result of high sea levels the beach fronting the sandstone cliffs are expected to narrow further and in places may disappear. This could result in a slight increase in the rate of cliff erosion, although the rate of erosion will be restricted due to the resistance of the cliffs. Along the low-lying sections of coast there would be beach roll-back and the probability of a significant storm/swell wave event occurring that could cause more extensive rollback of the beach on to the low-lying part of this section would increase during this period.
Freshwater Beach	This section of coast has no hard defences, but currently beach management involves unblocking of the river outlet and redistribution of sediment and reprofiling when required. It is assumed for this scenario that this management would cease.	No beach management activities.	No beach management activities.
	The beach levels along this section fluctuate over time, although the very recent past has seen a trend of accretion. The discharge of the River Bride through and over the beach at the eastern end of this section is intermittent, with beach material periodically closing the river mouth off. The biggest impact of ceasing management	It is possible that the recent period of stability would change to one of beach retreat, due to sea level rise. The natural response of the beach would be to migrate landwards into the low-lying bay. The volume of sediment should mean the shingle beach is relatively resilient to change although risk of overtopping could increase during this period. At the western end of the beach a more natural	The beach would retreat, in response to sea level rise, onto the low-lying land behind. The beach would probably retreat at a faster rate than the adjacent cliffs, forming a slight embayment, which could mean greater stability. It is likely therefore that beach would remain relatively resilient as it moves into the bay and at a similar volume to present. Erosion of the cliffs either side would provide

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	activities would be as a result of blockage of the river outlet. These blockages are currently cleared to prevent flooding backing up towards the village of Burton Bradstock under extreme events. Although the blockages would eventually clear naturally the period and extent of flooding would be much greater. During this period the beach is likely to remain quite stable, with little net change in plan shape expected. The western end of the beach, where the caravan park as been built out artificially, is the greatest area of risk. Here, any erosion of the shingle beach could reveal the easily eroded material upon which the park has been built, resulting in more rapid erosion at this location. There would be continued sediment linkages to adjacent beaches as the periodic blocking and unblocking of the river would continue.	alignment would be reached, with erosion of the caravan park. The greatest risk will be due to blockage of the river mouth and resultant flooding inland. Without the blockage being cleared the extent and period of flooding would be increased.	sediment to the lower foreshore, but littoral drift could be reduced as beaches narrow at the toe of the cliffs. The extent and frequency of inland flooding due to the river blockages could increase during this period and would be exacerbated by the river mouth blockages not being removed.
East Cliff (West Bay)	There are no defences present along this section.	No defences.	No defences.
	This section is dominated in its western part by bedded sandstone cliffs up to 40m high. These sandstone cliffs fail as a result of wave undercutting at the toe about every 10 years. These cause localised small scale losses. It is predicted that between 2 and 3m of sandstone cliff could be lost to erosion by 2025. The section is fronted by Chesil Beach which narrows in front of the sandstone cliffs compared to the much wider beach that fronts the adjacent	As a result of accelerated sea level rise, the historical trend of stability could change to one of erosion. As the beaches are backed by relatively resistant cliffs, the beaches would be unable to retreat in response to the sea level rise therefore there could be beach steepening and narrowing along this section. This, in turn, could slightly increase the rate of cliff toe erosion and therefore failure, although ultimately the rate of erosion will be restricted due to the natural resistance of the	Beach narrowing and steepening would continue, with erosion of the sandstone cliffs continuing, with total erosion by 2105 predicted to be between 14 and 35m. There would be a feed of sediment to the beaches, but the accelerated rate of sea level rise is likely to mean that only very narrow beaches would remain.

Location	Predicted Change for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	sections. The beach has shown negligible change over the past 100 years, although short-term fluctuations as a result of storms do occur. It is predicted that the beach will continue to experience similar stability during this period to 2025.	cliffs. The total erosion of the sandstone cliffs by 2055 is predicted to be between 7 and 10m. This cliff erosion will contribute to the beach sediment budget both locally and to adjacent beaches, although drift rates tend to be low along this frontage.	
West Bay (East Beach to eastern pier)	This section of coast has no hard defences along most of its length. At the western end, the beach is controlled by the eastern pier of West Bay Harbour entrance. There would be a cessation of the regular beach re-cycling and re-profiling as part of ongoing beach management practices.	No beach management activities. The harbour pier is assumed to remain during this period, although without maintenance its condition would deteriorate during this period.	No beach management activities. The harbour pier could fail during this period as a result of a lack of maintenance, reducing its effect on adjacent beaches.
	The beach at this location is wider than along the cliffed section to the east, due to the indented nature of the coast. However, without beach management activities it is likely that the current standard of protection would not naturally be maintained during this period. The western end would be most vulnerable, as the beach crests are lower and narrower here. There would be an increased risk of overtopping and overwashing, resulting in an increased risk of flooding extent and frequency to the low-lying land behind. There has been a historic tendency for beach drawdown and this is likely to continue, with the net beach volume gradually reducing.	The lack of beach management activity would result in an increasing risk of flooding, in terms of both frequency and extent, as a result of sea level rise during this period. The beach would retreat in response to sea level rise and the occurrence of storm/swell wave events onto the low-lying land behind, and this would likely occur at a faster rate than the erosion of the adjacent cliffs over this period resulting in the development of a slight embayment between the cliffs and harbour pier. There could, however, also be some erosion of the beach with subsequent draw-down of sediment.	Without the beach management, the beaches would return to a more natural profile along much of this stretch, although there would still be an influence of the remains of the piers (see below). Due to accelerated sea level rise during this period and the occurrence of storm/swell wave events, the beaches would tend to retreat landwards through overwash and overtopping. This process would, however, result in flooding of the low-lying land behind. There would be erosion of the cliffs to the east, but historical evidence suggests that these cliffs would not keep pace with sea level rise, resulting in narrowing beaches, the coastline at East Beach

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	The probability of a significant storm/swell wave event occurring that could cause either rollback of the beach on to the low-lying land that lies behind the beach, or draw-down and loss of material to the offshore, is low during this period.	During this period it is expected that the piers would continue to have some stabilising influence on the beach.	would therefore become further indented, forming a small bay that could in turn mean greater stability. However, the loss of the harbour piers as a result of a lack of maintenance would reduce this stabilising effect of the bay formation as well as their impact on littoral drift, and may result in an increased sediment exchange with the beaches of West Beach. The remains of the harbour piers would probably prevent the full closure of the harbour entrance during this period and therefore would exert a local influence on the beaches.
West Bay (West Beach from eastern pier) to West Cliff (East)	There is a range of defences within this section that primarily provides defence against flooding, including seawalls, rock groynes and sluices to control the discharge of the River Brit through West Bay Harbour itself. The cliff toe at the eastern part of this section is protected from erosion by a seawall and promenade. The seawalls along this section could fail by the end of this period: the seawalls at the western end are probably most vulnerable as these are covered at high tide. There would also be a cessation in beach management activity, which could accelerate the failure of the seawalls.	Loss of seawalls and control structures in the early part of this period is anticipated. No beach management activity. The harbour piers are assumed to remain during this period, although without maintenance its condition would deteriorate during this period. The loss of defences within the harbour could lead to the extension upriver of the tidal limit and result in an increased risk of flooding in this area.	No defences or beach management activity. The harbour piers could fail during this period as a result of a lack of maintenance, reducing its effect on adjacent beaches.
	The piers at the entrance to West Bay Harbour are a significant influence upon littoral processes,	Sea level rise could continue to cause coastal squeeze, with the narrowing of the beach and an	As a result of high sea levels the beach fronting this section is expected to narrow further and in

Location	Predicted Change for 'No Active Intervention'		
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	as are the rock groynes to the west of the harbour, preventing influx of new material to this section from either east or west. There is, however, also a natural obstruction to the eastwards drift of sediment at Thorncombe Beacon that is thought likely to remain during this period. The seawall prevents wave action from eroding the toe of the eastern part of West Cliff, which is a degraded sandstone cliff. The seawall is anticipated to fail by the end of this period, which would ultimately result in reactivation of the cliff, although defences would continue to reduce the rate of the erosion for a period. The beach fronting the seawall along this section has eroded significantly during the past century, and experiences scour during storm events due to the effect of the seawall. The cessation of beach management activity would result in lowered beach levels persisting after storm events, and could lead to the failure of the seawall during the middle of this period rather than the end of this period. Coastal squeeze as a result of sea level rise could become increasingly significant as there is very little new sediment input to the beach.	increase in flood risk along this section. It is not likely that there will be any increased feed of sediment into this area during this period due to the continued obstruction of the eastwards drift of sediment at Thorncombe Beacon that is thought likely to remain during this period. The loss of defences along this section would also increase the risk of flooding to low-lying land, whilst along the cliffed section at the western end, recession of West Cliff due to increased exposure of the cliff toe to wave action would occur, reaching similar rates to adjacent unprotected cliffs by 2055 of about 0.4m/yr. The loss of shoreline control structures would allow for some longshore transport of sediment, although it is unlikely to allow sufficient build-up of material to affect flood risk or cliff erosion rates. This would also be unlikely to impact on East Beach or the coast to the east due to the impact of the harbour piers on sediment linkages.	places may disappear due to a lack of new coarse sediment input from cliff erosion to the west. This would also result from the continued obstruction of the eastwards drift of sediment at Thorncombe Beacon that is thought likely to remain during this period. An increasing risk of flooding of the low-lying land would result. The loss of the harbour piers as a result of a lack of maintenance would reduce their impact on littoral drift, and may result in an increased sediment exchange with the beaches of West Beach. This may provide some beach material to West Beach. The remains of the harbour piers would likely prevent the full closure of the harbour entrance. Cliff recession would occur at similar rates to the adjacent unprotected cliffs to the west.
West Cliff (East) to Thorncombe Beacon	There are no defences present along this section.	No defences.	No defences.
	West Cliff is undefended along this section and is predicted to erode between 5 and 50m by 2025.	West Cliff is predicted to erode as historically during the period 2025 and 2055 by between 15	West Cliff is predicted to erode as historically during the period 2055 and 2105 by between 35

Location	Predicted Change for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	Cliff failures along West Cliff occur about every 10 years and cause the loss of between 10 and 50m of cliff top in a single event. The clay-rich cliffs towards the west of this section experience failures at a similar frequency as West Cliff although with a lesser magnitude per event. The underlying rate of erosion of these more cliffs is also similar to West Cliff, although with greater uncertainty, giving rise to total erosion of between 5 and 20m predicted along this part by 2025. Coastal squeeze as a result of sea level rise could become increasingly significant, particularly in the area fronting the seawall, as there is very little new sediment input to the beach.	and 125m, whilst the cliffs to the western end of this section are predicted to erode between 10 and 50m over the same period. There would be a feed of coarse sediment from erosion of cliffs to the west, which should help retain a small beach at Eype although this would be hindered by the continued presence of the headland at Thorncombe Beacon. The clay rich cliffs are very sensitive to climate change and the rate of erosion could increase both due to sea level rise and an increase in rainfall. Due to uncertainty in the possible future changes in precipitation, no direct account has been taken of this in the predictions.	and 250m, whilst the cliffs to the western end of this section are predicted to erode between 25 and 100m over the same period. There would be an input of coarser sediment from the east which will feed beaches here, although this would be hindered by the continued presence of the headland at Thorncombe Beacon. The clay rich cliffs are very sensitive to climate change and the rate of erosion could increase both due to sea level rise and an increase in rainfall. Due to uncertainty in the possible future changes in precipitation, no direct account has been taken of this in the predictions.
Thorncombe Beacon to Seatown (East)	There are no defences present along this section, although this section does cover the car park at Seatown, on the eastern side of the River Winniford that discharges to the sea at this location, which is only protected by naturally functioning cliffs.	No defences.	No defences.
	The clay-rich cliffs along this section experience complex landslide behaviour with cyclic backscar retreats as a result of short (episodic) events causing rapid retreat by rotational landsliding. These episodic events along this section occur about every 10 years on a small scale, although the underlying erosion is predicted to be as historically and result in total average erosion of	These clay rich cliffs are very sensitive to climate change and the rate of erosion could increase both due to sea level rise and an increase in rainfall. Due to uncertainty in the possible future changes in precipitation, no direct account has been taken of this in the predictions. Therefore the rate of cliff erosion is likely to increase from that observed historically, with	These clay rich cliffs are very sensitive to climate change and the rate of erosion could increase both due to sea level rise and an increase in rainfall. Due to uncertainty in the possible future changes in precipitation, no direct account has been taken of this in the predictions. Therefore the rate of cliff erosion is likely to increase from that observed historically, with

Location	Predicted Change for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	between 10 and 20m by 2025.	total erosion of this section between 2025 and 2055 predicted to be between 30 and 50m, although the effects of sea level rise would be outweighed by large landslide events that could occur during this period. Any coarse sediment released through cliff erosion should feed the beach at Eype, meaning that a beach should be retained here. Thorncombe Beacon acts as a barrier to drift therefore there is no sediment interaction with the beaches to the east.	total erosion of this section between 2055 and 2105 predicted to be between 70 and 100m, although the effects of sea level rise would be outweighed by large landslide events that could occur during this period. The beach at Eype will be fed by any release of coarse sediment from cliff erosion, with any fines being lost offshore. Thorncombe Beacon would continue to act as a barrier to drift to the east.
Seatown	A rock revetment extends along the toe of part of the cliff that fronts the western part of Seatown. This prevents wave action from eroding the cliff toe in this area. It is likely that this and the short stretch of promenade along Seatown frontage would fail during this period, although the rocks would still have a small impact on the rate of cliff retreat.	No defences.	No defences.
	With failure of the defences during this period, there would be reactivation of the cliffs behind, with erosion occurring at similar rates to the adjacent sections at about 0.7m/yr, with erosion of between 5 and 20m predicted. The beach is likely to remain similar to present, being able to adapt to rising sea levels by retreating into the mouth of the river.	These clay rich cliffs are very sensitive to climate change and the rate of erosion could increase both due to sea level rise and an increase in rainfall. Due to uncertainty in the possible future changes in precipitation, no direct account has been taken of this in the predictions. The loss of the defences in the short term will lead to cliff recession during this period occurring at a similar rate to the adjacent cliffs. Cliff erosion would continue at a faster rate than historically,	These clay rich cliffs are very sensitive to climate change and the rate of erosion could increase both due to sea level rise and an increase in rainfall. Due to uncertainty in the possible future changes in precipitation, no direct account has been taken of this in the predictions. Cliff erosion would therefore continue to occur at increased rates from historically, with total erosion of up to 100m predicted by 2105, although the effects of sea level rise would be

Location	Predicted Change for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
		with total erosion of up to 50m predicted by 2055, although the effects of sea level rise would be outweighed by large landslide events that could occur during this period. The beaches will receive some sediment from the cliff erosion, although any fines will be lost offshore. It is anticipated that additional sediment input will enter Seatown beach from the west as erosion of the lobe of sediment at Golden Cap is removed, and this may serve to reduce wave exposure at the cliff toe and so serve to slow the rate of recession by counter-acting the effect of sea level rise. Under accelerated sea level rise the beach would be expected to retreat landwards into the embayment within which Seatown sits. The beaches will therefore narrow at the western and eastern extremities.	outweighed by large landslide events that could occur during this period. Sediment supply to the beach at Seatown would continue from the west. Despite these inputs, the net trend under sea level rise would be for beaches to migrate landwards. Seatown sits within a slight indent within the embayment, therefore a beach would be retained here. However should Golden Cap experience a large landslide event then a new lobe would form and cut off this supply. If this occurs, then the beach would likely narrow relatively rapidly, exacerbated by sea level rise.
Seatown (West) to Golden Cap	There are no defences present along this section.	No defences.	No defences.
	The clay-rich cliffs along this section experience complex landslide behaviour with cyclic backscar retreats as a result of short (episodic) events causing rapid retreat by rotational landsliding. These episodic events along this section occur about every 10 years on a small scale, although the underlying erosion is predicted to be as historically at a rate of about 0.7m/yr, resulting in total erosion of between 10 and 20m by 2025.	These clay rich cliffs are very sensitive to climate change and the rate of erosion could increase both due to sea level rise and an increase in rainfall. Due to uncertainty in the possible future changes in precipitation, no direct account has been taken of this in the predictions. Cliff erosion is likely to occur at a faster rate than historically, with total erosion of this section by 2055 predicted to be between 35 and 50m, although the effects of sea level rise would be	These clay rich cliffs are very sensitive to climate change and the rate of erosion could increase both due to sea level rise and an increase in rainfall. Due to uncertainty in the possible future changes in precipitation, no direct account has been taken of this in the predictions. Cliff erosion is likely to occur at a faster rate than historically, with total erosion of this section by 2105 predicted to be between 70 and 100m, although the effects of sea level rise would be

Location	Predicted Change for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	This erosion would result in some beach feed although fines would be lost offshore. Therefore beaches would be maintained at the toe of the cliffs. A previous landslide event has resulted in a lobe of debris cutting off longshore sediment transport feeding beaches to the east. It is anticipated that this will gradually erode and be largely removed as a barrier to transport by 2025.	outweighed by large landslide events that could occur during this period. Any large scale events that occur during this period could result in a lobe of sediment interrupting the sediment drift, which could impact on adjacent beaches.	outweighed by large landslide events that could occur during this period.
Golden Cap to Charmouth (East)	There are no defences present along this section.	No defences.	No defences.
	The clay-rich cliffs along this section experience complex landslide behaviour with cyclic backscar retreats as a result of short (episodic) events causing rapid retreat by rotational landsliding. The frequency and magnitude of these events varies depending upon specific local geology that comprise each individual cliff, although large events occur about every 100 years or so. Throughout this section, erosion would continue as historically, with variable erosion occurring along the shoreline at rates ranging from 0.1 to 1.0m/yr. At Golden Cap, total erosion of between 3 and 50m is predicted by 2025, whilst at Stonebarrow erosion of 7 to 50m is predicted, and 17 to 50m of erosion is predicted at Broom Hill over the same period.	These clay rich cliffs are very sensitive to climate change and the rate of erosion could increase both due to sea level rise and an increase in rainfall. Due to uncertainty in the possible future changes in precipitation, no direct account has been taken of this in the predictions. Cliff erosion is likely to occur at faster rates than historically, although the effects of sea level rise would be outweighed by large landslide events that could occur during this period, with total erosion of this section by 2055 predicted to be between 8 and 50m at Golden Cap; 20 to 50m at Stonebarrow, and 40 to 50m at Broom Hill. These varying rates of erosion would lead to Golden Cap developing into a more defined headland, with the cliffs to the west becoming more set-back forming a shallow embayment. This is not likely to affect adjacent beaches, as Golden Cap is already a barrier to littoral transport.	Cliff erosion is likely to occur at faster rates than historically, although the effects of sea level rise would be outweighed by large landslide events that could occur during this period, with total erosion of this section by 2105 predicted to be between 17 and 50m at Golden Cap; 40 and 50 at Stonebarrow, and 50 and 100m at Broom Hill. These varying rates of erosion would lead to Golden Cap developing into a more defined headland, with the cliffs to the west becoming increasingly set-back forming a deepening embayment. This is not likely to affect adjacent beaches, as Golden Cap is already a barrier to littoral transport.

Location	Predicted Change for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
Charmouth (East) to East Cliff (Lyme Regis)	Defences are present at the eastern end of this section at Charmouth, where a short length of seawall and promenade provides flood protection. Defences could begin to fail at the end of this period.	The defences along this section would fail in the early to middle part of this period.	No defences.
	The seawall and promenade at Charmouth backs a sandy beach, with shingle veneer. Defences will become increasingly exposed and therefore the risk of overtopping would increase. There is limited beach present in front of the defences and this would continue to narrow during this period. This could result in undermining of the rock revetment and accelerate failure of the seawall at the car park. Therefore this section of seawall could fail towards the end of this period. This would allow retreat of the beach and reactivation of the low slopes and cliffs. The majority of this section consists of clay-rich cliffs that experience complex landslide behaviour with cyclic backscar retreats as a result of short (episodic) events causing rapid retreat by rotational landsliding. The frequency and magnitude of these events varies depending upon specific local geology that comprise each individual cliff, although large events occur about every 100 years or so causing recession of more than 50m per event. The most recent event occurred in May 2008 within The Spittles	Beach narrowing and resultant undermining, together with outflanking due to adjacent cliff erosion, is likely to result in failure of the defences along the Charmouth frontage towards the start of this period. This would result in reactivation of the low slopes and cliffs but would also allow retreat of the beach system. Due to the sensitivity of these cliffs to climate change, cliff erosion is likely to increase from rates observed historically. Although the rate of erosion could increase both due to sea level rise and an increase in rainfall, due to uncertainty in the possible future changes in precipitation, no direct account has been taken of this in the predictions. Sea level rise would result in the submergence of the fronting beaches and shore platforms (ledges), resulting in more rapid erosion of the cliffs behind. However the effects of sea level rise are likely to be outweighed by large landslide events that could occur during this period, The east and central parts of Black Ven are predicted to experience total erosion of between	Without defences along the Charmouth frontage this section of coast would experience net retreat of both beach and the low cliffs and slopes. Due to the sensitivity of these cliffs to climate change, cliff erosion is likely to increase from rates observed historically. Although the rate of erosion could increase both due to sea level rise and an increase in rainfall, due to uncertainty in the possible future changes in precipitation, no direct account has been taken of this in the predictions. Sea level rise would result in the submergence of the fronting beaches and shore platforms (ledges), resulting in more rapid erosion of the cliffs behind. Due to differences in cliff composition, total erosion by 2105 would occur at variable rates. The east and central parts of Black Ven are predicted to have eroded between 40 and 50m over this period, whilst Black Ven West is predicted to have eroded by 50 to 60m, and The Spittles by about 50m. However it is possible that landslide events may periodically occur that cause greater amounts of recession although it is not

Location	Predicted Change for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	complex, and resulted in around 50m of cliff top recession along a 400m length, and which was considered to be the largest event in this area for around 25 years. Throughout this section, erosion would continue as historically, with variable erosion occurring along the shoreline at rates ranging from 0.2 to 3.3m/yr, although rates vary greatly depending upon the time period looked at as a result of landslide events causing distortions in the data. By 2025, the east and central parts of Black Ven are predicted to erode between 7 and 50m. Over this same period, Black Ven West is predicted to erode by 10 to 50m, whilst The Spittles is predicted to erode by about 10m. However it is possible that landslide events may periodically occur that cause greater amounts of recession although it is not possible to predict this. Continued beach narrowing as a result of sea level rise could become increasingly significant as there is very little new sediment input to the beach. The large scale landslides also act as a barrier to any sediment transport along this section. Locally there could be beach building sediment released from the cliffs, in particular Black Ven West cliffs.	20 and 50m over this period, whilst Black Ven West is predicted to erode by 30 to 50m, and The Spittles by 25 to 50m. However it is possible that landslide events may periodically occur that cause greater amounts of recession although it is not possible to predict this. A larger amount of recession could occur during this period as a result of large landslide events that occur about every 100 years or so causing recession of more than 50m per event. However, without further detailed investigation, it is uncertain as to exactly where and when such a large scale event would occur. These effects may be mitigated by the release of beach building material from the significant erosion along this section, particularly at Black Ven West, which would release suitable beach material from the Upper Greensands.	possible to predict this. If not already happened in the medium term, a larger amount of recession could occur during this period as a result of large landslide events that occur about every 100 years or so causing recession of more than 50m per event. However, without further detailed investigation, it is uncertain as to exactly where and when such a large scale event would occur. These effects may be mitigated by the release of beach building material from the significant erosion along this section, particularly at Black Ven West, which would release suitable beach material from the Upper Greensands that would also be available to be transported to beaches to the east. Any large scale landslide events, could, however, result in sediment drift being interrupted.
East Cliff (Lyme Regis) to Broad Ledge (Lyme	Defences are present along the length of this section, with a seawall along East and Church Cliffs at Lyme Regis that protects the cliff toe	The defences along this section would fail in the early to middle part of this period.	No defences.

Location	Predicted Change for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
Regis)	from erosion. Defences could begin to fail at the end of this period.		
	The seawall at Lyme Regis prevents erosion of the cliff toe and since its construction has prevented any significant landslide activity. The continued presence of the seawall at Lyme Regis will continue to limit landslide activity over this period. All of these defences would continue to prevent erosion and flooding during this period, although they would start to fail by 2025.	Submergence of the rock platform and beach at Lyme Regis could also lead to a similar coastal squeeze problem in this area. The failure of the defences fronting Church and East Cliffs would lead to the gradual increase in exposure of the cliff toe to wave action and lead to the resumption of cliff recession in this area by 2055. The risk of the defences along the eastern part of this section becoming outflanked by the continued erosion of the adjacent undefended cliffs to the east will initially increase throughout this period. However, the loss of defences and resumption of erosion would likely lead to the 'outflanked' sections eroding more rapidly for a short period as they 'catch up' to the adjacent retreated cliffline position. Total erosion of up to 50m could occur by 2055 following failure of the defences.	Failure of defences during the medium-term at Lyme Regis would see Church and East Cliffs retreat at pre-defence rates, with recession of between 50 and 70m possible by 2105 depending upon the occurrence of landslide events that could remove more than 50m in one go.
Broad Ledge (Lyme Regis) to The Cobb (Lyme Regis)	This section is entirely defended by a range of structures including seawalls and rock groynes, which would remain during this period. Beach management activities, including beach recharge would cease.	Defences would remain along this section, although they would gradually begin to fail during the latter part of this period.	All defences along this section are expected to fail by the early part of this period.
	The defences along this section prevent cliff erosion, and their continued presence would	Prior to the failure of The Cobb, the continued presence of defences along this section means that there would be very little change in shoreline	The failure of The Cobb (discussed in the adjacent section) would have significant impacts on this bay, which has developed as a result of the

Location	Predicted Change for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	result in no change in cliff position by 2025. The beaches along the central frontage have been recently recharged and control structures built. Although under this scenario it is assumed that no further beach recharge would be undertaken, the beaches are likely to remain quite stable, as the control structures would remain, and so would continue to provide some stability and retain beach material.	position during this period, even as defences along the back of the beach gradually fail towards 2055. Increased sea levels would, however, result in increased exposure of the beaches and there would therefore be increased beach erosion and narrowing. This in turn will increase exposure of the defences to wave attack and there could be an increased risk of overtopping and so an increased risk of flooding to low-lying areas behind the defences. Failure of The Cobb, which could occur towards the end of this period, would have a significant impact on this beach, which would suddenly become exposed to the force of south-westerly waves. As a result, there would be significant beach loss, which would further expose the remaining defences along the backshore.	protection afforded by the structure. There would be significant loss of beach volume, particularly along the western end. It is unlikely, due to the coastal orientation, that there would be any significant feed of sediment from the west, even once The Cobb fails. During the early part of this period, defences are likely to fail completely, a loss which would be significantly accelerated by the failure of The Cobb, and although shoreline retreat would be inhibited by the remaining infrastructure, in the longer term the sloping hinterland would become exposed to wave action and erosion. Similar rates to those experienced by adjacent unprotected cliffs to the west by 2105 would be expected, although recession would occur in the cliff base and no recession of the cliff top would occur during this period.
The Cobb (Lyme Regis) to Seven Rock Point	The eastern part of this section is protected by a seawall that runs along the cliff toe. The immediate eastern end is The Cobb breakwater.	The seawall along this section would fail in the middle of this period. The Cobb could also fail by the end of this period.	No defences.
	The seawall prevents erosion of the cliff toe along the eastern part of this section, and has resulted in no significant cliff recession in this area, although Monmouth Beach that fronts the defences has, over the past 100 to 150 years experienced a long term trend of erosion and steepening, except at the very eastern end where some limited accretion occurs against The Cobb.	The loss of defences along the cliff toe at Monmouth Beach will result in a gradual increase in cliff recession, anticipated to reach similar rates as the adjacent unprotected cliffs by 2055. These cliffs are sensitive to climate change and therefore the rate of erosion of the cliff base would increase from that observed historically, in response to rising sea levels (this does not take	With no defences along the cliff toe at Monmouth Beach, cliff recession here would occur at a similar rate as the adjacent undefended cliff. The undefended cliffs in the western part of this section would erode at faster rates than historically along the cliff base, due to sea level rise. However it is unlikely that recession of the cliff top would occur by 2105.

Location	Predicted Change for 'No Active Intervention'		
	Short Term (to 2025)	**Medium Term (to 2055)**	**Long Term (to 2105)**
	Beach narrowing is predicted to continue as a result of sea level rise. West of the defended part of this section, cliffs are unprotected and so erosion of the cliff base here is expected to continue as historically at a rate of about 0.2m/yr, although no cliff top recession is predicted by 2025.	account of any increase due to increased precipitation). The cliff top is unlikely to erode by 2055. These clay-rich cliffs are unlikely to significantly contribute to the beach budget. Therefore both in front of the cliffs at the western end and remains of defences and infrastructure at Monmouth Beach, sea level rise would continue to cause beach narrowing along the whole of this stretch. It is possible that due to beach narrowing and subsequent undermining, that The Cobb could fail during this period. This would have a significant impact on both this stretch and Lyme Regis frontage (discussed in previous section). Along this stretch, sediment remaining in the lee of the structure would be lost either offshore or to infill the marina.	As a result of high sea levels beaches are expected to narrow and in places may disappear as the rock platforms become submerged, resulting in increased exposure of the cliff toe to wave action. This process would have been accelerated at the eastern end of this stretch by loss of The Cobb. It is unlikely that any of this beach sediment would feed the Lyme Regis frontage due to the coastline orientation and the fact that the adjacent frontage would suddenly be exposed to waves from the south-west.
Seven Rock Point to Haven Cliff (West)	There are no defences present along this section.	No defences.	No defences.
	The clay-rich cliffs along this section experience complex landslide behaviour with cyclic backscar retreats as a result of short (episodic) events causing rapid retreat by rotational landsliding. The frequency and magnitude of these events varies along this section due to changes in geology. Along the eastern stretch there is a risk of large scale landslide events occurring, but the frequency of these is low; every 250 years or more. Whereas along the western section of this	These clay rich cliffs are very sensitive to climate change and the rate of erosion could increase both due to sea level rise and an increase in rainfall. Due to uncertainty in the possible future changes in precipitation, no direct account has been taken of this in the predictions. Taking account of rising sea levels alone, the rate of cliff erosion would be expected to be higher than experienced historically, although it is likely to be outweighed by the occurrence of landslide	These clay rich cliffs are very sensitive to climate change and the rate of erosion could increase both due to sea level rise and an increase in rainfall. Due to uncertainty in the possible future changes in precipitation, no direct account has been taken of this in the predictions. Taking account of rising sea levels alone, the rate of cliff erosion would be expected to be higher than experienced historically, although it is likely to be outweighed by the occurrence of landslide

Location	Predicted Change for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	frontage, smaller, more frequent, landslides are characteristic. On average by 2025 between 3 and 10m of erosion is expected to occur towards the western end of this section, as has been experienced historically at a rate of about 0.2m/yr, supplying sediment to local beach stocks. No recession is predicted towards the eastern end of this section. Due to natural barriers to littoral drift it is unlikely that this stretch would be affected by management changes along adjacent sections.	events, with about 10m of cliff top recession predicted by 2055. The supply of sediment across the mouth of the Axe is expected to continue as at present.	events, with between 10 and 20m of cliff top recession predicted by 2105. This could be much greater in some areas should a large landslide event occur during this period, the probability of which would increase towards 2105 as the last such event occurred in 1839. Should such an event occur, then it would form a lobe of debris that would inhibit littoral transport processes.
Haven Cliff (West) to Seaton Hole	Defences along the toe of the cliff from Seaton to Seaton Hole include both seawalls and rock revetment. Those at the western end could begin to fail by 2025.	The defences along this frontage are expected to fail during the middle to end of this period, with the rock revetment and defences at western end likely to fail first where the beach is narrowest.	No defences.
	The defences along the toe of the cliff have caused the rate of cliff erosion to be reduced over the recent past. This has been aided by natural beach accumulation in the very recent past, although beach levels have fluctuated in this area, historically the trend is one of accretion and so it is thought that the recent lower rate of recession of about 0.2m/yr would continue until 2025, with total erosion of 3 to 5m predicted over this period. As these cliffs are mudstones, this erosion will not significantly contribute to the beaches. There could be beach narrowing in front of the	Along the western stretch of this frontage, there would be beach narrowing in front of the defences, due to continued west to east transport of sediment and lack of new input to the system. This would be exacerbated by sea level rise. Where the cliffs are protected by rock revetment, cliff erosion would continue to be reduced, with a total erosion of between 5 and 10m expected between 2025 and 2055. However, these defences would begin to fail and become less effective during the early part of this period and this loss combined with sea level rise could	The loss of defences by this period would result in reactivation of the regraded slopes that currently sit behind defences. The effect of sea level rise on these simple cliffs is likely to lead to increased rates of recession above those observed historically. As such there would be an estimated total erosion of 60 to 90m at Seaton and 80 to 100m at Seaton Hole by 2105. The increased cliff recession is unlikely to add significantly to the beach stock as the cliffs comprise of mudstone and sandstone. Therefore a narrowing of the beaches due to limited contemporary input of sediment and continued

Location	Predicted Change for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	defences due to continued west to east transport of sediment and lack of new input to the system. Sediment transport along the frontage from west to east would continue to maintain the spit that extends across the mouth of the Axe estuary and here beaches would be stable and could continue to accrete.	lead to an increase in this rate by 2055. Where defences fail, the effect of sea level rise on these simple cliffs is likely to increase the rate of recession. As a result total recession of 20 to 30m along the Seaton frontage could occur by 2055 following the loss of defences, rising to 30 to 35m at Seaton Hole over the same period. The seawall is expected to remain for much of this period, although the western stretch is most vulnerable due to the narrowing beaches here. Therefore for the majority of this period there would be little change in cliffline position. Once defences fail, and it is likely that the western ones could fail first, there would be an initial period during which the remaining structures would continue to have some impact, but then the regraded slope behind would become reactivated. A total erosion of between 15 and 25m is therefore expected during this period. Beaches to the east would continue to receive sediment moved alongshore and should remain stable during this period. There could be elongation with re-curving of the spit into the harbour and under sea level rise, beach steepening could occur together along the length of the spit as material is pushed onshore by overwashing storm waves.	west to east littoral transport, coupled with higher sea levels would be anticipated. There would be continued sediment moved alongshore towards the Axe estuary which should help maintain the spit in a similar form to today. The tendency of the spit will be to migrate inland in response to sea level rise. This would result in an increased risk of overtopping and breaching as the coast becomes more exposed where the spit attaches to the land.
Seaton Hole to Beer Head	There are no defences present along this section, although there are structures, such as the car	The structures along the short length at Beer that provide some limited defence function would fail	No defences.

Location	Predicted Change for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	park, along a short stretch at Beer that also have some limited defence function.	during this period.	
	Chalk cliffs that are largely resistant to erosion dominate this section. There has been negligible erosion of this section over the past 100 years, with only very localised small to medium sized rock falls occurring every 10 to 100 years. This pattern of recession is expected to continue over this period to 2025, with total erosion of between 0 and 50m possible depending on whether or not a cliff failure event occurs. There are isolated pocket beaches at Beer and Pound's Pool. The low rate of cliff erosion means that there is little or no contemporary sediment input to these beaches. During this period the beaches may remain quite stable, but may start to experience some narrowing and steepening towards the end of the period. At Beer there could be some leakage of sediment at the eastern end of the beach. The short length of defence at Beer is unlikely to have a significant impact on cliff recession due to the natural resistance of the rocks that would recede little in any case.	The resistant nature of the chalk cliffs will continue to result in negligible cliff recession, except for very infrequent localised rock falls; it is not, however, possible to predict the exact locations of these. Total erosion of between 0 and 50m is possible by 2055, depending on whether or not a cliff failure event occurs. The pocket beaches would continue to experience narrowing and steepening during this period due to accelerated sea level rise. The loss of the structures that provide limited defence function over a short length at Beer is unlikely to have a significant impact on cliff recession due to the natural resistance of the rocks that would recede little in any case.	The resistant nature of the chalk cliffs will continue to result in negligible cliff recession, except for very infrequent localised rock falls; it is not, however, possible to predict the exact locations of these. Total erosion of between 0 and 50m is possible by 2105, depending on whether or not a cliff failure event occurs. The pocket beaches would continue to experience narrowing and steepening during this period due to accelerated sea level rise, but a beach should still be present at Beer due to the indented nature of this frontage.
Beer Head to Salcombe Hill (West)	There are no defences present along this section, apart from very localised rock placement at Branscombe.	The rock at Branscombe would fail during this period.	No defences.
	The long term trend of the beaches that front the	Cliff recession of the chalk cliffs at Beer would	Cliff recession of the chalk cliffs at Beer would

Location	Predicted Change for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	cliffs along this section has been one of slight accretion towards Beer Head and erosion towards Salcombe Hill, with the intervening beach having been relatively stable, due to the west to east drift of sediment. This situation is predicted to continue in to the future. The beach erosion at the western end of this section is related to the presence of control structures in front of Sidmouth (see section below) that prevent littoral drift from bringing sediment to the beaches in this area. It is assumed that these structures would remain during this period, and so the beach in this area will continue to erode. The varying beach levels contribute to varying rates of cliff recession by permitting varying amount of cliff toe erosion. The rate of cliff erosion is also due to the varying geologies along this stretch. At Beer Head the cliffs are composed of chalk, but this is replaced by sandstone and marl cliffs towards the east. Towards Beer Head, total cliff erosion by 2025 is predicted to be between 3 and 10m, whilst towards Salcombe Hill, total erosion over the same period is predicted to be 5 to 6m at a rate of about 0.3m/yr as observed historically with possible cliff fall events towards Beer Head resulting in localised increases in recession.	continue as has occurred historically at rates of between 0.05 and 0.35m/yr combined with infrequent small scale cliff fall events, with total erosion by 2055 of 8 to 10m predicted towards Beer Head. The softer cliffs composed of sandstone and marl, which characterise the remainder of this stretch are more sensitive to climate change and therefore, taking account of sea level rise, these are expected to erode between 14 and 18m during this period. These cliffs are prone to small but frequent mudslides, but whilst these would remain as lobes on the beach for a while, they do not contribute to the shingle beach (although any sands may remain on the intertidal beach). East of Branscombe the cliffs are vulnerable to complex, large scale landslides, where the chalk sits on top of the marl. These events could cause several metres of erosion, but would tend to be very localised. There would be continued feed of sediment alongshore due to the west to east littoral drift, which would help maintain beaches along this stretch. Any larger scale landslide event could interrupt this and impact on downdrift beaches such as Branscombe, but the location of future failures is difficult to predict. Under sea level rise the rock at Branscombe will become less effective and due to increased exposure would start to breakdown. This would only have a very localised	continue as historically at rates of between 0.05 and 0.35m/yr combined with infrequent small scale cliff fall events, with total erosion by of 10 to 17m predicted towards Beer Head by 2105. The softer clay-rich cliffs to the west are more sensitive to climate change and therefore, taking account of sea level rise, these are expected to erode between 29 and 53m during this period. Superimposed on these rates are the possibility of large scale failures, which would be localised but could cause several metres of erosion in one event. There would be continued alongshore transport from west to east, but beaches would be expected to narrow and steepen due to higher sea levels, particularly in the western part of this section, as a result of a lack of shingle to this area. A beach is expected to remain at Branscombe, but is likely to be narrower and will have been pushed inland slightly.

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		impact and would ultimately lead to reactivation of erosion of the cliffs behind. At the western end of this stretch initially the littoral input would be reduced by defences at Sidmouth and here beaches could narrow, potentially resulting in increased cliff erosion, however once defences start to fail towards the end of this period there could be a slight increase in beach volume. The feed of sediment could be periodic, due blocking and unblocking of the river mouth.	
Sidmouth	Defences along this section include rock groynes and offshore rock breakwaters, as well as seawalls. These would remain during this period but it is assumed that all other beach management activities would cease.	The defences along this frontage would fail in the early to middle part of this period. No beach management activity.	Rock groynes and breakwaters could still remain, but would be increasingly ineffective due to sea level rise. The seawall would have failed at least by the early part of this period.
	The seawall along this section protects low-lying land from flooding, whilst the shoreline structures and offshore breakwaters serve to retain beach material in front of the seawall. Although the breakwaters and groynes would remain, the current trend for gradual erosion would continue, particularly without any beach management taking place, due to the cross-shore movement of shingle during storm events that is not completely returned by post-storm action. The defences would continue to prevent material from being transported eastwards by littoral drift to the adjacent undefended section, which would	Beach narrowing would be an issue during this period due to the limited input of shingle from the west and the impact of rising sea levels. Although the groynes and breakwaters would remain, without improvement these could become increasingly ineffective as sea levels rise. The upper shingle beaches could therefore become less stable with an increased tendency for drawdown and volume loss during storm events. The beaches would also become more exposed, therefore littoral transport towards the east could also increase. There would therefore be a gradually denudation of shingle.	There would only be very narrow shingle beaches fronted by a sandy foreshore. In response to sea level rise the natural tendency would be for landward migration. Despite failure of the seawall retreat would still be inhibited by remaining infrastructure, the shingle beaches would be expected to narrow further and in places could disappear as a result of sediment being transported both offshore during storm events and alongshore to the beaches to the east and not being replaced with new sediment from the west. The lack of defences would also result in an increased risk of flooding to low-lying coastal

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	help retain beaches along this stretch. Therefore beaches would be expected to remain in place with a slight trend for narrowing of the upper shingle beach. The seawall would therefore continue to hold the current shoreline position. There could, however, be an increase risk of overtopping during severe events as the beaches narrow slightly.	Narrower beaches, combined with rising sea levels would increase exposure of the backing seawall. There would therefore be an increased risk of both overtopping and, should shingle start to be removed, undermining at the toe of the structure. The timing of the seawall failure is uncertain but it is possible that some sections could start to fail by the middle of this period. Failure of the remaining sections could then occur fairly rapid. This would also result in an increased risk of flooding of low-lying areas behind the defences.	areas. The lower sand foreshore would be fed from cliff erosion from adjacent sections, therefore a sandy beach could remain. At the western end, where defences currently front cliffs, these cliffs would become actively eroded again, at rates similar to adjacent undefended sections Therefore by 2105, erosion of between 10 and 15m would be expected.
Chit Rocks to Big Picket Rock	There are no defences present along this section.	No defences.	No defences.
	Cliff erosion along this section has historically occurred very slowly as a result of small scale events every 10 years or so, controlled by the local geology. This would continue during this period, with total erosion by 2025 of between 3 and 5m predicted. Cliff erosion does not contribute any shingle to the beach, but sands may remain on the lower foreshore, which would help to maintain the upper shingle beach. The beaches will retreat with the cliff, although there could be some slight narrowing and steepening towards the end of this period.	Continued cliff recession as has occurred historically at a rate of about 0.2m/yr, although sea level rise could begin to lead to this rate increasing during this period, and it is predicted to result in total erosion of between 9 and 11m by 2055. Sea level rise would lead to the narrowing of the beach and submergence of the rock platforms that front the cliffs along this section. This would lead to increased wave exposure, although it would be unlikely to significantly increase the rate of cliff recession as this is pre-dominantly controlled by local geological factors. A shingle beach with sandy foreshore would remain and retreat with the cliffs. There could be	Erosion of the cliffs would continue as observed historically at a rate of about 0.2m/yr, although sea level rise is likely to result in this rate increasing during this period, with total erosion by 2105 of 20 to 30m predicted. As a result of high sea levels the beach along this section is expected to narrow, and the rock platforms would become increasingly submerged. This would result in increased exposure of the cliff toe to wave action, although it would be unlikely to significantly increase the rate of cliff recession as this is pre-dominantly controlled by local geological factors. Shingle beaches would increasingly become confined to little pockets that may develop as the

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		some erosion of the shingle beach due to increased exposure as sea level rises and greater drawdown rates.	cliffs erode.
Big Picket Rock to Otterton Ledge	There are no defences present along this section.	No defences.	No defences.
	The cliffs along this section are composed of more resistant sandstone. Erosion of the cliffs that extend along this section would continue to occur as historically, with infrequent, small scale cliff falls resulting from wave undercutting occurring with a frequency of about 10 years. These events tend to affect very localised areas, but it is not possible to predict where the next events will occur. The underlying rate of recession is predicted to result in cliff erosion of 3 to 5m by 2025. Any sediment released from the cliffs will tend to remain locally, within the pocket beaches.	Cliff erosion would continue as observed historically at a rate of about 0.2m/yr, although sea level rise could begin to lead to this rate increasing during this period, with total erosion of between 9 and 13m predicted by 2055. Material from cliff erosion would not contribute to the shingle beaches, therefore local pocket beaches may narrow.	Erosion would continue as observed historically at a rate of about 0.2m/yr, although sea level rise could begin to lead to this rate increasing during this period, with total erosion of 20 to 40m predicted to occur by 2105. Local pocket beaches, such as Ladram Bay, would steepen and narrow due to sea level rise. The more exposed ones could disappear.
Otterton Ledge to Budleigh Salterton (West)	The seawall and gabions that extend along the cliff toe along the western part of this section, up to the landward end of the spit that extends across the mouth of the Otter estuary, are expected to fail towards the end of this period.	Loss of defences will be completed in the early part of this period, leaving it undefended for the majority of this period.	No defences.
	The presence of the defences along the toe of the cliff that forms the western part of this section has resulted in there being negligible cliff or shoreline recession over the long term. This trend is likely to continue for most of this period. Where gabions are exposed by lowering beach	The beach has historically been relatively stable, but this could change to a trend of migration due to the accelerated sea level rise during this period, despite the input of coarse sediment from cliffs to the west. There would also be increased exposure of the backing seawall and remaining	Cliff erosion would continue unabated, as small scale cliff failures causing the loss of less than 10m of cliff top at a time with a frequency of 10 to 100 years between 2055 and 2105. As sea levels rise, the tendency would be for landward beach retreat. Where this is inhibited,

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	levels, these could start to deteriorate during this period. The beach fronting this section, including the spit that extends across the mouth of the Otter estuary, has been stable over the long term as a result of continued sediment supply from cliff erosion to the west. This stable trend is expected to continue during this period although there may be fluctuations in beach level which expose areas of the gabion defences which would contribute to their deterioration during this period. The spit across the Otter estuary is subject to temporary breaching during high river flow events every 20-30 years. As such, the probability of such an event occurring could increase throughout this period as it is not thought that such an event has occurred recently.	gabions. This would accelerate their failure. Along much of this frontage current beach levels are up to the level of the promenade (which is possible evidence that the beach has migrated landwards) and here the beach could start to migrate landwards where beach levels are high enough. Where the beach fronts a more substantial structure, such as along South Parade, there could be increased scour at the toe and potential failure of the wall. At Coastguard Hill and along the western stretch of this frontage, the cliff could become exposed to wave action during this period. Erosion would occur as small scale cliff failures causing the loss of less than 10m of cliff top at a time with a frequency of 10 to 100 years. This renewed erosion would provide some fresh inputs of sediment into the system, but the cliffs here are low and therefore not a significant source of sediment. The loss of defences in the area to the east, which front low-lying land would increase the risk of flooding in this area during this period, due to increased risk of overtopping. However, it is unlikely that a breach would occur during this period. The probability of a high river flow event causing a temporary breach of the spit across the mouth of the Otter estuary would increase during this	by either slower eroding cliffs or man-made structures, beach narrowing could occur, despite coarse sediment being supplied from the west (up to Straight Point). There would be continued transport of sediment toward the spit resulting in elongation and recurve into the estuary. The probability of a high river flow event causing a temporary breach of the spit across the mouth of the Otter estuary would continue to increase during this period. Migration landward of the spit in response to sea level rise would also occur. The continued input of sediment means this feature would remain relatively resilient to a breach, and it is unlikely that a permanent breach would occur. There would, however, be an increase risk of overtopping and flooding due to rising sea levels.

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		period, particularly with the loss of the gabions that previously served to prevent this. However, the continued supply of sediment to this feature would mean it would remain relatively resilient.	
Budleigh Salterton (West) to Straight Point	There are no defences present along this section.	No defences.	No defences.
	The cliffs along this section are up to 130m at the western end and experience very infrequent complex landslide failures every 100 to 250 years. The majority of this section experiences small scale failures much more frequently, with events less than every 10 years occurring as a result of geological factors and undercutting by wave action at the cliff toe. The underlying rate of recession along this section is predicted to result in the erosion of about 7m of cliff by 2025. Towards Straight Point, the nature of cliffs changes and recession is only as a result of infrequent small scale cliff falls, and so in this area 0 to 10m of recession is predicted by 2025. The continued erosion of mudstones, sandstones and pebbles beds provides material to the local beach stock that is then transported eastwards along the shoreline by littoral processes to the spit across the mouth of the Otter estuary.	Cliff erosion is expected to continue as historically, although sea level rise could begin to lead to this rate increasing during this period, with total erosion by 2055 of about 20m predicted along much of this section. Towards Straight Point, the nature of cliffs changes and recession is only as a result of infrequent small scale cliff falls, and so in this area 0 to 10m of recession is predicted by 2055. Sea level rise would lead to the narrowing of the beach, which in turn would result in increased wave exposure of the cliff toe and therefore in a slightly increased rate of erosion. This erosion would supply beach sediment to the beaches, thus maintaining beaches and reducing the rate of erosion slightly. Erosion of these cliffs is also an important source of sediment to the Budleigh Salterton frontage. The clay-rich cliffs towards the western end of this section are expected to be more sensitive to sea level rise and any increased in precipitation, and the frequency of cliff failure events in this area could increase in the future.	Erosion of the cliffs would continue as observed historically, although sea level rise is likely to lead to this rate increasing during this period, with total erosion of 40 to 55m predicted by 2105. Towards Straight Point, the nature of cliffs changes and recession is only as a result of infrequent small scale cliff falls, and so in this area 0 to 10m of recession is predicted by 2105. Beaches are likely to be maintained by the input of new sediment though cliff erosion, although some narrowing could occur. The clay-rich cliffs towards the western end of this section are expected to be more sensitive to sea level rise and any increase in precipitation, potentially leading to an increase in the frequency of cliff failure events in this area in the future, resulting in additional localised loss of less than 10m per event. There is a risk that relict landslides could be reactivated.

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Straight Point to Orcombe Rocks	There are no defences present along this section.	No defences.	No defences.
	The beaches along this stretch to the west are a different composition from those to the east in that they are predominantly composed of sand. The cliffs along this section experience slow erosion as a result of small scale cliff failure events about every 10 years. This is expected to continue to 2025, with erosion of the cliffs at the back of Sandy Bay predicted to erode by 3 to 5m over this period. The cliffs at Orcombe Rocks have historically eroded slightly more rapidly, possibly as a result of reduced cliff toe protection by a lack of beach compared to the rest of this section. As such these cliffs are predicted to erode by about 5m by 2025. Here, the erosion of the cliffs would continue to supply sediment to the local sandy beaches, therefore a beach will be maintained here despite little or no littoral input.	Continued cliff recession would occur as historically at a rate of up to about 0.4m/yr, although sea level rise could begin to lead to this rate increasing during this period, with total erosion of the cliffs at the back of most of Sandy Bay predicted to be between 10 and 15m by 2055, whilst towards Orcombe Rocks, total erosion of about 15m is predicted over the same period. The erosion of the cliffs would continue to supply sediment to the local beach, therefore a narrow beach is likely to remain, despite rising sea levels.	Continued cliff recession would occur as historically at a rate of up to about 0.4m/yr, although sea level rise could begin to lead to this rate increasing during this period, with total erosion of the cliffs along this section predicted to be between 19 and 46m by 2105. The erosion of the cliffs would continue to supply sand to the local beach stock, helping to maintain a narrow beach at the toe of the cliffs.
Orcombe Rocks to Exmouth Point	Seawalls and esplanade along the length of the Exmouth seafront that forms this section protect both the cliff toe and areas of low-lying land, including two small areas of relict dune systems,. These defences would remain in place.	The defences along this section would all fail during this period.	No defences present.
	The seawall at Exmouth at its eastern end prevents erosion of the cliff toe and this would	Narrowing beaches and increased exposure would result in the failure of defences along the	Rising sea levels combined with the inhibition of the ability of the beach to adapt because of the

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	continue, resulting in no change in cliffline position. Towards the Exe estuary, the seawall fronting Exmouth protects low-lying land from flooding and this would also remain in place, meaning there would be no change in shoreline position during this period. The defences have also prevented the local input of sediment to the beach system from cliff erosion. There is also limited sediment input from the east (with Orcombe Rocks reducing some transport, but also Straight Point being a barrier to littoral drift). The beach levels that front the seawalls at Exmouth have historically fluctuated, although in recent years has experienced a trend of erosion. This trend is expected to continue. This would increase exposure of the defences.	Exmouth frontage during this period. This would result in gradual resumption of cliff erosion by 2055 and reactivation of the relict dune system. It is, however, unlikely that this would significantly increase sediment inputs to counter this trend. Cliff recession would occur as infrequent small scale cliff failure events, with 0 to 10m of recession possible by 2055 where defences have failed at the base of the cliffs. The loss of defences during this time would lead to an increased risk of flooding to low-lying parts of Exmouth. The ability of the beach to adapt and retreat in response of rising sea levels would be inhibited by the urban area of Exmouth, as such, along the Exmouth frontage coastal squeeze is predicted due to the lack of sediment input and increasing sea levels.	urban extent of Exmouth, combined with insufficient sediment input from cliff erosion, would be expected to cause narrowing and steepening of the beach fronting Exmouth. Cliff recession would occur as infrequent small scale cliff failure events, with 0 to 10m of recession possible by 2105 where defences have failed at the base of the cliffs.
Exe Estuary	Within the Exe estuary, some defences are expected to fail towards the end of this period.	The remaining defences within the Exe estuary would all fail during this period.	No defences present.
	The Exe Estuary is also believed to be a sink for sediment, with Pole Sand having steadily increased in size since 1853. It is anticipated that there would be continued feed to the flood and ebb deltas at the mouth of the estuary and therefore these are likely to remain stable. The loss of some of the defences within the	The loss of defences within the estuary would mean it would be more readily able to adapt to rising sea levels and changes in hydrology resulting from future climate change. This would be likely to result in the estuary being translated landwards whilst maintaining its current form. There would be continued feed to the flood and	There would be continued feed to the flood and ebb deltas at the mouth of the estuary and therefore these are likely to remain stable. The Exe Estuary would be unconstrained in its ability to adapt to rising sea levels and changes in hydrology resulting from future climate change. This would be likely to result in the estuary being

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	estuary during this period would lead to localised increases in the risk of flooding during high water level events to the areas of low lying land behind the defence line.	ebb deltas at the mouth of the estuary and therefore these are likely to remain stable and would continue to have a sheltering affect on the shoreline.	translated landwards whilst maintaining its current form.
Dawlish Warren to Langstone Point	The proximal end and central section of Dawlish Warren spit is presently protected by groynes and gabions (some of which are currently buried). Where these are exposed, along the central section, they would also fail by the end of this period without continued maintenance. There are also groynes in various states, along this stretch; it is likely that many of these would fail during this period. Between Dawlish Warren and Langstone Rock the coast is protected by a sea wall and rock armour.	The remaining defences along this section would all fail during this period. Timing of failure would vary along this coast, depending upon the type of defence structure.	No defences present.
	The Dawlish Warren spit across the western part of the mouth of the Exe estuary is defended at its proximal end, effectively anchoring the spit to the land. The distal end is practically undefended, with former defences having been buried, and so behaves more naturally. Historically this spit has fluctuated greatly, and although the distal end has been accreting in recent years due to west to east sediment drift, its evolution is strongly linked to complex nearshore sediment circulation patterns. The loss of most of the defences along Dawlish Warren spit by 2025 would result in the majority of the spit behaving naturally by this time,	The natural response of the Dawlish Warren spit would be to migrate landwards, although further elongation and re-curving of the spit would be prevented by the fast ebb tide flows. These fast flows may however be altered by the change in tidal prism of the estuary that would be expected to occur as a result of the loss of estuary defences and the expansion of the area regularly covered by tidal waters within the estuary. There would be continued erosion of the spit at the proximal end with accretion at the distal end. Landward migration of the spit would be able to occur along its length due to the lack of defences	Dawlish Warren spit would function naturally during this period, and if it has not happened during the medium term, then a breach is increasingly likely to occur along the spit during this period. However, the distal end has historically been shown to experience periodic rapid erosion in response to south-easterly storm events. Whilst it is not possible to predict if such an event would occur during this period, if it were to occur then there would be an increased risk of flooding to the land behind the spit within the Exe estuary due to greater exposure to wave action.

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	although some old defences that are presently buried may be exposed and so retain some influence on natural processes. The erosional trend at the western end of the spit is expected to continue due to the net west to east littoral drift and lack of sediment input from the east. Drift could increase slightly due to failure of the groynes. Continued accretion of the spit is predicted at the distal end, however further elongation and re-curving of the spit would be prevented by the fast ebb tide flows that are caused by the presence of the docks on the Exmouth side of the estuary mouth. However, the distal end has historically been shown to experience periodic rapid erosion in response to south-easterly storm events. Whilst it is not possible to predict if such an event would occur during this period, if it were to occur then there would be an increased risk of flooding to the land behind the spit within the Exe estuary due to greater exposure to wave action. To the south-west of Dawlish Warren, erosion is prevented by the seawall and rock armour, which would remain during this period, therefore there will be no change in shoreline position. There is also little or no sediment input from the west past Langstone Rock.	during this period. However, the distal end has historically been shown to experience periodic rapid erosion in response to south-easterly storm events. Whilst it is not possible to predict if such an event would occur during this period, if it were to occur then there would be an increased risk of flooding to the land behind the spit within the Exe estuary due to greater exposure to wave action. It is possible that a breach could develop at the narrowest part of the spit, although it is uncertain exactly when this would actually occur and it is possible that the volume of sediment contained within the spit would prevent this. To the south-west of Dawlish Warren, erosion previously prevented by the seawall and rock armour would gradually resume upon the loss of the defences, although it is unlikely that this would result in significant change in shoreline position by 2055, as the remains of the defences would continue to have some influence. The loss of the breakwater at Langstone Rock, along with the defences along the frontage to the south-west, could allow some additional material to reach Dawlish Warren spit by longshore transport, although much of this could be lost offshore due to the orientation and exposure of the coast.	Loss of defences to the south-west of Dawlish Warren would provide some additional sediment input to this area by littoral drift processes.
Langstone Rock	A seawall extends along this section as protection	The defences along this section would be	No defences.

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to Coryton Cove	to the railway line. The beach fronting the seawall is controlled by groynes and breakwaters.	expected to fail during this period.	
	The presence of the seawall prevents erosion of the cliff toe along this section and has resulted in negligible cliff recession occurring over the past century or more. This would remain in place during this period, therefore there would be no change in shoreline position, and in turn a lack of sediment supply to the local beaches. The defences along this section have prevented any input of sediment through cliff erosion, but also sit several metres in front of the natural cliffline. Therefore, despite the presence of the control structures, the beach fronting this section has a long term trend of erosion and narrowing, which would continue during this period increasing exposure of the defences. In places the sea already reaches the defences at high water and here overtopping would increasingly become an issue.	Continued beach narrowing and exposure of the defences would result in their failure during this period. This would ultimately lead to the exposure of the cliff toe to wave action, resulting in a resumption of cliff recession by 2055. The net erosion expected by 2055 would be between 0 and 10m as a result of the occurrence of localised cliff failure events. The issue of beach narrowing would continue to be important during this period with most of the beach likely to disappear during this period, due to insufficient sediment supply from cliff erosion, even after the loss of defences, combined with sea level rise.	The lack of defences would result in cliff recession at pre-defence rates, with erosion occurring as cliff failures with a frequency of 10 to 100 years causing loss of less than 10m of cliff top per event. The net erosion expected by 2105 would be between 0 and 10m as a result of the occurrence of localised cliff failure events. This erosion would supply beach building material to the fronting beach, and so help to retain a narrow sandy beach in front of the cliffs that would retreat with the cliff line in response to sea level rise. This new sediment input would also be transported north-eastwards towards Dawlish Warren although it is uncertain how much material would reach the spit.
Coryton Cove to Holcombe	Short lengths of seawall that protect the railway line are located at the backs of small pocket beaches that indent this section.	The defences along this section would be expected to fail during this period.	No defences.
	This section consists of small cliffed headlands indented with small pocket beaches. These beaches have been stable over the loner term and this is expected to continue to 2025, although coastal squeeze could start to become increasingly important towards the end of this	The cliffed headlands would continue to erode as historically at a rate of about 0.1m/yr due to infrequent small scale cliff failure events, although sea level rise could begin to lead to an increase in this rate during this period, with total erosion of 2 to 6m predicted by 2055. Along the rest of the	Continued erosion of the cliffed headlands as a result of infrequent small scale cliff failure events is expected to occur, although sea level rise could begin to lead to an increase in this rate during this period, with total erosion of 5 to 30m predicted by 2105.

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	period. The cliffed headlands are undefended and expected to continue to erode as historically as a result of infrequent small scale cliff failures events, with total erosion of 1 to 2m predicted by 2025.	coast, narrowing beaches and subsequent undermining could result in the gradual loss of defences along the frontage. This would result in erosion of the backing cliffs, reaching similar rates as the adjacent undefended cliffs by 2055. This resumption of erosion would supply new sediment input to the small pocket beaches, which would help to maintain narrow beaches in these areas as sea levels rise.	Erosion at a similar rate would occur within the small pocket embayments along this section. This would provide new inputs of sediment to the pocket beaches which would maintain a narrow beach in front of the cliffs as sea levels rise.
Holcombe to Sprey Point	A seawall extends along this section as protection to the railway line, which sits at the toe of the cliffs. There are also a couple of groynes midway along this stretch, which could fail during this period.	The defences along this section would be expected to fail during this period.	No defences.
	The presence of the seawall prevents erosion of the cliff toe along this section and has resulted in negligible cliff recession occurring over the past century or more, and in turn a lack of sediment supply to the local beaches. This situation is expected to continue to 2025. The beach fronting the seawall has a long term trend of erosion and narrowing. Coastal squeeze as a result of sea level rise is therefore likely to become increasingly significant during this period to 2025. This would increase exposure of the defences, increasing the risk of both overtopping and undermining.	The defences would gradually fail along this section between 2025 and 2055, and it is not expected that the railway line would offer any resistance to erosion. Therefore there would be fairly rapid exposure of the regraded cliffs behind to wave action and erosion. Therefore a cliff recession of between 0 and 10m would be expected by 2055 as a result of localised cliff failures. The issue of beach narrowing will continue to be important during this period with most of the beach likely to disappear during this period, due to insufficient sediment supply from cliff erosion even after the loss of defences combined with sea level rise.	The lack of defences would see cliff recession occur at pre-defence rates, with erosion occurring as cliff failures with a frequency of 10 to 100 years causing loss of less than 10m of cliff top per event. Between 0 and 10m would be expected by 2105 as a result of localised cliff failures. This erosion would supply beach building material to the fronting beach, and so help to retain a narrow beach in front of the cliffs that would retreat with the cliff line in response to sea level rise. Failure of the Sprey Point breakwater would result in increased connectivity with the shoreline to the south. Currently there is a drift divide at

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			this point, but this could change with removal of this artificial headland. Erosion along this stretch could also be slightly greater than adjacent stretches, as the coast slightly juts out at this location (which has resulted in narrower beaches here).
Sprey Point to Teignmouth Pier	A seawall protects the railway line along the northern part of this section, and provides flood protection to low-lying land towards the mouth of the Teign estuary. There are also wooden groynes along the Teignmouth frontage. A small section of the defences fronting the railway line, which already shows damage to the toe of the defence, would be expected to fail towards the end of this period without further maintenance.	The defences along this section would be expected to fail during this period.	No defences.
	The presence of the seawall prevents erosion of the cliff toe along this section and has resulted in negligible cliff recession occurring over the past century or more, and in turn a lack of sediment supply to the local beaches. This situation is expected to continue along the majority of this coastline to 2025, although very small scale, localised landslides could occur as a result of elevated groundwater conditions. Whilst the loss of a small length of seawall towards 2025 would expose part of the cliff toe to wave action, it is unlikely to result in any immediate significant erosion of the cliffs,	The failure of the defences during this period would lead to the gradual exposure of the cliff toe to wave action, resulting in a slow resumption of cliff recession by 2055, aided by some localised small scale cliff failures that are likely to occur as a result of elevated groundwater. As such, following loss of defences, total erosion of 0 to 10m is predicted by 2055. The beach along this section would be expected to narrow as sea levels rise, due to the continued effect of the defences and insufficient input of new sediment despite slow resumption of cliff erosion.	The lack of defences would see cliff recession occur at pre-defence rates, with erosion occurring as cliff failures with a frequency of 10 to 100 years causing loss of less than 10m of cliff top per event. This erosion would supply beach building material to the fronting beach, and so help to retain a narrow beach in front of the cliffs that would retreat with the cliff line in response to sea level rise.

<table>
<tr><th rowspan="2">Location</th><th colspan="3">Predicted Change for 'No Active Intervention'</th></tr>
<tr><th>Short Term (to 2025)</th><th>Medium Term (to 2055)</th><th>Long Term (to 2105)</th></tr>
<tr><td></td><td>although it could trigger failures of adjacent defences.

The beach fronting the seawall along this section has a long term trend of erosion and narrowing. Coastal squeeze as a result of sea level rise is therefore likely to become increasingly significant during this period to 2025. This could reduce the life of defences due to risk of undermining.</td><td></td><td></td></tr>
<tr><td>Teign Estuary</td><td>A seawall protects the railway line along the northern side of the Teign estuary, whilst along the open coast a separate seawall provides flood protection to low-lying land towards the mouth of the Teign estuary.</td><td>Upgrade of the defences is likely to be required during this period in order to maintain the current level of protection.</td><td>No defences.</td></tr>
<tr><td></td><td>The beach towards the Teign estuary mouth has historically fluctuated as part of a cyclic sediment transport regime that exists in this area. This is expected to continue to 2025.

The Teign Estuary itself is likely to maintain its current form during this period, assuming continued riverine sediment inputs continue.</td><td>The beach fronting Teignmouth towards the mouth of the Teign estuary would be expected to continue to fluctuate as part of the cyclic sediment transport system, and the loss of defences during this period would allow the beach in this area to adapt naturally as sea levels rise by 2055. The spit across the mouth of the estuary would remain as part of this cyclic sediment transport system and so continue to influence the estuary.

The Teign Estuary would be unable to translate landwards in response to sea level rise during this period due to the constraints of human intervention and steeply rising valley sides where no defences are present. It is therefore anticipated that the estuary would accrete</td><td>Without the presence of any defences, the Teign Estuary would be unconstrained in its ability to adapt to rising sea levels and changes in hydrology resulting from future climate change, and is likely to transgress landwards, although this response may remain constrained by the steeply rising estuary valley sides.

The beach fronting Teignmouth towards the mouth of the Teign estuary would be expected to continue to fluctuate as part of the cyclic sediment transport system, however the impact of the landward transgression of the estuary may possibly result in the movement of the flood and ebb tidal deltas into the estuary (if there is an insufficient supply of new sediment entering the system to keep pace with sea level rise), although</td></tr>
</table>

Location	Predicted Change for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
		vertically at a rate keeping pace with sea level rise whilst maintaining its present form during this period. This situation may begin to change towards 2055 as the defences within the estuary fail and their effect reduces. This may alter the tidal flows at the mouth of the estuary and so possibly affect the cyclic sediment transport regime along the coast, although this effect may not be as extensive as in the Exe estuary due to the steeply sloping sides of the Teign estuary valley that limits the lateral migration of the estuary.	there is insufficient information about this to provide great certainty. If this were to occur then it could lead to the reduction or cessation of the cyclic sediment transport system at the mouth which in turn could impact upon beach levels. The lack of defences during this period would allow the beach in this area to adapt more naturally as sea levels rise, although the remaining presence of the town of Teignmouth urban area would still have some influence on this. The spit across the mouth of the estuary would therefore remain as part of this cyclic sediment transport system and so continue to influence the estuary.
Shaldon (The Ness) to Petit Tor Point	The majority of the coast is undefended but there are several short lengths of wall, associated with provision of facilities, located at the back of small pocket beaches along this section.	It is anticipated that the short lengths of wall along this section would fail during this period.	No defences.
	Much of this section consists of relatively resistant rock that has eroded very little over the past century. This is expected to continue in the short term, with total erosion of about 2m predicted by 2025. The Ness would remain as a southern control of the estuary mouth. The short lengths of wall located at the back of small pocket beaches that indent this section serve to prevent erosion of the cliff toe very locally, although they are unlikely to significantly inhibit supply of sediment to the local beaches. Narrow beaches may be retained as small pocket	Slow cliff erosion would continue as historically at a rate of about 0.2m/yr, although the effect of sea level rise could result in this rate increasing during this period, with total erosion of up to 7m predicted by 2055. The Ness would remain as a southern control of the estuary mouth. As sea levels rise some of the pocket beaches could become submerged as the rate of cliff erosion does not keep pace with the accelerated rate of sea level rise. Other beaches may remain if there is sufficient local erosion to maintain the beaches. The few coastal structures that exist	Slow cliff erosion would continue as historically at a rate of about 0.2m/yr, although the effect of sea level rise could result in this rate increasing during this period, with total erosion of 10 to 25m predicted by 2105. The Ness would remain as a southern control of the estuary mouth. Many of the small pocket beaches will have become submerged due to accelerated sea level rise meaning that cliffs here will plunge directly into the sea. This may result in a slight increase in erosion rates, but in general the rate of erosion is determined by the relatively resistant geology.

Location	Predicted Change for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	beaches, if there is sufficient local sediment input from the sandstone cliffs.	could be lost during this period should beaches narrow sufficiently, but loss of these is unlikely to have a significant impact on the coastal evolution.	
Petit Tor Point to Hope's Nose	Much of this cliffed frontage is unprotected, but within the small pocket beaches there are a range of structures including seawalls and revetments.	The defences along this section would be expected to fail during the early to middle part of this period.	No defences.
	The unprotected sandstone cliffs have eroded slowly in the past as a result of infrequent and small scale cliff failures. This is expected to continue during this period, with total erosion of between 3 and 10m predicted by 2025 along this section. Along Oddicombe Beach there are defences in front of the cliff toe which protects the lift and facilities at the back of the beach. These also serve to prevent any local release of sediment from cliff erosion. Here beaches will continue to narrow and steepen, as experienced historically. There is a similar situation at Redgate Beach. Any impacts of defences are only felt very locally as these pocket beaches are not connected in terms of littoral drift.	Slow erosion of the unprotected cliffs would continue as historically at a rate of about 0.15m/yr, although the effect of rising sea level would have varying impacts depending upon the nature of the cliffs, with total erosion of between 7 and 10m predicted by 2055. Narrowing beaches in front of the existing defences would become an increasing issue, and this would remain after the failure of the defences as the rate of cliff erosion would be unlikely to keep pace with the accelerated rate of sea level rise and input of new sediment would be insufficient to build up beaches. Failure of the breakwater at the southern end of Babbacombe Bay could accelerate beach loss locally as increased wave exposure is experienced. Failure of defences would result in reactivation of the cliffs behind and theses would erode at the same rates as the adjacent unprotected cliffs.	Slow erosion of the cliffs would continue as historically at a rate of about 0.15m/yr, although the effect of rising sea level would have varying impacts depending upon the nature of the cliffs, with total erosion of 10 to 15m predicted by 2105 along most of this section, but rising to 15 to 25m of predicted erosion at Walls Hill by 2105. As sea level rise accelerates and with insufficient input of sediment from cliff erosion to keep pace, the beaches are likely to disappear with water levels up to the toe of the cliffs. This may result in a slight increase in erosion rates, but in general the rate of erosion is determined by the relatively resistant geology.
Hope's Nose to Livermead Head	A range of defences and other structures are located along parts of the cliff toe throughout this section, including seawalls, revetments and	The defences along this section would all be expected to fail during this period.	No defences.

Location	Predicted Change for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	breakwaters associated with Torquay Marina.		
	There has been very little recession of the cliffs, which are protected at the base by the various defences located along this section. Defences are likely to remain in place during this period, therefore this trend would continue. The unprotected cliffs consist of relatively resistant rocks that have historically eroded very slowly. This is expected to continue to 2025, with total erosion of 1 to 10m predicted over this period at rates of about 0.05 to 0.25m/yr, depending upon specific local geology and the occurrence of small scale, localised cliff failure events. The beaches along this section of coast have been relatively stable over the long term, and this is expected to continue during most of this period. Coastal squeeze as a result of sea level rise could however become increasingly an issue towards the end of this period, which would increase pressure on the defences and hasten their failure. This could be a particular issue at Meadfoot Beach, where the beach is already very narrow.	Cliff erosion of the unprotected cliffs along this section would continue only very slowly as has occurred historically, with total erosion of 2 to 13m predicted by 2055 depending upon specific local geology and the occurrence of small scale, localised cliff failure events. The gradual loss of defences along the remaining parts of this section of coast during this period, would ultimately result in re-exposure of the old cliffline along most of this coast. However, due to both continued influence of infrastructure and the resistance of the cliffs, there would by little change in cliff position by 2055 in these areas. Sea level rise would cause narrowing and steepening of the beaches along this section where historically they have been prevented from retreating by defences and the hard, resistant cliffs, and now, even without defences in place, there is limited new sediment input from local cliff erosion. The exception is at Torre Abbey where there is a small pocket of low-lying land. Here it is possible that a narrow pocket beach could form.	Continued slow cliff erosion of the unprotected cliffs would continue as historically, with total erosion of between 5 and 30m predicted by 2105 depending upon specific local geology and the occurrence of small scale, localised cliff failure events. The lack of defences along the remaining parts of this section of coast would result in cliff recession rates varying locally depending upon specific local geology, likely obtaining rates similar to adjacent sections of coast. Between 5 and 10m is therefore predicted by 2105. As sea levels rise, it is expected that there would be further narrowing and steepening of the beaches along this section due to no new inputs of sediment. By the end of this period beaches would either be very narrow or non existent along this shoreline, although small pocket beaches could exist at Livermead Head and in front of Torre Abbey. At these two locations there would be a higher localised flood risk. It is unlikely that any changes along this frontage would impact adjacent stretches of coast, as Livermead Head and Hope's Nose prevent sediment transport out of this frontage.
Livermead Head to Roundham	Defences are located along the majority of this section that protect low-lying land from flooding.	The defences along this section would all be expected to fail during this period.	No defences.

Location	Predicted Change for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
Head	The majority of this section is defended, preventing flooding of the low-lying land behind. The beaches that front the defences have mainly been stable over the long term despite receiving little new sediment from erosion of adjacent cliffs. This situation is expected to continue during most of this period, although coastal squeeze as a result of sea level rise could become increasingly important towards 2025. The beaches are divided by small rock headlands that prevent transport of beach material between adjacent beaches. These rock headlands are cliffed and have historically eroded very slowly with only localised erosion of between 0 and 1m predicted by 2025 around Hollicombe Head.	Sea level rise would lead to the continued narrowing and steepening of the beaches fronting the defences in the early part of this period, before the loss of defences towards 2055 begins to allow the beaches to adapt and retreat landwards onto low-lying land. However the ability of the beach to respond in this way would remain inhibited by the urban extent of this part of Torbay. There would be no new input of sediment to the beaches, therefore they would continue to narrow. There would be an associated increase in risk of flooding of low-lying land behind as a result. The cliffed headlands that divide the beaches along this section would be expected to continue to experience negligible recession as has occurred historically, with only localised erosion of 0 to 4m predicted by 2055 around Hollicombe Head.	The beaches would continue to be inhibited in their ability to rollback onto low-lying land, and it is expected that further narrowing and steepening of the beaches would occur due to no new inputs of sediment to keep pace with accelerating sea level rise. This would result in increasing flood risk to the low-lying land that is behind the beaches. The cliffed headlands that divide the beaches along this section would be expected to continue to experience negligible recession as has occurred historically, with only localised erosion of 0 to 8m predicted by 2105 around Hollicombe Head.
Goodrington Sands to Broadsands	Seawalls are located at the back of the two beaches along this section. At Goodrington Sands the wall protects low-lying land from flooding whilst at Broad Sands part of the wall protects a slope and part of the wall protects a low-lying area. It is anticipated that parts of the seawalls at both Goodrington and Broadsands could start to fail towards the end of this period.	The remaining defences along this section would all be expected to fail during the early to middle part of this period.	No defences.
	The beaches at Goodrington Sands and Broadsands have been relatively stable over the	Sea level rise would lead to the continued narrowing and steepening of the beaches fronting	There is expected to be further rollback of the beaches onto low-lying land. The indented nature

Location	Predicted Change for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	long term and this is expected to continue to 2025, although beach narrowing as a result of sea level rise could become increasingly important during this period due to a lack of new sediment input from local cliff erosion (the beaches being largely relict features) to counter-act the effects of rising sea levels, and the defences preventing landward migration of the beach, a situation that would not impacted by the loss of short lengths of aging defences towards the end of this period. The cliffs along this section are very resistant and have eroded very little over the long term. This is expected to continue to 2025, with negligible cliff recession predicted.	the defences whilst they remain in the first part of this period, resulting in an associated increase in risk of flooding of low-lying land behind Goodrington Sands and Broad Sands. The loss of defences by 2055 would allow these beaches to adapt and retreat to sea level rise by rolling back onto the low-lying land by the end of this period. Along the Broadsands frontage there could be erosion at the toe of the backing slope. Cliff recession would continue to occur very slowly as historically, with negligible erosion predicted between 2025 and 2055. This would supply a limited amount of sand to the beaches.	of these stretches should mean a beach will be retained at both Goodrington and Broad Sands but in a retreated location. There could be beach narrowing at Broad Sands, where the beach fronts a low slope. Some new sand may be input to the system from erosion of the cliffs, but this will be limited due to the slow erosion rates. There could be an increased flood risk to areas where beaches are backed by low-lying land at Goodrington Sands and Broad Sands. Cliff recession along the remainder of this stretch would continue to occur very slowly as historically, with negligible erosion predicted between 2055 and 2105.
Broadsands to Churston Cove (East)	There are no defences present along the shoreline of this section, although the eastern part of this section may be affected by the presence of the Brixham Harbour breakwater farther east. It is assumed that this will remain during this period.	No defences along the shoreline. Brixham Harbour breakwater could fail towards the end of this period due to lack of maintenance.	No Defences.
	The majority of this section consists of hard rock cliffs that plunge directly into the sea and that are resistant to erosion and have eroded very little over the long term. This is expected to continue to 2025, with negligible cliff recession predicted. The very small pocket beaches at Elberry and Churston Coves have been stable and slowly accreting over the long term, with material likely derived from local cliff erosion. This is expected	There would continue to be negligible erosion of the hard rock cliffs between 2025 and 2055. Depending upon the rate of sediment supply from cliff erosion to the two pocket beaches along this section, sea level rise could cause a change from an accretion/stable trend to one of narrowing and steepening. The rate of cliff recession would not be affected	There would continue to be negligible erosion of the hard rock cliffs between 2055 and 2105. As sea levels rise, the small pocket beaches could become narrower and steeper if there is insufficient material supplied from erosion of local cliffs in the future. The rate of cliff recession would not be affected by any change to Brixham Harbour breakwater.

Location	Predicted Change for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	to continue to 2025.	by any change to Brixham Harbour breakwater.	
Churston Cove (East) to Berry Head	A range of defences and coastal structures are located around Brixham, including the Brixham Harbour breakwater, which influences wave action along the western part of this section. It is assumed that all defences will remain in place during this period. The remainder of this hard rock coast is undefended.	The defences along this section would all be expected to fail during this period. Brixham Harbour breakwater could also fail towards the end of this period due to lack of maintenance.	No defences.
	Within Brixham Harbour the cliffline has been modified by quarrying and defences and defences are in place to protect assets which have been constructed between the coast and the quarried cliff face. The presence of defences along this section prevents wave action at the base of the cliffs and protect the properties constructed in front of the cliffs. These backing cliffs consist of hard rock and are very resistant to erosion. The undefended cliffs that make up the rest of this section also consist of very hard rock and have eroded very little over the long term. This is expected to continue to 2025, with negligible cliff recession predicted.	There would continue to be very little erosion of the hard rock cliffs that make up this section, with negligible cliff recession predicted between 2025 and 2055. The loss of defences along this section would be unlikely to result in significant recession of the hard, resistant cliffs that they protect, although there could be an increased risk of flooding to low-lying areas that are located in front of the quarried cliff face, following loss of defence combined with increased wave exposure from the loss of the breakwater by 2055.	There would continue to be very little erosion of the hard rock cliffs that make up this section, with negligible cliff recession predicted between 2055 and 2105. There would be no impact of the loss of defences on the coastal processes, but the risk of very isolated flooding to the low-lying areas, that sit in front of the quarried cliff face, would increase during this period as sea levels rise.
Berry Head to Sharkham Point	There are no defences present along this section.	No defences.	No defences.
	The cliffs along this section vary in character from resistant limestones to more erodible shales. Small scale landslide events occur about every 10-100 years within the shale cliffs as a result of	Erosion of the shale cliffs that back St Mary's Bay is driven by both marine erosion of the toe and heavy rain, so they are sensitive to both changes in precipitation and sea level. Due to uncertainty	The more erodible shale cliffs that occur along St Mary's Bay are sensitive to climate change and the rate of erosion could increase both due to sea level rise and an increase in rainfall. Due to

Location	Predicted Change for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	marine action at the cliff toe and elevated groundwater conditions. This situation is expected to continue during this period, with total erosion along the shale cliffs of between 1 and 3m predicted by 2025, but negligible change expected along the limestone cliff sections. The small pocket beach at St Mary's Bay is fed by sediment derived from local cliff erosion as there is no other sediment source available. This would be expected to continue to 2025.	in the possible future changes in precipitation, however, no direct account has been taken of this in the predictions. Although sea level rise could increase the rate of cliff erosion, release of beach material will help to counter this effect and should ensure that a narrow beach remains at this location. Total erosion of between 7 and 10m is predicted along St Mary's Bay by 2055, with the remaining shale cliffs along this frontage experiencing erosion of 4 to 7m by 2055, although the limestone headlands of Sharkham Point and Durl Head are expected to experience negligible change.	uncertainty in the possible future changes in precipitation, no direct account has been taken of this in the predictions. As sea levels rise, the beach may narrow and result in increased erosion of the backing cliffs. This, in turn, will release beach sediment and reduce cliff exposure. This may slow erosion, but erosion is still likely to be at a greater rate than historically, due to the acceleration of sea level rise proposed during this period. Total erosion of between 15 and 35m is predicted along St Mary's Bay by 2105, with the remaining shale cliffs along this frontage experiencing erosion of 8 to 28m by 2105, although the limestone headlands of Sharkham Point and Durl Head are expected to experience negligible change.
Sharkham Point to Blackstone Point	There are no defences present along this section.	No defences.	No defences.
	This section is largely cliffed with isolated pocket beaches separated by rocky headlands, which plunge into the sea. The cliffs are relatively resistant to erosion and have undergone only very slow recession over the long term. This is expected to continue during this period with total erosion of between 1 and 10m predicted by 2025 depending on the occurrence of small scale cliff failure events during this period.	Very slow cliff erosion would continue by 2055, with total erosion of between 2 and 10m predicted over this period depending on the occurrence of small scale cliff failure events during this period. Sea level rise could also result in the narrowing and steepening of the small pocket beaches along this section as it is unlikely that sufficient sediment would be released from the relatively resistant backing cliffs.	Erosion of the cliffs would continue to occur at historically slow rates, with total erosion of between 5 and 10m predicted by 2105 depending on the occurrence of small scale cliff failure events during this period. As sea levels rise, the small pocket beaches along this section could narrow further and ultimately could be lost where they are backed by steep resistant cliffs. At Man Sands, there could be some rollback

Location	Predicted Change for 'No Active Intervention'		
	Short Term (to 2025)	**Medium Term (to 2055)**	**Long Term (to 2105)**
	The small pocket beaches that indent this section of coast are supplied with sediment from local cliff erosion as there is no other sediment source available. The Dart Estuary is a ria estuary characterised by a deep channel confined by steep resistant cliffs. Therefore, no change in the estuary form is predicted.	At Man Sands, beach narrowing could result in more frequent localised flooding of the low-lying area behind. There would be no change to the Dart Estuary.	possible in front of the low-lying hinterland, but beach narrowing could result in more frequent localised flooding of this low-lying area behind. There would be no change to the Dart Estuary.
Blackstone Point to Stoke Fleming	There are no defences present along this section.	No defences.	No defences.
	This section is largely cliffed with isolated pocket beaches separated by rocky headlands. The cliffs historically have experienced varying rates of recession, dependent upon local geological characteristics. This is expected to continue during this period with total erosion of between 2 and 10m predicted by 2025 at rates of about 0.2 to 0.3 m/yr combined with the occurrence of infrequent, small scale cliff failure events that result in localised increases in recession. The small pocket beaches that indent this section of coast are supplied with sediment from local cliff erosion as there is no other sediment source available.	Slow, variable rates of cliff erosion, as has occurred historically, with total erosion of between 4 and 10m predicted by 2055 depending on the occurrence of small scale cliff failure events during this period. Sea level rise could also result in the narrowing of the small pocket beaches along this section as it is unlikely that sufficient material would be supplied by the backing resistant cliffs. This would not result in more rapid erosion of the cliffs, which are relatively resistant to erosion with cliff failures controlled by geological factors.	Erosion of the cliffs would continue to occur at historically slow rates, with total erosion of about 10m predicted by 2105 depending on the occurrence of small scale cliff failure events during this period. As sea levels rise, the small pocket beaches along this section could narrow and possibly become submerged as it is unlikely that sufficient material would be supplied by the backing resistant cliffs. This would not result in more rapid erosion of the cliffs, which are relatively resistant to erosion with cliff failures controlled by geological factors.
Stoke Fleming to Strete	The only defences along this section are located at the back of Blackpool Sands.	It is expected that the defences at Blackpool Sands would fail during this period.	No defences.
	This section is largely cliffed with isolated pocket beaches separated by rocky headlands, the largest	Sea level rise would continue to cause narrowing and steepening of the beaches along this section.	As sea levels rise it is expected that the beaches along this section would narrow further and could

Location	Predicted Change for 'No Active Intervention'		
	Short Term (to 2025)	**Medium Term (to 2055)**	**Long Term (to 2105)**
	of which is Blackpool Sands, which fronts a small area of low-lying land which is protected against flooding by a short length of defence. The beach here has gradually narrowed over the long term, suggesting a trend of erosion as a result of insufficient sediment supply from local cliff erosion, but rising sea levels. It is predicted that this would continue to occur to 2025, and that coastal squeeze as a result of sea level rise would be likely to become increasingly important during this period. The cliffs historically have experienced varying rates of recession, dependent upon local geological characteristics. This is expected to continue during this period with total erosion of between 2 and 10m predicted by 2025.	It is possible that the very small pocket beaches that are backed by resistant cliffs could disappear. At Blackpool Sands the narrowing trend is expected to continue and may accelerate as sea level rises and this could result in an increased risk of localised flooding whilst the defences remain in the first half of this period. This would also put pressure on the defences. Any potential roll back of the beach in response to higher sea levels would be prohibited until the latter half of this period when the defences have failed and their effect significantly diminished. Cliff erosion along the remainder of the coast would be expected to continue at similar rates to historically, with total erosion of between 4 and 10m predicted by 2055.	disappear in places due to insufficient sediment supply and the resistant nature of the backing cliffs. As the beaches narrow headlands will become more prominent which may interrupt littoral drift. At Blackpool Sands, beach narrowing would occur in the part backed by cliffs, although the beach could rollback in the southern end onto low-lying land. Combined with higher sea levels, this could increase the risk of localised flooding. Erosion of the cliffs would continue at similar rates to historically, with total erosion of about 10m predicted by 2105.
Strete to Limpet Rocks (Torcross)	This section is protected in parts by a range of defences including revetments and seawalls. These defences could require upgrading towards the end of this period in order to maintain current levels of protection. The A379 coast road extends along the crest for the length of this section, although not all of its length is protected by defences: the shingle ridge forms a natural barrier in places.	The defences along this section would be expected to fail during this period. It may become necessary to provide an alternative route to the A379 as loss of defences occurs.	No defences.
	The dominant feature of this section is the shingle barrier beach of Slapton Sands that fronts freshwater lagoons that are backed by higher	Sea level rise would be expected to cause narrowing and steepening of the beach where it is backed by defences in the first part of this period.	Under a scenario of accelerated sea level rise, the tendency of the undefended beach would be to roll back to a position commensurate with the

<table>
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<tr><td></td><td>ground. The water level within the lagoons is higher than the sea level on the seaward side of the barrier beach.

The defences protect against flooding but also prevent the beach from rolling back. Beach levels fluctuate greatly over short time scales. However the overall trend is for a small net drift of material from south to north along this section, resulting in a long term trend of accretion towards the northern end of the beach, and a long term trend of erosion at the southern end.

There is no contemporary sediment supply to the beach and no links to adjacent sections of coast and so coastal squeeze where the beach is backed by defences and thus prevented from rolling landwards, as a result of sea level rise, is likely to become increasingly an issue. The sections where the crest is topped only by the A379 or at the northern end, where there is accommodation space, would be able to rollback in response to sea level rise.

The small section of cliffs at the northern end of this section would continue to erode as has occurred historically, with total erosion of between 2 and 10m predicted by 2025.</td><td>There would be net loss of beach sediment as part of this process. This trend would be accelerated in the south due to the northward transport of sediment and it is here that defences could fail first.

The unprotected areas of beach, where only the road is present along its crest, could rollback causing partial loss of the road in the process. This could lead to a step change in the shoreline plan form and lead to increased exposure of the defended areas, particularly at Torcross. This could accelerate failure of defences.

As defences fail, the fronting beaches will need to adjust more rapidly as by this time they will be seaward of their natural position. Due to the integrity of the barrier it is thought unlikely that the barrier would breach during this period.

The small section of cliffs at the northern end of this section would be expected to continue to erode as historically at a rate of about 0.3m/yr, with total erosion by 2055 of 4 to 10m predicted depending on the occurrence of small scale cliff failure events during this period.</td><td>new sea level. This would result in a more pronounced curvature of the beach between the two resistant headlands and could result in beach narrowing and possible degradation of the barrier.

There would therefore be an increased risk of breaching of the barrier beach itself during this period, possibly at the Torcross end due to the continuation of the south-north sediment drift and due to net loss in volume of beaches when defences were present. Breaches would likely only be temporary provided that sufficient material remains in the system to allow littoral drift processes to close it.

Changes along this shoreline would not impact on the adjacent sections of coast as there is little or no sediment exchange with the beaches to the south except during infrequent high energy wave events.

The small section of cliffs at the northern end of this section would be expected to continue to erode as historically at a rate of about 0.3m/yr, with total erosion by 2105 of about 10m predicted depending on the occurrence of small scale cliff failure events during this period.</td></tr>
<tr><td rowspan="2">Limpet Rocks (Torcross) to Tinsey Head</td><td>Defences in the form of seawall and rock revetment are present along much of this section, providing protection against flooding and erosion.</td><td>The defences along this section would fail during this period.</td><td>No defences.</td></tr>
<tr><td>This section consists of an area of low-lying land</td><td>Sea level rise would be expected to cause further</td><td>Roll back of the beach ridge along the undefended</td></tr>
</table>

Location	Predicted Change for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	backed by higher ground, fronted by a shingle barrier beach and bounded at its northern and southern ends by rock headlands. Sediment is largely confined to this section, with only infrequent transport of material to and from adjacent beaches during high energy wave events. The long term trend of the beach is one of erosion, with narrowing and steepening having occurred historically, a situation exacerbated by the presence of the defences that back the beach. There is no contemporary sediment supply to the beach and so coastal squeeze as a result of sea level rise is likely to become increasingly important towards 2025, resulting in further narrowing and steepening of the defended parts of the beach, whilst the unprotected northern part could rollback onto the low-lying land behind. This would start to cause a discontinuity in the planform. The rock headlands of Limpet Rocks and Tinsey Head that bound this section would be expected to erode slowly as has occurred historically, with total erosion of between 4 and 10m predicted by 2025 depending on the occurrence of small scale cliff failure events during this period. This erosion is more likely at Limpet Rocks than Tinsey Head.	narrowing and steepening of the beach where it is backed by defences in the first part of this period. The natural tendency for the beach ridge would be to roll back in response to sea level rise, and this could occur along the unprotected northern part of the beach. This could lead to a step change in the shoreline plan form and result in increased wave exposure of the defended southern part of this section before the failure of defences, due to undermining, in the latter part of this period allows the southern part of the beach to retreat, likely at an initial accelerated rate, to catch up with the northern part. This could lead to an increased risk of flooding to low-lying areas. Erosion of the rock headlands that bound this section is expected to continue as has occurred historically, with total erosion of 10 to 12m predicted by 2055 depending on the occurrence of small scale cliff failure events during this period. This erosion is more likely at Limpet Rocks than Tinsey Head. These headlands would, however, remain prominent features.	beach would continue in response to sea level rise and therefore could start to form an embayment between the two headlands at Tinsey Head and Limpet Rocks. This could affect the integrity of the barrier and could result in increased risk of breaching along this section. The rock headlands that bound this section would be expected to continue to erode as historically, with total erosion by 2105 of between 10 and 25m predicted depending on the occurrence of small scale cliff failure events during this period. This erosion is more likely at Limpet Rocks than Tinsey Head.
Tinsey Head to Start Point	There are no defences present along most of this section, but there has been ad-hoc rock placement at the back of Hallsands beach to	No defences apart from localised rock placement at Hallsands, which are assumed to be lost during this period.	No defences.

Location	Predicted Change for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	protect a local development.		
	The cliffs along this section consist of hard, resistant rock that has eroded very little over the long term. This is expected to continue to 2025, with negligible cliff recession predicted over this period. In places narrow beaches front the steep cliffs and these may continue to narrow during this period. At Hallsands the beach fronts a small valley, and this likely to remain in a similar form to today, although there could be steepening of the beach, which could start to undermine the rock defences here.	Negligible erosion of the hard rock cliffs that dominate this section is predicted between 2025 and 2055. Many of the narrow beaches that front the steep cliffs could become submerged under a scenario of accelerated sea level rise. At Hallsands the beach will attempt to roll landwards in response to sea level rise into the valley behind. The rock placement is unlikely to impact on this process, particularly towards the end of this period when it is expected to have failed or ceased to be effective due to rising sea levels. There could also be an increased risk of localised flooding	Negligible erosion of the hard rock cliffs that dominate this section is predicted between 2055 and 2105. At Hallsands there would be continued migration of the beach in response to sea level rise, which would become increasing contained within the small valley. This would be unlikely to result in increased erosion of the cliffs on either side of this pocket beach. There could be an increased risk of very localised flooding.
Start Point to Prawle Point	There is a small section of defence at the back of Lannacombe Beach along this otherwise undefended section.	The defences at the back of Lannacombe Beach would fail during this period.	No defences.
	The defences at the back of Lannacombe Beach, as well as the hard rock cliffs that make up the majority of this section, could result in some coastal squeeze occurring in this area as sea levels rise during this period. This section largely consists of hard, resistant rock that has eroded very little over the long term. This is expected to continue to 2025, with negligible cliff recession predicted over this period. Small scale cliff failures could occur as a	There would continue to be negligible cliff recession along this section, although very localised small scale cliff failures could occur between 2025 and 2055. As such total erosion of 0 to 10m is predicted by 2055. Sea level rise could cause the narrowing of Lannacombe Beach and the other small pocket coves along this stretch, this could result in the failure of defences within Lannacombe Beach. Failure of the defences would not significantly	There would continue to be negligible cliff recession along this section, although very localised small scale cliff failures could occur between 2055 and 2105. As such total erosion of 0 to 10m is predicted by 2105. As sea levels rise, there could be further submergence of remaining pocket beaches. Along the rest of the coast sea level rise would only mean that still water level sits higher up the cliff face and therefore it would be unlikely for

Location	Predicted Change for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	result of geological factors and wave undercutting at the cliff toe, although these would be very localised and it is not possible to predict the location of such events. As such total erosion of 0 to 10m is predicted by 2025. There is no interaction between the small coves/ pocket beaches along this stretch.	impact on coastal evolution of this stretch. .	erosion rates to accelerate.
Prawle Point to Bolt Head	Small lengths of defence are located at the back of a number of pocket beaches that indent this otherwise cliffed section.	The short lengths of defence along this section would all be expected to fail during this period.	No defences.
	This section is dominated by hard rock cliffs that are indented with small pocket beaches. The resistant nature of the cliffs has historically resulted in very little cliff recession, although some areas are more erodible than others depending on local geological characteristics. In these localised areas of less resistant rock, erosion of 0 to 10m is predicted by 2025. The small pocket beaches fluctuate seasonally but have remained largely unchanged over the long term. These are supplied by erosion of the slightly more erodible cliffs within which they are located. There is little, if any, interaction with adjacent beaches. Coastal squeeze as a result of sea level rise is likely to become increasingly important towards 2025 if there is insufficient sediment supply to the pocket beaches from local cliff erosion. This is	The majority of the cliffs would be expected to experience only negligible erosion between 2025 and 2055. Faster rates of cliff recession within the slightly softer cliffs could occur, with a net recession of between 0 and 10m is predicted over this period. Sea level rise could lead to the narrowing and possible submergence of the pocket beaches that indent the cliffs along this section, if there is insufficient supply of sediment from localised cliff erosion, or where beaches front resistant cliffs. The Kingsbridge Estuary system is largely natural and unconstrained, and it would be expected to undergo landward translation in response to rising sea levels. However, in parts of the estuary this may not be possible due to rapidly rising land. In these areas there it is likely that gradual loss of inter-tidal areas would occur.	Negligible erosion of the majority of the cliffs is expected to occur between 2055 and 2105. Faster rates of cliff recession within the slightly softer cliffs could occur, with a net recession of between 0 and 10m is predicted over this period. As sea levels rise, the small pocket beaches would be expected to narrow further and could disappear in places, where either resistant cliffs back the beaches or if there is insufficient supply of sediment from localised cliff erosion. The Kingsbridge Estuary system is largely natural and unconstrained, and it would be expected to undergo landward translation in response to rising sea levels. However, in parts of the estuary this may not be possible due to rapidly rising land. In these areas there it is likely that gradual loss of inter-tidal areas would occur.

Location	Predicted Change for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	particularly the case for those pocket beaches, where defences prevent erosion of softer cliffs, which would otherwise have contributed beach sediment as they eroded.		
Bolt Head to Bolt Tail	There are no defences present along this section.	No defences.	No defences.
	The cliffs along this section consist of hard, resistant rock that has eroded very little over the long term. This is expected to continue to 2025, with negligible cliff recession predicted over this period. As such total erosion of 0 to 10m is predicted by 2025 depending on the occurrence of small scale cliff failures.	Negligible erosion of the hard rock cliffs that dominate this section is predicted between 2025 and 2055. As such total erosion of 0 to 10m is predicted by 2055 depending on the occurrence of small scale cliff failures. Any small pocket beaches along this stretch are likely to become permanently submerged at all tidal states, due to sea level rise.	Negligible erosion of the hard rock cliffs that dominate this section is predicted between 2055 and 2105. As such total erosion of 0 to 10m is predicted by 2105 depending on the occurrence of small scale cliff failures.
Bolt Tail to Avon Estuary (East)	A small length of defence is located at the back of the beach at Thurlestone, protecting low-lying land from flooding.	It is expected that the defence at Thurlestone Beach would fail during this period.	No defence.
	The majority of this section consists of hard rock cliffs that have historically eroded very little over the long term, although there are localised areas that are slightly more erodible. This trend would continue to 2025, and a maximum erosion of between 0 and 10m is predicted in localised areas of softer cliffs over this period. Several pocket beaches indent this section, but there is little, if any, interaction between these. The largest of which is the beach at Thurlestone that fronts an area of low-lying land. Coastal squeeze as a result of sea level rise is	Cliff erosion would be limited to localised areas of slightly more erodible cliffs, with predicted erosion in these areas of 0 to 10m by 2055. Sea level rise could lead to the continued narrowing and possible submergence of the pocket beaches that front the cliffs along this section. At Thurlestone, this would result in an increased risk of flooding during storm events, particularly upon failure of the defences. However, the loss of the defences would allow the beach at Thurlestone to adapt to sea level rise by	Cliff erosion would be limited to localised areas of slightly more erodible cliffs, with total erosion in these areas predicted to be between 0 and 10m by 2105. Many of the pocket beaches that front the resistant cliffs will have disappeared by the end of this period, due to increases in sea level. At Thurlestone further sea level rise would result in continued retreat of the beach onto low-lying land, resulting in an increased risk of flooding of the low-lying land behind during storm events.

Location	Predicted Change for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	likely to become increasingly important during this period, particularly where either defences exist, as at Thurlestone, or where beaches front resistant cliffs. At Thurlestone, this would result in an increased risk of flooding during storm events by 2025.	retreating onto the low-lying land, which would counter-act the narrowing of the beach.	
Avon Estuary (East) to Challaborough (West)	There is a small length of defence located at the back of Challaborough Beach that protects low-lying land from flooding.	The defence at Challaborough Beach would be expected to fail during this period.	No defences.
	This section contains extensive areas of sand at both the mouth of the Avon estuary and in the small beach that fronts the defences and low-lying land at Challaborough in the western part of this section. Challaborough Beach fluctuates seasonally but has been stable over the long term. This situation is expected to continue to 2025, although coastal squeeze as a result of sea level rise could become increasingly important during this period, resulting in an increased risk of flooding during storm events by 2025. Sea level rise could also possibly result in some erosion and narrowing of the beaches around the mouth of the Avon estuary and the tombolo between the mainland and Burgh Island by 2025, features that have also historically been stable over the long term, although the channel at the mouth of the estuary has migrated from east to	Sea level rise would continue to cause narrowing and steepening of Challaborough Beach whilst the defences remain, resulting in an increased risk of localised flooding in this area during storm events between 2025 and 2055. The loss of the defence in this location during this period would serve to exacerbate this flood risk, although the beach would become able to adapt to sea level rise by retreating landwards onto the low-lying land and would counter-act some of the beach narrowing. There could also be erosion, narrowing and possibly submergence of the beaches and tombolo around the mouth of the Avon estuary in response to rising sea level. There is little or no link between the beaches therefore this would not impact on the adjacent Challaborough Beach. The hard rock cliffs would continue to erode only very slowly between 2025 and 2055, with negligible erosion predicted over this period. The dunes at Bantham Sand, which sit on top of a	As sea levels rise, it would be expected that Challaborough Beach would retreat further onto low-lying land between 2055 and 2105 whilst maintaining the narrow form established in the medium term. This would result in an increased risk of localised flooding in this area during storm events. The beaches and tombolo around the mouth of the Avon estuary could also erode and narrow and possibly disappear in places in response to rising sea levels. The submergence of the tombolo during this period would leave Burgh Island permanently detached from the mainland. The hard rock cliffs would continue to erode only very slowly between 2055 and 2105, with negligible erosion predicted over this period. The Avon Estuary itself is largely natural and unconstrained, and would be expected to adjust to rising sea levels to maintain its current form.

Location	Predicted Change for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	west over the past 100 years. The hard rock cliffs located along parts of this section have eroded very little over the long term, and this is expected to continue in the future, with negligible erosion predicted by 2025.	shore platform, would rollback in response to sea level rise, aided by net flood sediment transport that occurs over the sands. The Avon Estuary itself is largely natural and unconstrained, and would be expected to adjust to rising sea levels to maintain its current form.	
Challaborough (West) to Wembury Point	There are no defences present along this section.	No defences.	No defences.
	The majority of this section consists of hard rock cliffs that have eroded very little over the long term, although there are localised areas that are slightly more erodible. This trend would continue to 2025, and total erosion of between 0 and 10m is predicted in localised areas over this period, whilst only the remainder erosion would be negligible. The cliffs along this section are indented with small pocket beaches that are supplied with sediment from local cliff erosion only, there is no interaction between adjacent beaches. These beaches have historically been stable over the long term, however coastal squeeze as a result of sea level rise could become increasingly important during this period if there is insufficient sediment supply to the pocket beaches from local cliff erosion in the future. This stretch encompasses the estuaries Erme and Yealm. Both are ria type estuaries which are confined by steep cliffs. No change in the overall estuary forms are expected, although within the	Cliff erosion would be limited to localised areas of slightly more erodible cliffs, with total erosion in these areas of between 0 and 10m predicted by 2055 depending on the occurrence of small scale cliff failures. Sea level rise could lead to the narrowing and possible submergence of the pocket beaches that indent the cliffs along this section, if there is insufficient supply of sediment from localised cliff erosion and where beaches front resistant cliffs. Where beaches are not present the still water level will simply be higher up the cliff face. No change in the form of the Erme or Yealm is expected as they are natural and unconstrained by defences, allowing them to adjust to keep pace with rising sea levels.	Cliff erosion would be limited to localised areas of slightly more erodible cliffs, with total erosion in these areas of 0 to 10m predicted by 2105 depending on the occurrence of small scale cliff failures. As sea levels rise most of the small pocket beaches that indent the cliffs along this section would be expected to have disappeared, unless locally there is sufficient sediment supply from the cliffs. No change in the form of the Erme or Yealm is expected as they are natural and unconstrained by defences, allowing them to adjust to keep pace with rising sea levels.

Location	Predicted Change for 'No Active Intervention'		
	Short Term (to 2025)	**Medium Term (to 2055)**	**Long Term (to 2105)**
	Erme there could be natural fluctuations in the position of the low water channel.		
Wembury Point to Mount Batten Breakwater	The only defences present along this section occur at its western end in the form of the Mount Batten Breakwater, although its main effect is upon wave climate around the mouth of the Plym estuary. Part of this section is also affected by the sheltering effect of the Plymouth Breakwater within Plymouth Sound.	It is assumed that the Mount Batten and Plymouth Breakwaters would remain during this period and continue to affect wave climate within Plymouth Sound.	It is assumed that the Mount Batten and Plymouth Breakwaters would remain during this period and continue to affect wave climate within Plymouth Sound.
	The cliffs along this section consist of hard, resistant rock that has eroded very little over the long term. This is expected to continue to 2025, with negligible cliff recession predicted over this period. As such total erosion of 0 to 10m is predicted by 2025 depending on the occurrence of small scale cliff failures. This coast is geologically controlled and therefore would not be affected by any changes within Plymouth Sound, e.g. to the Breakwater.	Negligible erosion of the hard rock cliffs that dominate this section is predicted between 2025 and 2055. As such total erosion of 0 to 10m is predicted by 2055 depending on the occurrence of small scale cliff failures. The small pocket beaches will gradually become drowned as sea level rise and shore platforms become submerged. This coast is geologically controlled and therefore would not be affected by any changes within Plymouth Sound.	Negligible erosion of the hard rock cliffs that dominate this section is predicted between 2055 and 2105. As such total erosion of 0 to 10m is predicted by 2105 depending on the occurrence of small scale cliff failures. Many of the small pocket beaches would have been lost in a scenario of accelerated sea level rise. This coast is geologically controlled and therefore would not be affected by any changes within Plymouth Sound.
Mount Batten Breakwater to Devil's Point	This section consists of a wide range of defences that protect the toe of the cliff from wave action and areas of low-lying land from flooding (within the Plym estuary), although a number of the defences form part of amenity features including a lido. There are also structures associated with quays and marinas.	Partial loss of some defences along this section would occur during this period, although along Plymouth Hoe this would be associated with a lack of maintenance to the amenity features located along the cliff toe. Loss of some of the defences providing flood protection within the Plym estuary would be	There would be further loss of defences and amenity features along the cliff toe that provide protection. It is anticipated that any remaining defences within the Plym estuary would be lost during this period.

Location	Predicted Change for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	Part of this section is also affected by the sheltering effect of the Plymouth Breakwater within Plymouth Sound.	expected to occur towards the end of this period. It is assumed that the Plymouth Breakwater would remain during this period and continue to affect wave climate within Plymouth Sound.	It is assumed that the Plymouth Breakwater would remain during this period and continue to affect wave climate within Plymouth Sound.
	The cliff toe is almost entirely protected by defences and other structures along this section, and this has resulted in no cliff recession over the long term. Continued defence of this section by ongoing provision of amenity infrastructure would result in no cliff recession occurring by 2025, although even if undefended, the hard rock geology that forms this coastline would experience negligible, if any erosion. Increases in sea level and storminess as a result of climate change could cause increased flood risk to low-lying areas by 2025, particularly those within the Plym estuary such as at Cattedown and towards Marsh Mills.	Despite partial loss of defences, the continued defence afforded by remaining structures along this section would result in no cliff recession occurring between 2025 and 2055, although even where defences are lost, the hard rock geology that forms this coastline would experience negligible erosion. Rising sea levels and increased storminess due to climate change would lead to an increased risk of flooding to low-lying land as a result of wave overtopping. The effect of rising sea levels on the Plymouth Estuary system would vary depending upon whether the estuary is natural or constrained. The Plym estuary that lies within this section would be likely to experience gradual loss of inter-tidal areas as they are restricted from adapting by continued presence of defences, although the loss of some areas of defence towards 2055 would begin to allow the estuary to adapt to the effects of sea level rise by transgressing landwards.	Despite further losses of defences and other structures along this section, there would be no cliff recession between 2055 and 2105 as these losses would expose the underlying hard rock geology that would experience negligible erosion. Rising sea levels and increased storminess due to climate change would lead to an increased risk of flooding to low-lying land as a result of wave overtopping. The effect of rising sea levels on the Plymouth Estuary system would vary depending upon whether the estuary is natural or constrained. The Plym estuary that lies within this section would be likely to experience further gradual loss of inter-tidal areas as they are restricted from adapting by remaining defences, although this effect would be gradually reduced during this period as defences fail and the estuary is increasingly able to adapt to sea level rise by moving on to areas of low-lying land within its valley.
Devil's Point to Mount Edgcumbe	Defences are largely confined to the eastern side of the estuary south of the Tamar bridge. These	Upgrade of the defences and other structures is likely to be required during this period in order	Upgrade of the defences and other structures is likely to be required during this period in order

Location	Predicted Change for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
(Tamar Estuary)	defences and other structures are associated with the development of the port and naval dockyard at Plymouth, which has also seen the estuary heavily modified in this area by dredging activity. The rest of the estuary is largely undefended although there are short isolated lengths of defence.	to maintain current levels of protection.	to maintain current levels of protection.
	Human intervention in the outer part of the Tamar estuary south of the Tamar bridge has heavily modified the estuary in this area. The defences along the eastern side of the estuary protect small areas of low-lying land between the estuary and higher ground to the east from flooding. The majority of the remaining estuary is largely natural, with extensive areas of intertidal mudflats constrained by steeply rising ground.	The effect of rising sea levels on the lower Tamar estuary would be likely to result in the gradual loss of inter-tidal areas as they are restricted from adapting by the ongoing presence of defences at Plymouth. The remaining undefended areas of the estuary in this section would be likely to maintain their current form as they adapt landwards at a rate that keeps pace with sea level rise.	The effect of rising sea levels on the lower Tamar estuary would be likely to result in the gradual loss of inter-tidal areas as they are restricted from adapting by the ongoing presence of defences at Plymouth. The remaining undefended areas of the estuary in this section would be likely to maintain their current form as they adapt landwards at a rate that keeps pace with sea level rise.
Mount Edgcumbe to Kingsand	A small section of defence is present along the cliff toe around Picklecombe Point, which protect Fort Picklecombe (which sits in front of the cliffs).	The defences around Picklecombe Point would fail during this period.	No defences.
	The presence of defences around Picklecombe Point is unlikely to significantly affect cliff recession in this area by 2025, as the hard rock cliffs along which they are located would be likely to experience only negligible erosion over this period in any case. The unprotected hard rock cliffs that form the rest of this section have also eroded very little	The hard rock cliffs along this section would be expected to experience only negligible erosion between 2025 and 2055. As such total erosion of 0 to 10m is predicted by 2055 depending on the occurrence of small scale cliff failures. The small pocket beaches, such as Edgcumbe Beach would narrow due to rising sea levels and the lack of sediment input. At Edgcumbe there	The hard rock cliffs along this section would be undefended throughout and so be expected to experience only negligible erosion between 2055 and 2105. As such total erosion of 0 to 10m is predicted by 2105 depending on the occurrence of small scale cliff failures. Some pocket beaches could disappear due to rising sea levels. There could be increased risk of

Location	Predicted Change for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	over the long term, and negligible erosion of these cliffs is predicted by 2025. As such total erosion of 0 to 10m is predicted by 2025 depending on the occurrence of small scale cliff failures.	could be a risk of localised flooding. The loss of defences around Picklecombe Point would be unlikely to have a significant effect on cliff recession during this period, as they protect similarly hard rock cliffs that would also only experience negligible erosion when they become unprotected. There would also be no impact on the adjacent shoreline, although the loss of defences would lead to an increased risk of very localised flooding to low-lying areas.	localised flooding at Edgcumbe.
Kingsand/ Cawsand	Defences including seawalls are located at the back of the small pocket beaches located in front of Kingsand and Cawsand. Parts of these defences could fail by the end of this period.	The remaining defences along this section would fail during this period.	No defences.
	The small pocket beaches at Cawsand and Kingsand have been stable over the long term, although they do fluctuate as a result of storm events. Due to their indented position these are relatively sheltered pocket beaches. In the short term this trend is likely to continue although the impact of rising sea levels could start to have an impact towards the end of this period, which would result in beach narrowing. As a result defences could start to fail due to increased exposure and undermining. This could result in a greater risk of localised flooding at both Kingsand and Cawsand.	Sea level rise could result in the small pocket beaches of Cawsand and Kingsand becoming narrower and steeper during this period. This would be as a result of rising sea levels together with the resistance of the backing cliffs; which means there is a lack of sediment being input to the beaches (which are not fed by any other mechanism) and also prevents translation of the beach profile landwards in line with the rise in sea level. This will have implications for the small villages which would experience increased risk of localised flooding and overtopping as a result of both sea level rise and the failure of the defences that presently prevent this.	In the long term, the issue of narrowing beaches will continue under a scenario of accelerated sea level rise. This may mean that during this period the beaches of Cawsand and Kingsand disappear altogether or that a very narrow beach is present even at lowest tides. This will have implications for the small villages which would experience increased risk of localised flooding and overtopping.

Location	Predicted Change for 'No Active Intervention'		
	Short Term (to 2025)	**Medium Term (to 2055)**	**Long Term (to 2105)**
Cawsand to Rame Head	There are no defences present along this section.	No defences.	No defences.
	The cliffs along this section consist of hard, resistant rock that has eroded very little over the long term. This is expected to continue to 2025, with negligible cliff recession predicted over this period. As such total erosion of 0 to 10m is predicted by 2025 depending on the occurrence of small scale cliff failures. The cliffs mainly plunge directly into the sea along this stretch.	Negligible erosion of the hard rock cliffs that dominate this section is predicted between 2025 and 2055. As such total erosion of 0 to 10m is predicted by 2055 depending on the occurrence of small scale cliff failures.	Negligible erosion of the hard rock cliffs that dominate this section is predicted between 2055 and 2105. As such total erosion of 0 to 10m is predicted by 2105 depending on the occurrence of small scale cliff failures.

C.4.4 NAI Data Interpretation

C.4.4.1 Introduction

A number of data sets were used in the predictions of future shoreline response and evolution under the scenario of no active intervention, (these data were also used and reported in the Assessment of Shoreline and Estuary Dynamics, Section C.1 above):

- The cliff assessment database from Futurecoast, which includes information regarding likely failure mechanism, recession protection and frequency;
- Ordnance Survey historical maps, which date back to the 1880s.
- Other historical change data sets: e.g. at some locations cliff position data sets are available ;
- Futurecoast predictions of future shoreline change under an 'unconstrained' scenario: this assumed that all defence structures were removed and other coastal defence management interventions ceased and therefore is not directly comparable to a 'no active intervention' scenario;
- Strategic Regional Coastal Monitoring programmes beach profile data: this data is only relevant for specific locations and restricted to specific time frames i.e. ten to fifteen years at most.
- Predictions of future shoreline response under a 'Do Nothing' scenario from the first SMP.
- Other predictions of future shoreline response under no active intervention (or 'do nothing') scenario, e.g. from strategy studies completed since the first SMP.
- Various studies and research papers.
- The National Coastal Erosion Risk Mapping research and development project (Halcrow, in progress) that used the Futurecoast data described above as a starting point, but which has been through a process of local validation with all coastal operating authorities to ensure the correct up-to-date information is being used as part of this project.
- The Futurecoast aerial CDs, Google Earth and other photographs were also used, together with any local knowledge of the area.

C.4.4.2 Consideration of Sea Level Rise

Section C.3.2 discusses sea level rise (SLR) and climate change in more detail. For this appraisal we have not considered the potential impact of changes in precipitation or storminess when estimating future change, because of the inherent uncertainties in these predictions (see UKCIP08 (2007)). We have, however, mentioned where any coastal systems could be sensitive to changes in these factors.

In advance of the latest sea level rise scenarios from UKCIP08 (due to be released later this year), Defra (2006) have produced new allowances for sea level rise (see Table 3.1 in Section C.3), which have been considered in our predictions.

The response of the coast depends upon a number of factors, but at a basic level depends upon resistance of the coastal feature and the energy or forcing acting on it. In general terms, rising sea level results in higher water levels further up the beach profile and therefore increased wave energy. Response of the coast to changes in forcing factors is also often complex with a number of feedbacks, such as sediment inputs from cliff erosion, affecting the net change. There is a range of predictive methods available which incorporate sea level rise, but each is constrained by assumptions and limitations which affect their application to cliffs. The Bruun Model is probably one of the most used for cliffed coastlines and the modified version (as discussed in Bray and Hooke, 1997) has been used for this SMP. This is as follows:

$$R_2 = R_1 + \left(S_2 - S_1\right)\frac{L_*}{P\left(B + h_*\right)}$$

Where:

R_2 = future recession

R_1 = historical recession

S_1 = historical SLR

S_2 = future SLR

L_* = length of active profile

h_* = closure depth

B = height of cliff

P = proportion of sediment eroded that is coarse enough to remain on the beach

However, it is not appropriate to simply apply this equation across the board, as it assumes linear, year by year erosion, which is not the case for all cliffs. The manner in which cliff recession occurs depends upon the way in which the cliff tends to fail, which in turn depends upon its geological make-up, i.e. geology, rock structure, rock lithology and hydrogeology and the solubility of the rock.

In simple terms, cliffs may be divided into a number of generic categories (which were used by Futurecoast), and the general methodology for predicting cliff recession rates for each cliff type is discussed in the table below. However, there has also been consideration of local factors, such as: local geological characteristics, how it has behaved over the last century, human intervention and feedback mechanisms, for example inputs of sediment and beach build-up. Therefore a local-level appraisal, using these guidelines, has been undertaken.

Whichever method is used, a key input is the historical behaviour of the cliff, therefore the quality of this data affects the predictions made. The sources used in deriving this data are outlined above.

Cliff type	Key characteristics	General guidelines for predicting future recession
Simple cliff	This is usually a steep cliff face, with narrow foreshore zone and rapid removal of toe debris. Erosion typically occurs as rock falls, topples or slides from which material is deposited directly on the foreshore. There is often a rapid response to toe erosion.	As erosion rates are closely related to the rate of toe erosion and therefore sea level rise, the Bruun Model is an appropriate tool to use. Best and worst case scenarios have been derived by using historical rates, with no additional erosion assumed due to SLR as the lower estimate and historical rates + additional erosion due to SLR as the upper estimate. The exception to the above is where cliffs are composed of hard rock and are therefore resistant to erosion. In these situations historical recession rates would have been negligible or very low. These cliffs are unlikely to respond to sea level rise and the result will simply be that water levels lie higher up the cliff face. Historical rates of erosion should therefore be used as the best prediction.
Simple landslide	A marked degradation and storage zone is usually apparent, affording limited buffering against toe erosion. Toe erosion of cliff debris leads to oversteepening of the cliff face and a deep seated rotational slide develops.	Although there is a link between cliff erosion and the rate of toe erosion (or erosion of the debris), failure tends to be irregular and often medium or large scale, therefore in many cases, the use of the Bruun Model is not appropriate. The best estimate of erosion risk is therefore the recession potential identified by Futurecoast, unless other data is available on past landslide events.
Composite cliff	Partly coupled sequence of contrasting simple sub-systems. This typically involves inter-bedded hard and soft rocks. This can generally be as either soft	There is often a different response by different layers in the cliff face. The best approach therefore depends upon the exposures present and a site-by-site appraisal is required. It may be necessary to identify different rates for cliff face and cliff top

	rock caps resting on hard rock or as hard rock caps resting on softer rock. The latter case is more sensitive to recession.	recession.
Complex cliff	These have strongly coupled sequences of scarp and bench morphology, each with their own inputs, storage and outputs of sediment. The output from one system forms a cascading input to the next resulting in close adjustment of process and form with complex feedbacks.	There is often a different response by different layers in the cliff face. The best approach therefore depends upon the exposures present and a site-by-site appraisal is required. It may be necessary to identify different rates for cliff face and cliff top recession. In many cases the Bruun Model will not be appropriate as these types of cliffs often do not display a progressive recession, but are often subject to irregular events.
Relict cliff	Sequences of pre-existing landslides, which are currently not active, but which could be susceptible to reactivation and exhumation by either progressive marine erosion at the toe or raised groundwater levels.	The likelihood of reactivation over the next 100 years needs to be considered, because some systems are ancient. If reactivation is likely, the dominant driver of cliff top recession needs to be considered: if it is marine erosion driven, the Bruun Model is probably appropriate, if it is groundwater levels, then the recession potential estimates from Futurecoast may be most appropriate to estimate risk.
Additional Note: Where cliffs have been protected by defences which are then allowed to fail, the response to failure and removal of these defences will need to be considered. Soft cliff lines, which have been protected and prevented from retreating for a number of years may now lie seaward of their ‘natural position’. In these situations, the possibility of a ‘springback’ effect needs to be considered, where rates of erosion in the first few years may exceed historical rates until the cliff toe lies at a position along the beach profile which is more commensurate with wave conditions.		

C.4.4.3 Data Assessments (NAI)

Location	Data Assessment for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
Durlston Head to St Alban's Head	**Defended:** No defences present. **Undefended:** Very little erosion has occurred here in the past due to the resistant geology and this will continue to 2025 (Halcrow, 2002).	**Defended:** No defences present. **Undefended:** Very little erosion has occurred here in the past due to the resistant geology and this will continue to 2058 (Halcrow, 2002).	**Defended:** No defences present. **Undefended:** Very little erosion has occurred here in the past due to the resistant geology and this will continue to 2108 (Halcrow, 2002).
St Alban's Head to Worbarrow Tout	**Defended:** The small section of wall within Kimmeridge Bay would result in no change in shoreline position over this short length. **Undefended:** Lower limit of annual erosion will be in the region of 0.05-0.15m/yr for the area between Worbarrow Tout and Hobarrow Bay. These are also complex cliffs controlled by groundwater and so are also subject to infrequent small scale cliff failure events that occur every 1-10 years with a recession potential of less than 10m per event. This gives rise to total erosion of 2-20m predicted by 2025 (Halcrow, 2002; SCOPAC, 2004). Between Broad Bench and Kimmeridge Bay a similar pattern of annual erosion in the region of 0.2-0.4m/year that could be outweighed by infrequent landslide event. Total erosion of 5-20m in this area predicted by 2025 (SCOPAC, 2004). Complex cliffs also occur between St Alban's Head and Egmont Point, although here recession is as a result of large scale events of more than 50m that occur every 10-100 years	**Defended:** The small section of wall within Kimmeridge Bay would be expected to fail during this period, although the remains of the defence would be likely to still provide some protection. **Undefended:** Lower limit of annual erosion will be in the region of 0.05-0.15m/yr for the area between Worbarrow Tout and Hobarrow Bay, although these complex cliffs could also experience a number of small scale landslide events, giving rise to total erosion of 5-50m predicted by 2055 (Halcrow, 2002; SCOPAC, 2004). Between Broad Bench and Kimmeridge Bay, erosion will be in the region of 0.2-0.4m/year. Although there could also be a number of landslide events during this period. Total erosion of 14-50m predicted by 2055 (SCOPAC, 2004). The complex cliffs between St Alban's Head and Egmont Point could experience a large landslide event during this period, and so recession of 0-50m is predicted by 2055	**Defended:** No defences. Previously defended part of this section would function as per the adjacent undefended coast. **Undefended:** Lower limit of annual erosion will be in the region of 0.05-0.15m/yr for the area between Worbarrow Tout and Hobarrow Bay, although these complex cliffs could also experience a number of small scale landslide events, giving rise to total erosion of 10-100m predicted by 2105 (Halcrow, 2002; SCOPAC, 2004). Between Broad Bench and Kimmeridge Bay, erosion will be in the region of 0.2-0.4m/year. Although there could also be a number of landslide events during this period. Total erosion of 29-100m predicted by 2105 (SCOPAC, 2004). The complex cliffs between St Alban's Head and Egmont Point could experience a large landslide event during this period, and so recession of 0-50m is predicted by 2105 (Halcrow, 2002). Toe erosion within these complex cliffs is less

Location	Data Assessment for 'No Active Intervention'		
	Short Term (to 2025)	**Medium Term (to 2055)**	**Long Term (to 2105)**
	(Halcrow, 2002). Such an event could occur at anytime and so in this area total erosion of 0-50m predicted by 2025). The simple cliffs along Kimmeridge Ledges are likely to be affected by sea level rise, therefore use Bruun Rule estimate for upper limit of recession potential. However these cliffs have only eroded very slowly in the past and so recession of about 1m is predicted by 2025.	(Halcrow, 2002). Toe erosion within these complex cliffs is less important and so sea level rise effects are outweighed by infrequent cliff failure events. The simple cliffs along Kimmeridge Ledges are likely to be affected by sea level rise, therefore use Bruun Rule estimate for upper limit of recession potential. However these cliffs have only eroded very slowly in the past and so recession of 2-4m is predicted by 2055.	important and so sea level rise effects are outweighed by infrequent cliff failure events. The simple cliffs along Kimmeridge Ledges are likely to be affected by sea level rise, therefore use Bruun Rule estimate for upper limit of recession potential. However these cliffs have only eroded very slowly in the past and so recession of 5-12m is predicted by 2105.
Worbarrow Tout to Lulworth Cove (East)	**Defended:** No defences present. **Undefended:** Annual erosion within Worbarrow Bay will vary. Simple cliffs in the western part of the bay are likely to be affected by sea level rise therefore use Bruun rule estimate as upper limit of recession, as historical recession rate incorporates the small frequent landslide events. Therefore annual erosion will be in the region of 0.08-0.12m/yr, giving rise to total erosion of 1-2m predicted by 2025 (SCOPAC, 2004). The eastern part consists of simple chalk cliffs that have a similar rate of recession as the clay ones in the western part of the bay, and presently consist of degraded chalk cliffs. Therefore the historic rate alone is likely to be most appropriate as the upper limit in this part of the bay therefore total erosion of 0-2m	**Defended:** No defences present. **Undefended:** Annual erosion within Worbarrow Bay will vary. Simple cliffs in the western part of the bay are likely to be affected by sea level rise therefore use Bruun rule estimate as upper limit of recession, as historical recession rate incorporates the small frequent landslide events. Therefore total erosion of 5-6m predicted by 2055 (SCOPAC, 2004). The eastern part consists of simple chalk cliffs that have a similar rate of recession as the clay ones in the western part of the bay, and presently consist of degraded chalk cliffs. Therefore the historic rate alone of 0.08-0.12m/yr is likely to be most appropriate as the upper limit in this part of the bay therefore total erosion of 0-5m predicted by 2055	**Defended:** No defences present. **Undefended:** Annual erosion within Worbarrow Bay will vary. Simple cliffs in the western part of the bay are likely to be affected by sea level rise therefore use Bruun rule estimate as upper limit of recession, as historical recession rate incorporates the small frequent landslide events. Therefore total erosion of 10-17m predicted by 2105 (SCOPAC, 2004). The eastern part consists of simple chalk cliffs that have a similar rate of recession as the clay ones in the western part of the bay, and presently consist of degraded chalk cliffs. Therefore the historic rate alone of 0.08-0.12m/yr is likely to be most appropriate as the upper limit in this part of the bay therefore total erosion of 0-10m predicted by 2105

Location	Data Assessment for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	predicted by 2025 (SCOPAC, 2004). From Mupe Bay to Lulworth Cove (East), the annual erosion will be negligible (SCOPAC, 2004).	(SCOPAC, 2004). From Mupe Bay to Lulworth Cove (East), there has been negligible recession historically, although landslides could occur in softer rocks as per adjacent erosion of Worbarrow Bay. These are simple cliffs and likely to be affected by sea level rise, therefore use Bruun rule estimate total erosion of 0-1m predicted by 2055.	(SCOPAC, 2004). From Mupe Bay to Lulworth Cove (East), there has been negligible recession historically, although landslides could occur in softer rocks as per adjacent erosion of Worbarrow Bay. These are simple cliffs and likely to be affected by sea level rise, therefore use Bruun rule estimate total erosion of 0-8m predicted by 2105.
Lulworth Cove	**Defended:** The small section of defences within Lulworth Cove would result in no change in shoreline position of the defended section. **Undefended:** Annual erosion will be in the region of 0.12m/yr, giving rise to a total erosion of 0-2m predicted by 2025 (Halcrow, 2002). The frequency of cliff failures is 1-10 years, with a recession potential of less than 10m per event (Halcrow, 2002). Not considered likely that recession potential would be reached due to sheltered nature of cove. Therefore use historical rate for future projections.	**Defended:** The small section of defences within Lulworth Cove would be expected to fail during this period, although the remains of the defence would be likely to still provide some protection. **Undefended:** Annual erosion will be in the region of 0.12m/yr, giving rise to a total erosion of 0-6m predicted by 2055 (Halcrow, 2002). The frequency of cliff failures is 1-10 years, with a recession potential of less than 10m per event (Halcrow, 2002). Not considered likely that recession potential would be reached due to sheltered nature of cove. Therefore use historical rate for future projections.	**Defended:** No defences. Previously defended part of this section would function as per the adjacent undefended coast. **Undefended:** Annual erosion will be in the region of 0.12m/yr, giving rise to a total erosion of 0-12m predicted by 2105 (Halcrow, 2002). The frequency of cliff failures is 1-10 years, with a recession potential of less than 10m per event (Halcrow, 2002). Not considered likely that recession potential would be reached due to sheltered nature of cove. Therefore use historical rate for future projections.
Lulworth Cove (West) to White Nothe	**Defended:** No defences present. **Undefended:** Lower limit of annual erosion will be in the region of 0.06-0.22m/yr between White Nothe and Bats Head. These are also	**Defended:** No defences present. **Undefended:** Lower limit of annual erosion will be in the region of 0.06-0.22m/yr between White Nothe and Bats Head. These are also	**Defended:** No defences present. **Undefended:** Lower limit of annual erosion will be in the region of 0.06-0.22m/yr between White Nothe and Bats Head. These are also

Location	Data Assessment for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	complex cliffs controlled by groundwater and so toe erosion is less important and therefore sea level rise effects are outweighed by infrequent cliff failure events that occur along this length, giving rise to total erosion of 2-10m predicted by 2025 (Halcrow, 2002; SCOPAC, 2004). Between Bats Head and Lulworth Cove (West), there are hard rock cliffs with localised cliff failure events that cause increases in recession. Use mean of historical rate for future predictions as unlikely to be affected by sea level rise, therefore annual erosion in the region of 0.2-0.46m/yr. Total erosion of 0-6m predicted by 2025 (SCOPAC, 2004). The frequency of landslides is along most of this section is 1-10 years, with a recession potential of less than 10m. The exception being towards White Nothe, where a similar recession potential is likely, but at a frequency of 10-100 years (Halcrow, 2002).	complex cliffs controlled by groundwater and so toe erosion is less important and therefore sea level rise effects are outweighed by infrequent cliff failure events that occur along this length, giving rise to total erosion of 7-10m predicted by 2055 (Halcrow, 2002; SCOPAC, 2004). Between Bats Head and Lulworth Cove (West), there are hard rock cliffs with localised cliff failure events that cause increases in recession. Use mean of historical rate for future predictions as unlikely to be affected by sea level rise, therefore annual erosion in the region of 0.2-0.46m/yr. Total erosion of 0-16m predicted by 2055 (SCOPAC, 2004). The frequency of landslides is along most of this section is 1-10 years, with a recession potential of less than 10m. The exception being towards White Nothe, where a similar recession potential is likely, but at a frequency of 10-100 years (Halcrow, 2002).	complex cliffs controlled by groundwater and so toe erosion is less important and therefore sea level rise effects are outweighed by infrequent cliff failure events that occur along this length, giving rise to total erosion of 14-20m predicted by 2105 (Halcrow, 2002; SCOPAC, 2004). Between Bats Head and Lulworth Cove (West), there are hard rock cliffs with localised cliff failure events that cause increases in recession. Use mean of historical rate for future predictions as unlikely to be affected by sea level rise, therefore annual erosion in the region of 0.2-0.46m/yr. Total erosion of 0-32m predicted by 2105 (SCOPAC, 2004). The frequency of landslides is along most of this section is 1-10 years, with a recession potential of less than 10m. The exception being towards White Nothe, where a similar recession potential is likely, but at a frequency of 10-100 years (Halcrow, 2002).
White Nothe to Redcliff Point	**Defended:** The rock groyne and revetment within Ringstead Bay would continue to hold beach locally and reduce the exposure of the cliff toe to marine action, thus reducing the rate of erosion which is primarily controlled by groundwater. Coastal squeeze anticipated. **Undefended:** Cliff failures events with a recession potential of more than 50m occur	**Defended:** The rock groyne and revetment within Ringstead Bay would fail during this period, although the defence remains would be likely to continue to hold some beach locally and so continue to reduce the exposure of the cliff toe to marine action, thus reducing the rate of erosion which is primarily controlled by groundwater in this area. Coastal squeeze	**Defended:** The effect of defence remains would be lost by this period, and the coast would function as per the adjacent undefended coast. **Undefended:** Cliff failures events with a recession potential of more than 50m occur every 250 years or more at White Nothe (King Rock). No recession in this area is

Location	Data Assessment for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	every 250 years or more at White Nothe (King Rock). No recession in this area is predicted by 2025. The simple cliffs in Ringstead Bay are likely to be affected by sea level rise, therefore use Bruun Rule estimate for upper limit of recession potential. However, state of the beach is an important factor, as currently this is being managed and would reduce toe erosion. Lower limit is based on historic rate of annual erosion in the region of 0.5m/yr. Total erosion in this area of about 9m predicted by 2025 (Halcrow, 2002; SCOPAC, 2004). From Osmington to Redcliff Point are complex cliffs controlled by groundwater. Toe erosion is less important in this area and so sea level rise effects are outweighed by infrequent medium scale cliff failure events that occur every 10-100 years. Total erosion of 9-50m predicted by 2025 (Halcrow, 2002; SCOPAC, 2004).	anticipated. **Undefended:** Cliff failures events with a recession potential of more than 50m occur every 250 years or more at White Nothe (King Rock). No recession in this area is predicted by 2055. The simple cliffs in Ringstead Bay are likely to be affected by sea level rise, therefore use Bruun Rule estimate for upper limit of recession potential. However, state of the beach is an important factor, as currently this is being managed and would reduce toe erosion. Lower limit is based on historic rate of annual erosion in the region of 0.5m/yr. Total erosion in this area of 24-27m predicted by 2055 (Halcrow, 2002; SCOPAC, 2004). From Osmington to Redcliff Point are complex cliffs controlled by groundwater. Toe erosion is less important in this area and so sea level rise effects are outweighed by infrequent medium scale cliff failure events that occur every 10-100 years. Total erosion of 24-50m predicted by 2055 (Halcrow, 2002; SCOPAC, 2004).	predicted by 2105. The simple cliffs in Ringstead Bay are likely to be affected by sea level rise, therefore use Bruun Rule estimate for upper limit of recession potential. However, state of the beach is an important factor, as currently this is being managed and would reduce toe erosion. Lower limit is based on historic rate of annual erosion in the region of 0.5m/yr. Total erosion in this area of 49-67m predicted by 2105 (Halcrow, 2002; SCOPAC, 2004). From Osmington to Redcliff Point are complex cliffs controlled by groundwater. Toe erosion is less important in this area and so sea level rise effects are outweighed by infrequent medium scale cliff failure events that occur every 10-100 years. Total erosion of 49-100m predicted by 2105 (Halcrow, 2002; SCOPAC, 2004).
Redcliff Point to Preston Beach (Rock Groyne)	**Defended:** No change in shoreline position due to continued defence during the first part of this period, with associated coastal squeeze anticipated. Beach maintenance activities ceased, resulting	**Defended:** Defences at Bowleaze Cove would fail during this period, increasing risk of flooding. Shoreline position would be unlikely to change significantly due to residual protection of cliff toe by the remains of the	**Defended:** Defences would be lost and any residual effects of defence remains removed. The cliffs would function as per the adjacent undefended cliffs. Preston Beach would roll-back and experience

Location	Data Assessment for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	in reduction in beach volume along the northern part of Preston Beach in particular due to material moving both northwards towards Bowleaze Cove and southwards towards the rock groyne. **Undefended:** Lower limit of annual erosion of Furzy Cliff is in the region of 0.75m/yr (Weymouth & Portland Borough Council, 2002), whilst at Redcliff, the lower limit of annual erosion is in the region of 0.62m/yr (Mouchel, 1998). These are both complex cliffs controlled by groundwater. Toe erosion is therefore less important and so sea level rise effects are outweighed by infrequent medium scale cliff failure events. Total erosion of Furzy Cliff by 2025 is 13-50m whilst at Redcliff it is 11-50m (Halcrow, 2002). The frequency of cliff failures between Redcliff Point and Furzy Cliff is 10-100 years with a recession potential of 10-50m (Halcrow, 2002). Transport of material could occur from Preston Beach towards Bowleaze Cove with no beach recycling could lead to increased beach levels in front of Furzy Cliffs.	defences. Preston Beach could breach during this period due to reduced beach levels and no new sediment inputs. This could create a temporary inlet to the Lodmoor Nature Reserve behind the beach that would eventually be re-sealed by longshore transport of sediment. The wave return wall immediately north of Preston Beach could also fail during this period, depending upon fronting beach levels. **Undefended:** Lower limit of annual erosion of Furzy Cliff is in the region of 0.75m/yr (Weymouth & Portland Borough Council, 2002), whilst at Redcliff, the lower limit of annual erosion is in the region of 0.62m/yr (Mouchel, 1998). These are both complex cliffs controlled by groundwater. Toe erosion is therefore less important and so sea level rise effects are outweighed by infrequent medium scale cliff failure events. Total erosion of Furzy Cliff by 2025 is 35-50m whilst at Redcliff it is 29-50m (Halcrow, 2002). The frequency of cliff failures between Redcliff Point and Furzy Cliff is 10-100 years with a recession potential of 10-50m (Halcrow, 2002). Transport of material could occur from Preston Beach towards Bowleaze Cove with no beach recycling could lead to increased	episodic breaching leading to inundation of the low-lying land behind before the breach would be eventually closed by sediment transport processes, assuming sufficient sediment is available. **Undefended:** Lower limit of annual erosion of Furzy Cliff is in the region of 0.75m/yr (Weymouth & Portland Borough Council, 2002), whilst at Redcliff, the lower limit of annual erosion is in the region of 0.62m/yr (Mouchel, 1998). These are both complex cliffs controlled by groundwater. Toe erosion is therefore less important and so sea level rise effects are outweighed by infrequent medium scale cliff failure events. Total erosion of Furzy Cliff by 2025 is 73-100m whilst at Redcliff it is 60-100m (Halcrow, 2002). The frequency of cliff failures between Redcliff Point and Furzy Cliff is 10-100 years with a recession potential of 10-50m (Halcrow, 2002).

<table>
<tr><th rowspan="2">Location</th><th colspan="3">Data Assessment for 'No Active Intervention'</th></tr>
<tr><th>Short Term (to 2025)</th><th>Medium Term (to 2055)</th><th>Long Term (to 2105)</th></tr>
<tr><td></td><td></td><td>beach levels in front of Furzy Cliffs.</td><td></td></tr>
<tr><td>Preston Beach (Rock Groyne) to Weymouth Harbour (Stone Pier)</td><td>Defended: Parts of Weymouth Harbour and the seawall/promenade along the sea front would fail by the end of this period (residual lives of 10-35 for all defences along this section). This would lead to increased flood risk during high water level and storm events.

No change in the remaining shoreline position anticipated due to continued defence. Coastal squeeze anticipated in the northern part of this section, although accumulation of sand sediment in the southern part of the bay will continue (Halcrow, 2002; Channel Coastal Observatory, 2006).

Undefended: Section is completely defended.</td><td>Defended: The remaining defences would fail during the first half of this period. This would lead to increased flood risk during high water level and storm events.

Undefended: Section is completely defended.</td><td>Defended: No defences present. Beach could roll back in response to sea level rise. Increased risk of flooding during high water level and storm events.

Undefended: Section is completely defended.</td></tr>
<tr><td>Weymouth Harbour (Stone Pier) to Portland Harbour (North Breakwater)</td><td>Defended: No change in shoreline position along the majority of this section due to continued defence (residual life of 40-50 years). Coastal squeeze anticipated, along with continued land sliding due to groundwater conditions.

A short length of wall along this section (residual life of 10-15 years) could fail during this period, causing increased wave exposure at the toe of part of the coastal slope and so may lead to increased recession, although no significant change in shoreline position by 2025.

Undefended: Section is completely defended.</td><td>Defended: The extent of failed defences could slowly increase during this period, 'un-zipping' from the original failure of the short section of wall in the first epoch.

This could lead to gradually increasing rates of recession due to increased exposure of the toe to wave action combined with landsliding due to groundwater conditions along parts of this length of coast, with a potential a mean annual rate of recession of 0.5m/yr possible (Weymouth and Portland Borough Council, 2002).

The frequency of cliff failures along the affected</td><td>Defended: The extent of defence failure would increase further during this period due to erosion of parts of this section with failure and outflanking of previously unaffected parts of the coast.

Cliff recession due to increased exposure of the toe to wave action combined with landsliding due to groundwater conditions would continue to expand at a mean annual rate of recession of 0.5m/yr (Weymouth and Portland Borough Council, 2002).

The frequency of cliff failures along the affected length of this section is predicted to be 10-100</td></tr>
</table>

Location	Data Assessment for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
		length of this section is predicted to be 10-100 years, with a recession potential of 10-50m (Halcrow, 2002). Total erosion of 24-50m possible by 2055 where defences fail. No change in shoreline position of the unaffected part of this section due to continued defence (residual life of 40-50 years). Coastal squeeze anticipated along the unaffected sections. **Undefended:** Section is completely defended.	years, with a recession potential of 10-50m The frequency of events would increase to 1-10 years towards Newton's Cove, although the recession potential would be the same (Halcrow, 2002). Total erosion of about 50m possible by 2105 where defences fail. **Undefended:** Section is completely defended.
Portland Harbour (North Breakwater) to Small Mouth	**Defended:** A range of structures and ad-hoc defences are present along this section. These serve to reduce the exposure of the cliff toe to wave action, and thus reduce the rate of recession, which is primarily controlled by groundwater (Halcrow, 2008). The majority of these structures are expected to fail by the end of this period. The effect of wave action at the cliff toe is also limited by the presence of the Portland Harbour Breakwaters (Halcrow, 2008). **Undefended:** Recession along this section is highly dependent upon the local geology, however, erosion at a mean annual rate of in the region of 0.1-0.5/m/yr is possible along most parts (Halcrow, 2008). The frequency of events along this section varies between 1-10 years and 10-100 years, although in both cases, the recession potential is less than 10m per	**Defended:** The larger structures at Bincleaves and Castle Cove Sailing Club could fail by the end of this period, although they are backed by sizeable mass concrete fill and so the loss of the outer defence would not lead to increased erosion. No defences along the remaining defences would result in localised increases in erosion rate similar to undefended sections. The effect of wave action at the cliff toe is also limited by the presence of the Portland Harbour Breakwaters (Halcrow, 2008). **Undefended:** Recession along this section is highly dependent upon the local geology, however, erosion at a mean annual rate of in the region of 0.1-0.5/m/yr is possible along most parts (Halcrow, 2008). The frequency of events along this section varies between 1-10	**Defended:** The mass concrete structures would continue to prevent localised erosion. The effect of wave action at the cliff toe is also limited by the presence of the Portland Harbour Breakwaters (Halcrow, 2008). **Undefended:** Recession along this section is highly dependent upon the local geology, however, erosion at a mean annual rate of in the region of 0.1-0.5/m/yr is possible along most parts (Halcrow, 2008). The frequency of events along this section varies between 1-10 years and 10-100 years, although in both cases, the recession potential is less than 10m per event (Halcrow, 2008). These are however complex cliffs controlled by groundwater and toe erosion is therefore less important and so sea level rise effects are outweighed by infrequent small scale cliff failure events.

Location	Data Assessment for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	event (Halcrow, 2008). These are however complex cliffs controlled by groundwater and toe erosion is therefore less important and so sea level rise effects are outweighed by infrequent small scale cliff failure events. Total erosion of 5-10m predicted by 2025, inclusive of episodic landslide events (Halcrow, 2008 and Halcrow, 2002).	years and 10-100 years, although in both cases, the recession potential is less than 10m per event (Halcrow, 2008). These are however complex cliffs controlled by groundwater and toe erosion is therefore less important and so sea level rise effects are outweighed by infrequent small scale cliff failure events. Total erosion of 14-25m predicted by 2055, inclusive of episodic landslide events (Halcrow, 2008 and Halcrow, 2002).	Total erosion of 29-50m predicted by 2105, inclusive of episodic landslide events (Halcrow, 2008 and Halcrow, 2002).
Small Mouth to Osprey Quay (Portland Harbour)	**Defended:** There are some areas of rock revetment at either end of this section, along with other structures associated with flood protection at Portland and the entrance to The Fleet. Some of these defence lengths are expected to fail by the end of this period, resulting in increased risk of flooding and erosion. The presence of the Portland Harbour Breakwaters is also a significant control on this section by influencing wave climate. It is assumed these structures will remain and continue to influence wave climate along the shoreline. **Undefended:** Whilst not having defences along the shoreline, the central part of this section, which is occupied by the shingle barrier of Ham Beach, has been relatively stable with no observable change over the past century since	**Defended:** The remaining defences along this section would be expected to fail during this period, increasing the risk of flooding and erosion in these areas. This could also affect the entrance of The Fleet or a period of time. The presence of the Portland Harbour Breakwaters is also a significant control on this section by influencing wave climate. It is assumed these structures will remain and continue to influence wave climate along the shoreline. **Undefended:** Whilst not having defences along the shoreline, the central part of this section, which is occupied by the shingle barrier of Ham Beach, has been relatively stable with no observable change over the past century since the construction of the Portland Harbour Breakwaters (Halcrow, 2002). It is assumed the Portland Harbour	**Defended:** No defences present along this section resulting in increased flood and erosion risk during this period. The presence of the Portland Harbour Breakwaters is also a significant control on this section. It is assumed these structures will remain and continue to influence wave climate along the shoreline. **Undefended:** Whilst not having defences along the shoreline, the central part of this section, which is occupied by the shingle barrier of Ham Beach, has been relatively stable with no observable change over the past century since the construction of the Portland Harbour Breakwaters (Halcrow, 2002). It is assumed the Portland Harbour Breakwaters remain and continue to influence wave climate along the shoreline.

Location	Data Assessment for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	the construction of the Portland Harbour Breakwaters (Halcrow, 2002). It is assumed the Portland Harbour Breakwaters remain and continue to influence wave climate along the shoreline.	Breakwaters remain and continue to influence wave climate along the shoreline.	
Osprey Quay (Portland Harbour) to Grove Point	**Defended:** This section is entirely defended with a range of structures including rock revetment, quay walls and breakwaters, including the Portland Harbour Breakwaters for some of its length. As a result, there has been negligible recession of the backing cliffs along this section over the past century. **Undefended:** Section is completely defended.	**Defended:** The defences along the shoreline would be expected to gradually fail during this period. This would lead to increased flooding of low-lying areas and a return to cliff recession at rates similar to those which occurred prior to the defences, with cliff failures predicted to occur with a frequency of more than 250 years and a recession potential of 10-50m per event (Halcrow, 2002) , although no recession is predicted by 2055. It is assumed the Portland Harbour Breakwaters remain and continue to influence wave climate along the shoreline. **Undefended:** Section is completely defended.	**Defended:** No defences present along the shoreline. This would lead to increased flooding of low-lying areas and a return to cliff recession at rates similar to those which occurred prior to the defences, with cliff failures predicted to occur with a frequency of more than 250 years and a recession potential of 10-50m per event (Halcrow, 2002) , although no recession is predicted by 2105. It is assumed the Portland Harbour Breakwaters remain and continue to influence wave climate along the shoreline. **Undefended:** Section is completely defended.
Grove Point to West Weare	**Defended:** No defences present. **Undefended:** Lower limit of annual erosion of the north-west cliffs at West Weare in the region of 0.11m/yr. These are complex cliffs, where cliff recession is driven by small scale, infrequent rock falls, creating large debris fans, which are then gradually eroded by wave action. Therefore sea level rise does not appear to be dominant force in the rate of cliff	**Defended:** No defences present. **Undefended:** Lower limit of annual erosion of the north-west cliffs at West Weare in the region of 0.11m/yr. These are complex cliffs, where cliff recession is driven by small scale, infrequent rock falls, creating large debris fans, which are then gradually eroded by wave action. Therefore sea level rise does not appear to be dominant force in the rate of cliff	**Defended:** No defences present. **Undefended:** Lower limit of annual erosion of the north-west cliffs at West Weare in the region of 0.11m/yr. These are complex cliffs, where cliff recession is driven by small scale, infrequent rock falls, creating large debris fans, which are then gradually eroded by wave action. Therefore sea level rise does not appear to be dominant force in the rate of cliff

Location	Data Assessment for 'No Active Intervention'		
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	top recession. Therefore total erosion of about 2-10m predicted by 2025 (Halcrow, 2002). The other cliffs along this section that make up the southern part of the Isle of Portland are highly resistant and have changed very little over the past century (Halcrow, 2002). The frequency of cliff failure events along this entire section is 100-250 years, with a recession potential of less than 10m per event (Halcrow, 2002).	top recession. Therefore total erosion of about 5-10m predicted by 2055 (Halcrow, 2002). The other cliffs along this section that make up the southern part of the Isle of Portland are highly resistant and have changed very little over the past century (Halcrow, 2002). The frequency of cliff failure events along this entire section is 100-250 years, with a recession potential of less than 10m per event (Halcrow, 2002).	top recession. Therefore total erosion of about 10-11m predicted by 2105 (Halcrow, 2002). The other cliffs along this section that make up the southern part of the Isle of Portland are highly resistant and have changed very little over the past century (Halcrow, 2002). The frequency of cliff failure events along this entire section is 100-250 years, with a recession potential of less than 10m per event (Halcrow, 2002).
Chiswell to Chesil Beach (Northern end of Osprey Quay)	**Defended:** Most of this section is defended by a range of structures, including sea walls, gabions and revetments. Coastal squeeze anticipated as Chesil Beach is prevented from rolling back. The length of defence fronting part of West Weare would be expected to fail during this period (residual life 10-15 years), resulting in the gradual exposure of the cliff toe to wave action. It is unlikely that significant cliff recession would occur by 2025 due to remains of the defences. **Undefended:** This length is undefended on its seaward face, but is backed by storm interceptor drains along its landward length. Annual recession of Chesil Beach in the region 0.06-0.12m/yr. Total recession of 1-2m by	**Defended:** The remaining defences would fail in the early to middle part of this period (residual lives 15-35 years). This would allow Chesil Beach to respond more naturally during storm events. Increased risk of flooding and rollback of the beach. The loss of defence in front of West Weare cliffs would result in cliff recession occurring at similar rate as the adjacent undefended section. Anticipated annual erosion of 0.11m/yr. **Undefended:** This length is undefended on its seaward face, but is backed by storm interceptor drains along its landward length. Annual recession of Chesil Beach in the region 0.06-0.12m/yr. Total recession of 2-4m by 2055 predicted (SCOPAC, 2004).	**Defended:** No defences present. Chesil Beach likely to rollback onto low-lying land during this period. Increased risk of flooding. Cliff recession of West Weare would occur at a similar rate as the adjacent undefended section. Anticipated annual erosion of 0.11m/yr. **Undefended:** This length is undefended on its seaward face, but is backed by storm interceptor drains along its landward length. Annual recession of Chesil Beach in the region 0.06-0.12m/yr. Total recession of 3-6m by 2105 predicted (SCOPAC, 2004).

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	2025 predicted (SCOPAC, 2004).		
Chesil Beach (Northern end of Osprey Quay) and The Fleet	**Defended:** No defences present. **Undefended:** Annual recession of Chesil Beach in the region 0.06-0.12m/yr. Total recession of 1-2m by 2025 predicted (SCOPAC, 2004). The slopes behind The Fleet are simple (relict) cliffs, which are protected from direct wave action by Chesil Beach, therefore there would be no affect of sea level rise and failure will be due to the action of groundwater alone, resulting in infrequent small scale landslide events with a frequency greater than 250 years and a recession potential of less than 10m per event (Halcrow, 2002). Total erosion of 0-10m predicted by 2025 along these cliffs.	**Defended:** No defences present. **Undefended:** Annual recession of Chesil Beach in the region 0.06-0.12m/yr. Total recession of 2-4m by 2055 predicted (SCOPAC, 2004). The slopes behind The Fleet are simple (relict) cliffs, which are protected from direct wave action by Chesil Beach, therefore there would be no affect of sea level rise and failure will be due to the action of groundwater alone, resulting in infrequent small scale landslide events with a frequency greater than 250 years and a recession potential of less than 10m per event (Halcrow, 2002). Total erosion of 0-10m predicted by 2055 along these cliffs.	**Defended:** No defences present. **Undefended:** Annual recession of Chesil Beach in the region 0.06-0.12m/yr. Total recession of 3-6m by 2105 predicted (SCOPAC, 2004). The slopes behind The Fleet are simple (relict) cliffs, which are protected from direct wave action by Chesil Beach, therefore there would be no affect of sea level rise and failure will be due to the action of groundwater alone, resulting in infrequent small scale landslide events with a frequency greater than 250 years and a recession potential of less than 10m per event (Halcrow, 2002). Total erosion of 0-10m predicted by 2105 along these cliffs.
Abbotsbury to Cogden Beach	**Defended:** No defences present. **Undefended:** There has been negligible movement of this section over the past century (Halcrow, 2002).	**Defended:** No defences present. **Undefended:** There has been negligible movement of this section over the past century (Halcrow, 2002).	**Defended:** No defences present. **Undefended:** There has been negligible movement of this section over the past century (Halcrow, 2002).
Cogden Beach to Burton Cliff (West)	**Defended:** No defences present. **Undefended:** The lower limit of annual erosion of the cliffs along this section in the region of 0.14m/yr (Halcrow, 2002). The simple inter-bedded sandstone cliffs recede through a combination of gradual erosion and infrequent small scale cliff falls. Future rate is likely to be affected by sea level	**Defended:** No defences present. **Undefended:** The lower limit of annual erosion of the cliffs along this section in the region of 0.14m/yr (Halcrow, 2002). The simple inter-bedded sandstone cliffs recede through a combination of gradual erosion and infrequent small scale cliff falls. Future rate is likely to be affected by sea level	**Defended:** No defences present. **Undefended:** The lower limit of annual erosion of the cliffs along this section in the region of 0.14m/yr (Halcrow, 2002). The simple inter-bedded sandstone cliffs recede through a combination of gradual erosion and infrequent small scale cliff falls. Future rate is likely to be affected by sea level

Location	Data Assessment for 'No Active Intervention'		
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	rise therefore use Bruun Rule for future predictions. There could be a feedback mechanism through input of sand to the beaches, which may slow erosion for a period, but is unlikely to be sufficient to stop erosion under accelerated sea level rise. The simple low level clay cliff at the eastern end recedes through a combination of gradual erosion and mudslide events. Future recession of these cliffs is likely to be affected by sea level rise therefore use Bruun Rule for future predictions. Sediment released from the cliff is unlikely to be retained on the beaches. The frequency of cliff failures along this section is 1-10 years, with a recession potential of less than 10m per event (Halcrow, 2002). Therefore total erosion of about 2-3m predicted by 2025 in both the sandstone and clay cliffs.	rise therefore use Bruun Rule for future predictions. There could be a feedback mechanism through input of sand to the beaches, which may slow erosion for a period, but is unlikely to be sufficient to stop erosion under accelerated sea level rise. Total erosion of these cliffs of about 7-10m predicted by 2055. The simple low level clay cliff at the eastern end recedes through a combination of gradual erosion and mudslide events. Future recession of these cliffs is likely to be affected by sea level rise therefore use Bruun Rule for future predictions. Sediment released from the cliff is unlikely to be retained on the beaches. Total erosion of these cliffs of about 7-13m predicted by 2055.	rise therefore use Bruun Rule for future predictions. There could be a feedback mechanism through input of sand to the beaches, which may slow erosion for a period, but is unlikely to be sufficient to stop erosion under accelerated sea level rise. Total erosion of these cliffs of about 14-35m predicted by 2105. The simple low level clay cliff at the eastern end recedes through a combination of gradual erosion and mudslide events. Future recession of these cliffs is likely to be affected by sea level rise therefore use Bruun Rule for future predictions. Sediment released from the cliff is unlikely to be retained on the beaches. Total erosion of these cliffs of about 14-53m predicted by 2105.
Freshwater Beach	**Defended:** The beach has no hard defences, but is actively managed by beach recycling and re-profiling. Beach levels fluctuate, with accretion having occurred in recent years (Jacobs Babtie, 2006). Potential for rollback of the beach onto the low-lying land behind (Halcrow, 2002). Cessation of these activities would lead to the beaches failing as flood defences within a year, leading to increased extents and frequency of	**Defended:** No beach management activity. Increasing extents and frequency of flooding to the low-lying land behind during this period. **Undefended:** This section is completely defended.	**Defended:** No beach management activity. Increasing extents and frequency of flooding to the low-lying land behind during this period. **Undefended:** This section is completely defended.

Location	Data Assessment for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	flooding to the low-lying land behind. **Undefended:** This section is completely defended.		
East Cliff (West Bay)	**Defended:** No defences present. **Undefended:** The lower limit of annual erosion of the cliffs along this section in the region of 0.14m/yr (Halcrow, 2002). The simple inter-bedded sandstone cliffs recede through a combination of gradual erosion and infrequent small scale cliff falls. Future rate is likely to be affected by sea level rise therefore use Bruun Rule for future predictions. There could be a feedback mechanism through input of sand to the beaches, which may slow erosion for a period, but is unlikely to be sufficient to stop erosion under accelerated sea level rise. The frequency of cliff failures along this section is 1-10 years, with a recession potential of less than 10m per event (Halcrow, 2002). Total of erosion of about 2-3m predicted by 2025.	**Defended:** No defences present. **Undefended:** The lower limit of annual erosion of the cliffs along this section in the region of 0.14m/yr (Halcrow, 2002). The simple inter-bedded sandstone cliffs recede through a combination of gradual erosion and infrequent small scale cliff falls. Future rate is likely to be affected by sea level rise therefore use Bruun Rule for future predictions. There could be a feedback mechanism through input of sand to the beaches, which may slow erosion for a period, but is unlikely to be sufficient to stop erosion under accelerated sea level rise. Total erosion of these cliffs of about 7-10m predicted by 2055. The frequency of cliff failures along this section is 1-10 years, with a recession potential of less than 10m per event (Halcrow, 2002).	**Defended:** No defences present. **Undefended:** The lower limit of annual erosion of the cliffs along this section in the region of 0.14m/yr (Halcrow, 2002). The simple inter-bedded sandstone cliffs recede through a combination of gradual erosion and infrequent small scale cliff falls. Future rate is likely to be affected by sea level rise therefore use Bruun Rule for future predictions. There could be a feedback mechanism through input of sand to the beaches, which may slow erosion for a period, but is unlikely to be sufficient to stop erosion under accelerated sea level rise. Total erosion of these cliffs of about 14-35m predicted by 2105. The frequency of cliff failures along this section is 1-10 years, with a recession potential of less than 10m per event (Halcrow, 2002).
West Bay (East Beach to eastern pier)	**Defended:** There are no actual structures on the beach face, however the beach is actively managed by recycling and re-profiling, whilst the eastern pier of West Bay Harbour entrance also affects shoreline evolution. Cessation of the beach management activities	**Defended:** No beach management activity. Increasing extents and frequency of flooding to the low-lying land behind during this period. Potential for rollback of the beach onto the low-lying land behind (Halcrow, 2002).	**Defended:** No beach management activity. Increasing extents and frequency of flooding to the low-lying land behind during this period. Potential for rollback of the beach onto the low-lying land behind (Halcrow, 2002).

Location	Data Assessment for 'No Active Intervention'		
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	would lead to the beaches failing as flood defences within a year, leading to increased extents and frequency of flooding to the low-lying land behind. Beach levels vary in response to prevailing conditions, with MHW position having previously fluctuated within a range of 60m (HR Wallingford, 1997), although the management activities have resulted in very little net change (Halcrow, 2002). Potential for rollback of the beach onto the low-lying land behind (Halcrow, 2002). **Undefended:** This section is completely defended.	Harbour arms continue to inhibit longshore transport of sediment between East Beach and West Beach, although could fail by the end of this period and so have a reduced impact. **Undefended:** This section is completely defended.	The harbour arms would fail during the early part of this period, reducing their effect on longshore sediment transport processes. **Undefended:** This section is completely defended.
West Bay (West Beach from eastern pier) to West Cliff (East)	**Defended:** The east and west piers at the entrance to West Bay Harbour influence littoral drift, as do a number of rock groynes. There is also a sea wall the back the beach which could fail towards the end of this period. Beach levels fluctuate, with draw-down during storms exacerbated by scour at the sea wall. Cessation of active beach management using recycling and re-profiling could result in the failure of the seawall occurring in the middle of this period rather than towards the end, as well as failure of the rock groynes. **Undefended:** This section is completely defended.	**Defended:** Loss of seawall and control structures along this section resulting in increased risk of flooding during high water level and storm events. Roll back of the foreshore and low lying beach could occur in response to sea level rise. Harbour arms continue to inhibit longshore transport of sediment between East Beach and West Beach, although could fail by the end of this period and so have a reduced impact. Beach levels would remain low with little input from the west. **Undefended:** This section is completely	**Defended:** No defences along the shoreline with little sediment input from east or west keep beach levels low. Roll back of the foreshore and low lying beach could occur in response to sea level rise. The harbour arms would fail during the early part of this period, reducing their effect on longshore sediment transport processes. **Undefended:** This section is completely defended.

Location	Data Assessment for 'No Active Intervention'		
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		defended.	
West Cliff (East) to Thorncombe Beacon	**Defended:** The sea wall and promenade along the toe of the eastern part of West Cliff could fail by the end of this period. This would initially have little effect upon localised cliff erosion. **Undefended:** Annual erosion of the undefended part of West Cliff in the region of 0.37m/yr. These are complex cliffs which tend to recede due to landslide events controlled by groundwater. Toe erosion is therefore less important and so sea level rise effects are outweighed by infrequent large scale cliff failure events. Total erosion of these cliffs of about 6-50m predicted by 2025 (SCOPAC, 2004 and Halcrow, 2002). The cliffs towards Eype and Thorncombe Beacon experience annual erosion in the region of 0.05-0.5m/yr. These are also complex cliffs which tend to recede due to both gradual erosion and large scale landslide events controlled by groundwater. As for West Cliff, sea level rise effects are outweighed by infrequent large scale cliff failure events. Total erosion in this area of 5-20m predicted by 2025 (SCOPAC, 2004 and Halcrow, 2002). The frequency of landslides along this section is 1-10 years, with a recession potential of 10-50m at West Cliff, but less than 10m at	**Defended:** Failure of the sea wall and promenade along the toe of the eastern part of West Cliff would result in increased exposure of the cliff toe to wave action as debris is removed. This would result in the rate of recession occurring as per the adjacent undefended cliffs. **Undefended:** Annual erosion of the undefended part of West Cliff in the region of 0.37m/yr. These are complex cliffs which tend to recede due to landslide events controlled by groundwater. Toe erosion is therefore less important and so sea level rise effects are outweighed by infrequent large scale cliff failure events. Total erosion of these cliffs of about 17-125m predicted by 2055 (SCOPAC, 2004 and Halcrow, 2002). The cliffs towards Eype and Thorncombe Beacon experience annual erosion in the region of 0.05-0.5m/yr. These are also complex cliffs which tend to recede due to both gradual erosion and large scale landslide events controlled by groundwater. As for West Cliff, sea level rise effects are outweighed by infrequent large scale cliff failure events. Total erosion in this area of 13-50m predicted by 2055 (SCOPAC, 2004 and Halcrow, 2002). The frequency of landslides along this section is	**Defended:** No defences. **Undefended:** Annual erosion of the undefended part of West Cliff in the region of 0.37m/yr. These are complex cliffs which tend to recede due to landslide events controlled by groundwater. Toe erosion is therefore less important and so sea level rise effects are outweighed by infrequent large scale cliff failure events. Total erosion of these cliffs of about 36-250m predicted by 2105 (SCOPAC, 2004 and Halcrow, 2002). The cliffs towards Eype and Thorncombe Beacon experience annual erosion in the region of 0.05-0.5m/yr. These are also complex cliffs which tend to recede due to both gradual erosion and large scale landslide events controlled by groundwater. As for West Cliff, sea level rise effects are outweighed by infrequent large scale cliff failure events. Total erosion in this area of 27-100m predicted by 2105 (SCOPAC, 2004 and Halcrow, 2002). The frequency of landslides along this section is 1-10 years, with a recession potential of 10-50m at West Cliff, but less than 10m at Thorncombe Beacon (Halcrow, 2002).

Location	Data Assessment for 'No Active Intervention'		
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	Thorncombe Beacon (Halcrow, 2002).	1-10 years, with a recession potential of 10-50m at West Cliff, but less than 10m at Thorncombe Beacon (Halcrow, 2002).	
Thorncombe Beacon to Seatown (East)	**Defended:** No defences present. **Undefended:** Lower limit of annual cliff erosion in the region of 0.7m/yr. These are complex cliffs which tend to recede due to both gradual erosion and large scale landslide events controlled by groundwater. Toe erosion is therefore less important and so sea level rise effects are outweighed by infrequent large scale cliff failure events. This gives rise to total erosion of 12-20m predicted by 2025 (Halcrow, 2007b and Halcrow, 2002). The frequency of landslides along this section is 1-10 years, with a recession potential of less than 10m (Halcrow, 2002).	**Defended:** No defences present. **Undefended:** Lower limit of annual cliff erosion in the region of 0.7m/yr. These are complex cliffs which tend to recede due to both gradual erosion and large scale landslide events controlled by groundwater. Toe erosion is therefore less important and so sea level rise effects are outweighed by infrequent large scale cliff failure events. This gives rise to total erosion of 33-50m predicted by 2055 (Halcrow, 2007b and Halcrow, 2002). The frequency of landslides along this section is 1-10 years, with a recession potential of less than 10m (Halcrow, 2002).	**Defended:** No defences present. **Undefended:** Lower limit of annual cliff erosion in the region of 0.7m/yr. These are complex cliffs which tend to recede due to both gradual erosion and large scale landslide events controlled by groundwater. Toe erosion is therefore less important and so sea level rise effects are outweighed by infrequent large scale cliff failure events. This gives rise to total erosion of 68-100m predicted by 2105 (Halcrow, 2007b and Halcrow, 2002). The frequency of landslides along this section is 1-10 years, with a recession potential of less than 10m (Halcrow, 2002).
Seatown	**Defended:** Rock armour revetment along the toe of part of the cliff fronting the western part of Seatown. Despite this, annual cliff erosion in the region of 0.33m/yr could still occur within the complex cliffs which tend to recede due to both gradual erosion and large scale landslide events controlled by groundwater. Toe erosion is therefore less important and so sea level rise effects are outweighed by infrequent large scale cliff failure events. This gives rise to total erosion of 6-20m predicted by 2025 (Halcrow, 2007b).	**Defended:** Rock armour revetment along the toe of part of the cliff fronting the western part of Seatown would be expected to fail during this period. This would likely result in annual cliff erosion in the excess of the 0.33m/yr that occurs with defences present (Halcrow, 2007b). Annual recession at a similar rate as the adjacent cliffs would be most likely (i.e. 0.7m/yr, Halcrow (2007b)) with infrequent landslide events, giving rise to total erosion of up to 50m predicted by 2055 (Halcrow, 2002). The seawall that protects low-lying land would	**Defended:** No defences present. Cliff recession anticipated to occur at a similar rate as adjacent cliff sections (i.e. 0.7m/yr, Halcrow (2007b)) with infrequent landslide events, giving rise to total erosion of up to 100m predicted by 2105 (Halcrow, 2002). The low-lying part of this section would experience increased risk of flooding, whilst the beach fronting this part could rollback onto the low-lying land. **Undefended:** This section is completely

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	The remaining part of this section is low-lying land susceptible that is protected by a sea wall, fronted by shingle beach which has been significantly depleted by historical shingle mining (SCOPAC, 2004). **Undefended:** This section is completely defended.	also fail during this period, leading to an increased risk of flooding and the possibility that the beach would rollback onto this low-lying land. **Undefended:** This section is completely defended.	defended.
Seatown (West) to Golden Cap	**Defended:** No defences present. **Undefended:** Lower limit of annual cliff erosion in the region of 0.7m/yr. These are complex cliffs which tend to recede due to both gradual erosion and large scale landslide events controlled by groundwater. Toe erosion is therefore less important and so sea level rise effects are outweighed by infrequent large scale cliff failure events. This gives rise to total erosion of 12-20m predicted by 2025 (Halcrow, 2007b and Halcrow, 2002). The frequency of landslides along this section is 1-10 years, with a recession potential of less than 10m (Halcrow, 2002).	**Defended:** No defences present. **Undefended:** Lower limit of annual cliff erosion in the region of 0.7m/yr. These are complex cliffs which tend to recede due to both gradual erosion and large scale landslide events controlled by groundwater. Toe erosion is therefore less important and so sea level rise effects are outweighed by infrequent large scale cliff failure events. This gives rise to total erosion of 33-50m predicted by 2055 (Halcrow, 2007b and Halcrow, 2002). The frequency of landslides along this section is 1-10 years, with a recession potential of less than 10m (Halcrow, 2002).	**Defended:** No defences present. **Undefended:** Lower limit of annual cliff erosion in the region of 0.7m/yr. These are complex cliffs which tend to recede due to both gradual erosion and large scale landslide events controlled by groundwater. Toe erosion is therefore less important and so sea level rise effects are outweighed by infrequent large scale cliff failure events. This gives rise to total erosion of 68-100m predicted by 2105 (Halcrow, 2007b and Halcrow, 2002). The frequency of landslides along this section is 1-10 years, with a recession potential of less than 10m (Halcrow, 2002).
Golden Cap to Charmouth (East)	**Defended:** No defences present. **Undefended:** Lower limits of annual cliff erosion along this section based upon historical rates. At Broom Hill this is in the region of 0.99m/yr, whilst at Stonebarrow it is 0.39m/yr and at Golden Cap, annual cliff erosion in the region of 0.05-0.3m/yr	**Defended:** No defences present. **Undefended:** Lower limits of annual cliff erosion along this section based upon historical rates. At Broom Hill this is in the region of 0.99m/yr, whilst at Stonebarrow it is 0.39m/yr and at Golden Cap, annual cliff erosion in the region of 0.05-0.3m/yr	**Defended:** No defences present. **Undefended:** Lower limits of annual cliff erosion along this section based upon historical rates. At Broom Hill this is in the region of 0.99m/yr, whilst at Stonebarrow it is 0.39m/yr and at Golden Cap, annual cliff erosion in the region of 0.05-0.3m/yr

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	Short Term (to 2025)	**Medium Term (to 2055)**	**Long Term (to 2105)**
	(SCOPAC, 2004). These are all complex cliffs, which tend to recede due to both gradual erosion and medium to large scale landslide events controlled by groundwater. Toe erosion is therefore less important and so sea level rise effects are outweighed by infrequent cliff failure events along this section. The frequency of landslide events at along this section is 10-100 years (Halcrow, 2002) , although at Stonebarrow, it is up to 100-150 years (SCOPAC, 2004). The recession potential at Golden Cap is 10-50m per event, whilst at Stonebarrow it is greater than 50m per event (Halcrow, 2002). At Stonebarrow there is also a large landslide complex seaward of the cliff top, which will affect the rate of actual cliff top recession. Total erosion predicted along this section by 2025 therefore varies from 3-50m at Golden Cap, 17-50m at Broom Hill, and 7-50m at Stonebarrow (SCOPAC, 2004 and Halcrow, 2002).	(SCOPAC, 2004). These are all complex cliffs, which tend to recede due to both gradual erosion and medium to large scale landslide events controlled by groundwater. Toe erosion is therefore less important and so sea level rise effects are outweighed by infrequent cliff failure events along this section. The frequency of landslide events at along this section is 10-100 years (Halcrow, 2002) , although at Stonebarrow, it is up to 100-150 years (SCOPAC, 2004). The recession potential at Golden Cap is 10-50m per event, whilst at Stonebarrow it is greater than 50m per event (Halcrow, 2002). At Stonebarrow there is also a large landslide complex seaward of the cliff top, which will affect the rate of actual cliff top recession. Total erosion predicted along this section by 2055 therefore varies from 8-50m at Golden Cap, 47-50m at Broom Hill, and 18-50m at Stonebarrow (SCOPAC, 2004 and Halcrow, 2002).	(SCOPAC, 2004). These are all complex cliffs, which tend to recede due to both gradual erosion and medium to large scale landslide events controlled by groundwater. Toe erosion is therefore less important and so sea level rise effects are outweighed by infrequent cliff failure events along this section. The frequency of landslide events at along this section is 10-100 years (Halcrow, 2002) , although at Stonebarrow, it is up to 100-150 years (SCOPAC, 2004). The recession potential at Golden Cap is 10-50m per event, whilst at Stonebarrow it is greater than 50m per event (Halcrow, 2002). At Stonebarrow there is also a large landslide complex seaward of the cliff top, which will affect the rate of actual cliff top recession. Total erosion predicted along this section by 2105 therefore varies from 17-50m at Golden Cap, 50-100m at Broom Hill, and 38-50m at Stonebarrow (SCOPAC, 2004 and Halcrow, 2002).
Charmouth (East) to East Cliff (Lyme Regis)	**Defended:** Defences protect the low-lying land at Charmouth at the back of a sandy beach. Coastal squeeze anticipated here. **Undefended:** Major landslide complexes with varying annual rates of recession. Black Ven	**Defended:** Defences that protect the low-lying land at Charmouth at the back of a sandy beach are expected to fail during the early part of this period (residual life 15-25 years). This would reduce the risk of coastal squeeze in this area, but increase the risk of flooding as	**Defended:** No defences present along this section. The beach at Charmouth would rollback onto the low-lying land behind in response to sea level rise. **Undefended:** Major landslide complexes with

Location	Data Assessment for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	East and Central, annual cliff erosion in the region of 0.2-0.6m/yr (Halcrow, 2007a). Annual cliff erosion at Black Ven West in the region of 0.6m/yr (Halcrow, 2007a). This lower estimate of recession is based upon the more recent rate of recession observed, although depending upon the period looked at, there are potentially large distortions depending on the occurrence of failure events. Use of this rate is in broad agreement with the Futurecoast assessment of recession potential and frequency. At The Spittles, annual cliff recession in the region of 0.52m/yr. These cliffs are all complex cliffs, which tend to recede due to landslide events controlled by groundwater. Toe erosion is therefore less important and so sea level rise effects are outweighed by infrequent large scale cliff failure events. The frequency of landslide events is 10-100 years, with a recession potential of more than 50m per event (Halcrow, 2002). Total erosion of 10-50m is predicted by 2025 along this section (Halcrow, 2007a and Halcrow, 2002).	well as allow rollback of the beach. **Undefended:** Major landslide complexes with varying annual rates of recession. Black Ven East and Central, annual cliff erosion in the region of 0.2-0.6m/yr (Halcrow, 2007a). Annual cliff erosion at Black Ven West in the region of 0.6m/yr (Halcrow, 2007a). This lower estimate of recession is based upon the more recent rate of recession observed, although depending upon the period looked at, there are potentially large distortions depending on the occurrence of failure events. Use of this rate is in broad agreement with the Futurecoast assessment of recession potential and frequency. At The Spittles, annual cliff recession in the region of 0.52m/yr. These cliffs are all complex cliffs, which tend to recede due to landslide events controlled by groundwater. Toe erosion is therefore less important and so sea level rise effects are outweighed by infrequent large scale cliff failure events. The frequency of landslide events is 10-100 years, with a recession potential of more than 50m per event (Halcrow, 2002). Total erosion is predicted to vary along this section by 2055, with 19-50m predicted for Black Ven East and Central) and 28-50m at Black Ven West. At The Spittles, 24-50m of	varying annual rates of recession. Black Ven East and Central, annual cliff erosion in the region of 0.2-0.6m/yr (Halcrow, 2007a). Annual cliff erosion at Black Ven West in the region of 0.6m/yr (Halcrow, 2007a). This lower estimate of recession is based upon the more recent rate of recession observed, although depending upon the period looked at, there are potentially large distortions depending on the occurrence of failure events. Use of this rate is in broad agreement with the Futurecoast assessment of recession potential and frequency. At The Spittles, annual cliff recession in the region of 0.52m/yr. These cliffs are all complex cliffs, which tend to recede due to landslide events controlled by groundwater. Toe erosion is therefore less important and so sea level rise effects are outweighed by infrequent large scale cliff failure events. The frequency of landslide events is 10-100 years, with a recession potential of more than 50m per event (Halcrow, 2002). Total erosion is predicted to vary along this section by 2105, with 40-50m predicted for Black Ven East and Central) and 50-60m at Black Ven West. At The Spittles, about 50m of erosion is predicted by 2105 (Halcrow, 2007a and Halcrow, 2002).

Location	Data Assessment for 'No Active Intervention'		
	Short Term (to 2025)	**Medium Term (to 2055)**	**Long Term (to 2105)**
		erosion is predicted by 2055 (Halcrow, 2007a and Halcrow, 2002).	
East Cliff (Lyme Regis) to Broad Ledge (Lyme Regis)	**Defended:** A sea wall extends along the toe of East and Church Cliffs at Lyme Regis and has prevented any significant landslide activity in this area. It is estimated that prior to construction of the sea wall, recession at an annual rate of 0.45-0.8m/yr (East Cliff) or even 1.3m/yr (Church Cliff) occurred (SCOPAC, 2004), with a landslide frequency of 10-100 years and a recession potential of more than 50m per event (Halcrow, 2002). **Undefended:** This section is completely defended.	**Defended:** The sea wall that extends along the toe of East and Church Cliffs at Lyme Regis would also gradually fail in the early to middle part of this period (residual life 15-35 years). This would result in a return of cliff recession as a result of landslide activity as a rate estimated to have occurred prior to construction of the sea wall. Recession therefore anticipated at an annual rate of 0.45-0.8m/yr (East Cliff) or even 1.3m/yr (Church Cliff) occurred (SCOPAC, 2004), with a landslide frequency of 10-100 years and a recession potential of more than 50m per event (Halcrow, 2002). These are complex cliffs which would tend to recede due to landslide events controlled by groundwater. Toe erosion is therefore less important and so sea level rise effects are outweighed by infrequent large scale cliff failure events. Total erosion of 20-50m predicted by 2055 upon failure of defences. **Undefended:** This section is completely defended.	**Defended:** Cliff erosion at East and Church Cliffs at Lyme Regis would occur at an estimated annual rate of 0.45-0.8m/yr (East Cliff) and 1.3m/yr (Church Cliff) (SCOPAC, 2004), with a landslide frequency of 10-100 years and a recession potential of more than 50m per event (Halcrow, 2002). These are complex cliffs which would tend to recede due to landslide events controlled by groundwater. Toe erosion is therefore less important and so sea level rise effects are outweighed by infrequent large scale cliff failure events. Total erosion of 50-70m predicted by 2105 upon failure of defences. **Undefended:** This section is completely defended.
Broad Ledge (Lyme Regis) to The Cobb (Lyme Regis)	**Defended:** The presence of defences along the cliff toe prevents cliff erosion and also littoral	**Defended:** The presence of defences along the cliff toe prevents cliff erosion and also littoral	**Defended:** Loss of defences in the early part of this period would allow cliff recession to

Location	Data Assessment for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	drift of sediment. **Undefended:** This section is completely defended.	drift of sediment for the majority of this period, although defences would begin to fail in the latter part of this period (residual lives 25-50 years). **Undefended:** This section is completely defended.	occur, possibly at a rate similar to that which occurs in adjacent cliffs. Littoral drift processes would transport sediment along the beaches from west to east. **Undefended:** This section is completely defended.
The Cobb (Lyme Regis) to Seven Rock Point	**Defended:** Sea wall along part of cliff toe at Lyme Regis prevents cliff erosion in this area. Some accretion of Monmouth Beach immediately adjacent The Cobb, but overall long term trend of erosion along Monmouth Beach. **Undefended:** This section comprises complex cliffs which tend to recede due to landslide events controlled by groundwater. Toe erosion is therefore less important for continued erosion of cliff base, with historic rates of recession of cliff base presented in SCOPAC (2004), but historic rates of cliff top recession are not available. The frequency of landslide events is 250-1000+ years, with a recession potential of 10-50m per event (Halcrow, 2002). No cliff top recession is predicted to occur by 2025.	**Defended:** Sea wall along part of cliff toe at Lyme Regis that prevents cliff erosion in this area would fail during the early to middle part of this period (residual life 25-35 years). This would result in the gradual resumption of cliff recession at a rate similar to adjacent undefended cliffs. This in turn could release new sediment to local beaches. The Cobb could also fail during this period, which could allow increased longshore sediment transport towards the east, although its remains would continue to hinder this process. **Undefended:** This section comprises complex cliffs which tend to recede due to landslide events controlled by groundwater. Toe erosion is therefore less important for continued erosion of cliff base, with historic rates of recession of cliff base presented in SCOPAC (2004), but historic rates of cliff top recession are not available. The frequency of landslide events is 250-1000+	**Defended:** No defences along this section, with cliff recession occurring at a similar rate to adjacent undefended cliffs. This could lead to new inputs of sediment to local beaches which could then be transported eastwards by littoral drift processes. The beach would also retreat at a rate inline with cliff recession. **Undefended:** This section comprises complex cliffs which tend to recede due to landslide events controlled by groundwater. Toe erosion is therefore less important for continued erosion of cliff base, with historic rates of recession of cliff base presented in SCOPAC (2004), but historic rates of cliff top recession are not available. The frequency of landslide events is 250-1000+ years, with a recession potential of 10-50m per event (Halcrow, 2002). No cliff top recession is predicted to occur by 2105.

Location	Data Assessment for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
		years, with a recession potential of 10-50m per event (Halcrow, 2002). No cliff top recession is predicted to occur by 2055.	
Seven Rock Point to Haven Cliff (West)	**Defended:** No defences present. **Undefended:** Along this section the cliffs are all complex cliffs, which tend to recede due to landslide events controlled by groundwater. Towards the eastern end of this section (Pinhay and Dowland Cliffs) the frequency of landslide events is 250-1000+ years, with a recession potential of more than 50m per event. Toe erosion in this area is important for continued erosion of the cliff base. Historic rates of recession of the cliff base area presented in SCOPAC (2004), but historic rates of cliff top recession are not available. No cliff top recession is predicted in this area by 2025. Towards the western end of this section (Haven Cliffs), the lower limit of annual cliff erosion in this area is in the region of 0.2m/yr (SCOPAC, 2004). The frequency of landslide events is 10-100 years with a recession potential of less than 10m per event (Halcrow, 2002). Toe erosion is less important and so sea level rise effects are outweighed by infrequent cliff failure events. Total erosion in this area is	**Defended:** No defences present. **Undefended:** Along this section the cliffs are all complex cliffs, which tend to recede due to landslide events controlled by groundwater. Towards the eastern end of this section (Pinhay and Dowland Cliffs) the frequency of landslide events is 250-1000+ years, with a recession potential of more than 50m per event. Toe erosion in this area is important for continued erosion of the cliff base. Historic rates of recession of the cliff base area presented in SCOPAC (2004), but historic rates of cliff top recession are not available. No cliff top recession is predicted in this area by 2055. Towards the western end of this section (Haven Cliffs), the lower limit of annual cliff erosion in this area is in the region of 0.2m/yr (SCOPAC, 2004). The frequency of landslide events is 10-100 years with a recession potential of less than 10m per event (Halcrow, 2002). Toe erosion is less important and so sea level rise effects are outweighed by infrequent cliff failure events. Total erosion in this area is	**Defended:** No defences present. **Undefended:** Along this section the cliffs are all complex cliffs, which tend to recede due to landslide events controlled by groundwater. Towards the eastern end of this section (Pinhay and Dowland Cliffs) the frequency of landslide events is 250-1000+ years, with a recession potential of more than 50m per event. Toe erosion in this area is important for continued erosion of the cliff base. Historic rates of recession of the cliff base area presented in SCOPAC (2004), but historic rates of cliff top recession are not available. No cliff top recession is predicted in this area by 2105. Towards the western end of this section (Haven Cliffs), the lower limit of annual cliff erosion in this area is in the region of 0.2m/yr (SCOPAC, 2004). The frequency of landslide events is 10-100 years with a recession potential of less than 10m per event (Halcrow, 2002). Toe erosion is less important and so sea level rise effects are outweighed by infrequent cliff failure events. Total erosion in this area is

<table>
<tr><th rowspan="2">Location</th><th colspan="3">Data Assessment for 'No Active Intervention'</th></tr>
<tr><th>Short Term (to 2025)</th><th>Medium Term (to 2055)</th><th>Long Term (to 2105)</th></tr>
<tr><td></td><td>predicted to be 3-10m by 2025.</td><td>predicted to be 9-10m by 2055.</td><td>predicted to be 10-20m by 2105.</td></tr>
<tr><td>Haven Cliff (West) to Seaton Hole</td><td>Defended: Sediment transport from west to east maintains spit across Axe estuary mouth. Beach is stable and accreting in recent years, though levels fluctuate seasonally.

Defences along the cliff toe from Seaton to Seaton Hole, along with recent natural beach accumulation, has reduced rate of cliff recession to the region of 0.2m/yr, giving rise to total erosion of 3-5m predicted by 2025 (SCOPAC, 2004). The defences at the western end towards Seaton Hole could begin to fail by 2025 (residual lives 10-20 years).

Prior to defences, annual cliff erosion occurred in the region of 0.5-1m/yr at Seaton (Posford Duvivier, 1996), and up to 1.5m/yr at Seaton Hole (Posford Duvivier, 1997).

Should the defences not be present, landslide frequency would be between 1-10 and 10-100 years, with a recession potential of less than 10m per event (Halcrow, 2002).

Undefended: This section is completely defended.</td><td>Defended: Sediment transport from west to east maintains spit across Axe estuary mouth. Beach is stable and accreting in recent years, though levels fluctuate seasonally.

Defences along the cliff toe from Seaton to Seaton Hole would be expected to fail during this period (residual lives 25-35 years). This could result in a return to the rate of annual cliff erosion that occurred prior to the defences, in the region of 0.5-1m/yr at Seaton (Posford Duvivier, 1996), and up to 1.5m/yr at Seaton Hole (Posford Duvivier, 1997).

As a result of the loss of defences, landslide events would occur with a frequency of between 1-10 and 10-100 years, and a recession potential of less than 10m per event (Halcrow, 2002).

These are simple cliffs which tend to recede through gradual erosion and small scale cliff falls. They are therefore likely to be affected by sea level rise and so use Bruun Rule for future predictions.

Total erosion of 20-30m predicted by 2055 upon failure of defences between Seaton and Seaton Hole, with 30-35m predicted at Seaton Hole over the same period once defences have been lost.</td><td>Defended: Sediment transport from west to east maintains spit across Axe estuary mouth. Beach is stable and accreting in recent years, though levels fluctuate seasonally.

No defences along the cliff toe from Seaton to Seaton Hole, resulting in a return to the rate of annual cliff erosion that occurred prior to the defences, in the region of 0.5-1m/yr at Seaton (Posford Duvivier, 1996), and up to 1.5m/yr at Seaton Hole (Posford Duvivier, 1997).

Landslide events would also occur with a frequency of between 1-10 and 10-100 years, and a recession potential of less than 10m per event (Halcrow, 2002).

These are simple cliffs which tend to recede through gradual erosion and small scale cliff falls. They are therefore likely to be affected by sea level rise and so use Bruun Rule for future predictions.

Total erosion of 60-90m predicted to occur by 2105 along the Seaton section, with 80-110m predicted at Seaton Hole.

Undefended: This section is completely defended.</td></tr>
</table>

Location	Data Assessment for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
		Undefended: This section is completely defended.	
Seaton Hole to Beer Head	**Defended:** No defences present along most of this section, except for a short length of defence at Beer which is unlikely to have much effect upon erosion rates as it is backed by resistant chalk cliffs. **Undefended:** Chalk cliffs largely resistant to erosion with little change over past century. Failure by infrequent cliff falls, with a frequency of 10-100 years and a recession potential of 10-50m per event (Halcrow, 2002). Total erosion of 0-50m predicted by 2025.	**Defended:** No defences present along most of this section. The short length of defence at Beer would fail during this period. **Undefended:** Chalk cliffs largely resistant to erosion with little change over past century. Failure by infrequent cliff falls, with a frequency of 10-100 years and a recession potential of 10-50m per event (Halcrow, 2002). Total erosion of 0-50m predicted by 2055.	**Defended:** No defences present. **Undefended:** Chalk cliffs largely resistant to erosion with little change over past century. Failure by infrequent cliff falls, with a frequency of 10-100 years and a recession potential of 10-50m per event (Halcrow, 2002). Total erosion of 0-50m predicted by 2105.
Beer Head to Salcombe Hill (West)	**Defended:** No defences present along the majority of this section, except for some very localised rock placement at Branscombe. **Undefended:** Beach erosion has occurred at the western end (Salcombe Hill) of this section, whilst a slight long term trend of accretion occurs towards Beer Head. The frequency of landslide events increases from east to west along this section, with events every 250-1000+ at Hooken Cliff, increasing to 100-250 years at Branscombe Cliff, and 10-100 years at Dunscombe Cliff and Salcombe Hill. The recession potential of landslide events along this section is typically less than 10m per event, except at Hooken	**Defended:** No defences present along the majority of this section. The very localised rock placement at Branscombe would fail during this period. **Undefended:** Beach erosion has occurred at the western end (Salcombe Hill) of this section, whilst a slight long term trend of accretion occurs towards Beer Head. The frequency of landslide events increases from east to west along this section, with events every 250-1000+ at Hooken Cliff, increasing to 100-250 years at Branscombe Cliff, and 10-100 years at Dunscombe Cliff and Salcombe Hill. The recession potential of landslide events along this section is typically	**Defended:** No defences present. **Undefended:** Beach erosion has occurred at the western end (Salcombe Hill) of this section, whilst a slight long term trend of accretion occurs towards Beer Head. The frequency of landslide events increases from east to west along this section, with events every 250-1000+ at Hooken Cliff, increasing to 100-250 years at Branscombe Cliff, and 10-100 years at Dunscombe Cliff and Salcombe Hill. The recession potential of landslide events along this section is typically less than 10m per event, except at Hooken Cliff, where it is more than 50m per event (Halcrow, 2002).

Location	Data Assessment for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	Cliff, where it is more than 50m per event (Halcrow, 2002). Lower limit of annual cliff erosion towards Beer Head in the region of 0.06-0.3m/yr. (Halcrow, 2002; SCOPAC, 2004). These are composite cliffs consisting of an undercliff formation and an upper chalk formation. Although erosion of the exposed cliff face would occur, cliff top recession would result from a large scale event which would be due to groundwater rather than wave action at the toe. Total erosion in this area is predicted to be 3-10m by 2025. At Salcombe Hill the lower limit of annual erosion is in the region of 1.2-1.7m/yr (Royal Haskoning, 2003), although longer term rate is 0.3m/yr (SCOPAC, 2004). These are simple cliffs, which tend to recede through gradual erosion and very small scale slides. These are likely to be affected by sea level rise therefore use Bruun Rule prediction. The cliffs do not appear to contribute much to the beach budget. Longer term historic rate of 0.3m/yr used here as higher rates based on more recent data likely distorted by recent events. Total erosion in this area is predicted to be 5-6m by 2025.	less than 10m per event, except at Hooken Cliff, where it is more than 50m per event (Halcrow, 2002). Lower limit of annual cliff erosion towards Beer Head in the region of 0.06-0.3m/yr. (Halcrow, 2002; SCOPAC, 2004). These are composite cliffs consisting of an undercliff formation and an upper chalk formation. Although erosion of the exposed cliff face would occur, cliff top recession would result from a large scale event which would be due to groundwater rather than wave action at the toe. Total erosion in this area is predicted to be 8-10m by 2055. At Salcombe Hill the lower limit of annual erosion is in the region of 1.2-1.7m/yr (Royal Haskoning, 2003), although longer term rate is 0.3m/yr (SCOPAC, 2004). These are simple cliffs, which tend to recede through gradual erosion and very small scale slides. These are likely to be affected by sea level rise therefore use Bruun Rule prediction. The cliffs do not appear to contribute much to the beach budget. Longer term historic rate of 0.3m/yr used here as higher rates based on more recent data likely distorted by recent events. Total erosion in this area is predicted to be 14-18m by 2055.	Lower limit of annual cliff erosion towards Beer Head in the region of 0.06-0.3m/yr. (Halcrow, 2002; SCOPAC, 2004). These are composite cliffs consisting of an undercliff formation and an upper chalk formation. Although erosion of the exposed cliff face would occur, cliff top recession would result from a large scale event which would be due to groundwater rather than wave action at the toe. Total erosion in this area is predicted to be 10-17m by 2105. At Salcombe Hill the lower limit of annual erosion is in the region of 1.2-1.7m/yr (Royal Haskoning, 2003), although longer term rate is 0.3m/yr (SCOPAC, 2004). These are simple cliffs, which tend to recede through gradual erosion and very small scale slides. These are likely to be affected by sea level rise therefore use Bruun Rule prediction. The cliffs do not appear to contribute much to the beach budget. Longer term historic rate of 0.3m/yr used here as higher rates based on more recent data likely distorted by recent events. Total erosion in this area is predicted to be 29-53m by 2105.
Sidmouth	**Defended:** The beach here is subject to active	**Defended:** The defences along this section	**Defended:** No defences present. Increasing risk

Location	Data Assessment for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	beach management, including the use of offshore breakwaters, which has kept the beach relatively stable over the long term all be it with a slight trend of erosion. This is likely associated with the frequent large fluctuations in beach volume that occur, with not all material being returned after initial erosion. Cessation of beach management activity could lead to more rapid failure of the shoreline defences than anticipated given present beach levels. The sea wall along this section protects low-lying land. **Undefended:** This section is completely defended.	would be expected to fail in the early to middle part of this period (residual lives 25-35 years). These failures may occur earlier as a result of the cessation of active beach management. Loss of defences would result in increased risk of flooding to the low-lying land behind, and would also allow longshore transport of sediment towards the east. Beach levels would continue to fluctuate in volume with continuing erosion to be the trend. **Undefended:** This section is completely defended.	of flooding to low-lying land during this period. Beach levels would continue to fluctuate in volume with continuing erosion to be the trend. Movement of sediment towards the east would continue as a result of littoral drift processes. **Undefended:** This section is completely defended.
Chit Rocks to Big Picket Rock	**Defended:** No defences present. **Undefended:** Lower limit of annual cliff erosion in the region of 0.2m/yr. These are simple cliffs which tend to recede through gradual erosion and very small scale slides. These are likely to be affected by sea level rise therefore use Bruun Rule prediction. Total erosion of 3-5m predicted by 2025 (SCOPAC, 2004). The frequency of landslide events is 10-100 years, with a recession potential of less than 10m per event (Halcrow, 2002). The cliffs do not appear to contribute much to	**Defended:** No defences present. **Undefended:** Lower limit of annual cliff erosion in the region of 0.2m/yr. These are simple cliffs which tend to recede through gradual erosion and very small scale slides. These are likely to be affected by sea level rise therefore use Bruun Rule prediction. Total erosion of 9-11m predicted by 2025 (SCOPAC, 2004). The frequency of landslide events is 10-100 years, with a recession potential of less than 10m per event (Halcrow, 2002).	**Defended:** No defences present. **Undefended:** Lower limit of annual cliff erosion in the region of 0.2m/yr. These are simple cliffs which tend to recede through gradual erosion and very small scale slides. These are likely to be affected by sea level rise therefore use Bruun Rule prediction. Total erosion of 19-29m predicted by 2025 (SCOPAC, 2004). The frequency of landslide events is 10-100 years, with a recession potential of less than 10m per event (Halcrow, 2002).

Location	Data Assessment for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	the beach budget.		
Big Picket Rock to Otterton Ledge	**Defended:** No defences present. **Undefended:** Lower limit of annual cliff erosion in the region of 0.2m/yr. These are simple cliffs which tend to recede through gradual erosion and very small scale slides. These are likely to be affected by sea level rise therefore use Bruun Rule prediction. Total erosion of 3-5m predicted by 2025 (SCOPAC, 2004). The frequency of landslide events is 1-10 years, with a recession potential of less than 10m per event (Halcrow, 2002).	**Defended:** No defences present. **Undefended:** Lower limit of annual cliff erosion in the region of 0.2m/yr. These are simple cliffs which tend to recede through gradual erosion and very small scale slides. These are likely to be affected by sea level rise therefore use Bruun Rule prediction. Total erosion of 9-13m predicted by 2055 (SCOPAC, 2004). The frequency of landslide events is 1-10 years, with a recession potential of less than 10m per event (Halcrow, 2002).	**Defended:** No defences present. **Undefended:** Lower limit of annual cliff erosion in the region of 0.2m/yr. These are simple cliffs which tend to recede through gradual erosion and very small scale slides. These are likely to be affected by sea level rise therefore use Bruun Rule prediction. Total erosion of 19-38m predicted by 2105 (SCOPAC, 2004). The frequency of landslide events is 1-10 years, with a recession potential of less than 10m per event (Halcrow, 2002).
Otterton Ledge to Budleigh Salterton (West)	**Defended:** Sea wall and gabions along part of the cliff prevent cliff toe erosion locally. Gabions also 'anchor' the landward end of the shingle spit that extends across the Otter estuary. Coastal squeeze possible in front of sea wall. These defences are expected to fail towards the end of this period (residual life 10-15 years). The beach fronting Budleigh Salterton, including the shingle spit, experiences seasonal fluctuations but has been stable long term due to continued sediment supply from the west. If the cliffs were not protected, landslide events would occur with a frequency of 10-100 years or even 100-250 years, with a recession	**Defended:** The loss of defences by the early part of this period would result in additional sediment input to the fronting beach from the onset of cliff erosion that would occur as landslide events with a frequency of 10-100 years or even 100-250 years, with a recession potential of less than 10m per event (Halcrow, 2002). The beach fronting Budleigh Salterton, including the shingle spit, experiences seasonal fluctuations but has been stable long term due to continued sediment supply from the west. **Undefended:** The shingle spit across the Otter estuary is mostly undefended, and subject to infrequent temporary breaching during times of high river discharge every 20-30 years	**Defended:** No defences present, resulting in cliff recession that would occur as landslide events with a frequency of 10-100 years or even 100-250 years, with a recession potential of less than 10m per event (Halcrow, 2002). This would supply sediment to the fronting beach. The beach fronting Budleigh Salterton, including the shingle spit, experiences seasonal fluctuations but has been stable long term due to continued sediment supply from the west. If the cliffs were not protected, landslide events would occur with a frequency of 10-100 years or even 100-250 years, with a recession potential of less than 10m per event (Halcrow, 2002).

Location	Data Assessment for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	potential of less than 10m per event (Halcrow, 2002). **Undefended:** The shingle spit across the Otter estuary is mostly undefended, and subject to infrequent temporary breaching during times of high river discharge every 20-30 years (Halcrow, 2002).	(Halcrow, 2002).	**Undefended:** The shingle spit across the Otter estuary is mostly undefended, and subject to infrequent temporary breaching during times of high river discharge every 20-30 years (Halcrow, 2002).
Budleigh Salterton (West) to Straight Point	**Defended:** No defences present. **Undefended:** Lower limit of annual cliff erosion in the region of 0.4m/yr (SCOPAC, 2004). These are simple cliffs which tend to recede through gradual erosion and very small scale slides. These are likely to be affected by sea level rise therefore use Bruun Rule prediction. Total erosion of about 7m predicted by 2025. The frequency of landslide events is typically 1-10 years, except at Straight Point where it is 100-250 years, with a recession potential of less than 10m per event (Halcrow, 2002). At Straight Point total erosion of 0-10m is predicted (Halcrow, 2002).	**Defended:** No defences present. **Undefended:** Lower limit of annual cliff erosion in the region of 0.4m/yr (SCOPAC, 2004). These are simple cliffs which tend to recede through gradual erosion and very small scale slides. These are likely to be affected by sea level rise therefore use Bruun Rule prediction. Total erosion of about 20m predicted by 2055. The frequency of landslide events is typically 1-10 years, except at Straight Point where it is 100-250 years, with a recession potential of less than 10m per event (Halcrow, 2002). At Straight Point total erosion of 0-10m is predicted (Halcrow, 2002).	**Defended:** No defences present. **Undefended:** Lower limit of annual cliff erosion in the region of 0.4m/yr (SCOPAC, 2004). These are simple cliffs which tend to recede through gradual erosion and very small scale slides. These are likely to be affected by sea level rise therefore use Bruun Rule prediction. Total erosion of 39-53m predicted by 2105. The frequency of landslide events is typically 1-10 years, except at Straight Point where it is 100-250 years, with a recession potential of less than 10m per event (Halcrow, 2002). At Straight Point total erosion of 0-10m is predicted (Halcrow, 2002).
Straight Point to Orcombe Rocks	**Defended:** No defence present. **Undefended:** Annual cliff erosion at the back of Sandy Bay in the region of 0.4m/yr gives rise to total erosion of 6-8m predicted by 2025. At Orcombe Rocks, annual erosion is in the region of 0.5-0.6m/yr (SCOPAC, 2004).	**Defended:** No defence present. **Undefended:** Annual cliff erosion at the back of Sandy Bay in the region of 0.4m/yr gives rise to total erosion of 10-15m predicted by 2055. At Orcombe Rocks, annual erosion is in the region of 0.5-0.6m/yr (SCOPAC, 2004).	**Defended:** No defence present. **Undefended:** Annual cliff erosion at the back of Sandy Bay in the region of 0.4m/yr gives rise to total erosion of 15-25m predicted by 2105. At Orcombe Rocks, annual erosion is in the region of 0.5-0.6m/yr (SCOPAC, 2004).

Location	Data Assessment for 'No Active Intervention'		
	Short Term (to 2025)	**Medium Term (to 2055)**	**Long Term (to 2105)**
	These are all simple cliffs which tend to recede through gradual erosion and small scale slides and cliff falls. These are likely to be affected by sea level rise, therefore use Bruun Rule prediction. Total erosion of 3-5m is predicted by 2025. The frequency of landslide events is 10-100 years, with a recession potential of less than 10m per event (Halcrow, 2002).	These are all simple cliffs which tend to recede through gradual erosion and small scale slides and cliff falls. These are likely to be affected by sea level rise, therefore use Bruun Rule prediction. Total erosion of 9-14m is predicted by 2055. The frequency of landslide events is 10-100 years, with a recession potential of less than 10m per event (Halcrow, 2002).	These are all simple cliffs which tend to recede through gradual erosion and small scale slides and cliff falls. These are likely to be affected by sea level rise, therefore use Bruun Rule prediction. Total erosion of 19-46m is predicted by 2105. The frequency of landslide events is 10-100 years, with a recession potential of less than 10m per event (Halcrow, 2002).
Orcombe Rocks to Exmouth Point	**Defended:** Exmouth frontage is lined by sea wall along the base of the cliffs that prevents cliff toe erosion. If left undefended, the cliffs would retreat as a result of landslide events with a frequency of 10-100 years and a recession potential of less than 10m per event (Halcrow, 2002). The sea wall also extends in front of low-lying land at Exmouth towards the mouth of the Exe estuary. Beach levels fluctuate but have a recent trend of erosion (Halcrow, 2007c). Coastal squeeze likely. **Undefended:** This section is completely defended.	**Defended:** The defences along the Exmouth frontage would be expected to fail towards the middle and end of this period (residual lives of 25-50 years). Increased risk of flooding and cliff erosion would result. Cliff erosion would be expected to occur as a result of landslide events with a frequency of 10-100 years and a recession potential of less than 10m per event (Halcrow, 2002). Total erosion of 0-10m is therefore predicted upon failure of defences by 2055. Beach levels fluctuate but have a recent trend of erosion (Halcrow, 2007c). Coastal squeeze likely until defences begin to fail. **Undefended:** This section is completely defended.	**Defended:** No defences along the Exmouth frontage would result in cliff recession as a result of landslide events with a frequency of 10-100 years and a recession potential of less than 10m per event (Halcrow, 2002). This cliff erosion would supply new sediment inputs to the local beaches, whose levels fluctuate but have a recent trend of erosion (Halcrow, 2007c). Total erosion of 0-10m is therefore predicted upon failure of defences by 2105. Sea level rise would result in increased flood risk to low-lying parts of this section. **Undefended:** This section is completely defended.
Exe Estuary	**Defended:** Within the Exe Estuary there are a range of defences that provide flood protection, including the railway line that runs	**Defended:** Remaining defences within the Exe Estuary would also fail during this period, resulting in increased flood risk.	**Defended:** No defences remaining within the Exe Estuary. Sea level rise would result in increased flood risk to low-lying parts of this

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	along both the east and west sides of the estuary as well as both earth and armoured embankments. The presence of these defences serve to restrict the ability of the estuary to respond naturally, although it has been constrained for so long by human activity that it has adapted to this situation and is in a state of sedimentary equilibrium. A number of these defences could fail towards the end of this period (residual lives 10-15 years), resulting in increased flood risk. **Undefended:** This section is completely defended.	The effect of sea level rise could result in the loss of some areas of inter-tidal mudflats as the estuary seeks to maintain its sedimentary equilibrium, unless the rate of sedimentation is able to keep pace with rising sea levels. **Undefended:** This section is completely defended.	section. The effect of sea level rise could result in the loss of some areas of inter-tidal mudflats as the estuary seeks to maintain its sedimentary equilibrium, unless the rate of sedimentation is able to keep pace with rising sea levels. This may also be mitigated as the estuary is able to adapt laterally onto its flood plain following the loss of defences. **Undefended:** This section is completely defended.
Dawlish Warren to Langstone Rock	**Defended:** The landward end of Dawlish Warren spit is also defended, effectively anchoring this end of the spit. The breakwater at Langstone Rock prevents material reaching the spit by longshore transport, although long term evolution is strongly related to complex nearshore sediment transport processes. **Undefended:** The distal end of Dawlish Warren spit is presently accreting, although it has fluctuated greatly in the past with long term evolution strongly related to complex nearshore sediment transport processes (Halcrow, 2007c). Historically the distal end has been shown to experience periodic rapid erosion in response to south-easterly storm events although it is	**Defended:** The breakwater at Langstone Rock would fail during this period, allowing material to reach the spit by longshore transport from the south-west, although long term evolution is strongly related to complex nearshore sediment transport processes. **Undefended:** The distal end of Dawlish Warren spit is presently accreting, although it has fluctuated greatly in the past with long term evolution strongly related to complex nearshore sediment transport processes (Halcrow, 2007c). Historically the distal end has been shown to experience periodic rapid erosion in response to south-easterly storm events although it is not possible to predict if such an event would	**Defended:** Dawlish Warren spit would be supplied with sediment by longshore transport from the south-west, although long term evolution is strongly related to complex nearshore sediment transport processes. **Undefended:** The distal end of Dawlish Warren spit is presently accreting, although it has fluctuated greatly in the past with long term evolution strongly related to complex nearshore sediment transport processes (Halcrow, 2007c). Historically the distal end has been shown to experience periodic rapid erosion in response to south-easterly storm events although it is not possible to predict if such an event would

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	not possible to predict if such an event would occur during this period (Fox *et al*, 2008).	occur during this period (Fox *et al*, 2008).	occur during this period (Fox *et al*, 2008).
Langstone Rock to Coryton Cove	**Defended:** The cliffs along this section are prevented from eroding by the sea wall that protects the railway line. The beach that fronts the sea wall is defended with groynes, and has gradually narrowed over the long term. On going narrowing and coastal squeeze very probable. **Undefended:** This section is completely defended.	**Defended:** The defences along this section would all fail in the early to middle part of this period (residual lives 15-35 years). Cliff erosion would gradually resume to a rate similar to observed prior to the construction of defences. Cliff failure events would be expected to occur with a frequency of 10-100 years and a recession potential of less than 10m per event (Halcrow, 2002). Total erosion of 0-10m is therefore predicted upon failure of defences by 2055. Beach sediment would be supplied from cliff erosion, with longshore transport processes moving material north-eastwards. **Undefended:** This section is completely defended.	**Defended:** No defences present. Cliff recession as a result of cliff failure events would be expected to occur with a frequency of 10-100 years and a recession potential of less than 10m per event (Halcrow, 2002). Beach sediment would be supplied by cliff recession, and would retreat in line with cliff recession. Longshore transport of sediment to the north-east would continue. Total erosion of 0-10m is therefore predicted upon failure of defences by 2105. **Undefended:** This section is completely defended.
Coryton Cove to Holcombe	**Defended:** Short lengths of sea wall at the back of small pocket beaches protect the railway line. These pocket beaches are relatively stable over the long term. Coastal squeeze likely. **Undefended:** Lower limit of annual cliff erosion in the region of 0.1m/yr. These are simple cliffs which recede through gradual erosion and small scale cliff falls. They are likely to be affected by sea level rise therefore use Bruun	**Defended:** Short lengths of sea wall at the back of small pocket beaches would fail during this period. This would result in the resumption of localised cliff erosion at a similar rate to adjacent undefended cliffs. This would result in supply of new sediment to the pocket beaches that have been relatively stable over the long term. **Undefended:** Lower limit of annual cliff erosion	**Defended:** No defences present. Cliff recession at similar rates as the adjacent undefended cliffs would occur. This would result in sediment supply to local pocket beaches that would rollback in line with cliff recession. **Undefended:** Lower limit of annual cliff erosion in the region of 0.1m/yr. These are simple cliffs which recede through gradual erosion and small scale cliff falls. They are likely to be

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	Rule prediction. Total erosion of about 1m predicted by 2025. The frequency of landslide events is 10-100 years with a recession potential of less than 10m per event (Halcrow, 2002).	in the region of 0.1m/yr. These are simple cliffs which recede through gradual erosion and small scale cliff falls. They are likely to be affected by sea level rise therefore use Bruun Rule prediction. Total erosion of 2-6m predicted by 2055. The frequency of landslide events is 10-100 years with a recession potential of less than 10m per event (Halcrow, 2002).	affected by sea level rise therefore use Bruun Rule prediction. Total erosion of 5-29m predicted by 2105. The frequency of landslide events is 10-100 years with a recession potential of less than 10m per event (Halcrow, 2002).
Holcombe to Sprey Point	**Defended:** The cliffs along this section are prevented from significant erosion by the sea wall that protects the railway line, although infrequent landslides occur due to elevate groundwater. These are with a frequency of 10-100 years and a recession potential of less than 10m per event (Halcrow, 2002). The beach that fronts the sea wall has gradually narrowed over the long term. On going narrowing and coastal squeeze very probable. **Undefended:** This section is completely defended.	**Defended:** The defences along this section would all be expected to fail during this period (residual lives 25-35 years). This would result in the resumption of cliff erosion at rates that occurred prior to the wall construction, assumed to occur as landslide events triggered by a combination of wave action and elevated groundwater levels. Such events would occur with a frequency of 10-100 years and a recession potential of less than 10m per event (Halcrow, 2002). Total erosion of 0-10m is therefore predicted upon failure of defences by 2055. Cliff erosion would supply new sediment input to the beaches that have gradually narrowed over the long term. **Undefended:** This section is completely defended.	**Defended:** No defences present. Cliff erosion anticipated to occur as a result of combined wave action at the toe and elevated groundwater levels. Such events would occur with a frequency of 10-100 years and a recession potential of less than 10m per event would be likely to occur (Halcrow, 2002). Total erosion of 0-10m is therefore predicted upon failure of defences by 2055. Cliff erosion would supply new sediment input to the beaches that have gradually narrowed over the long term. Beaches would rollback in line with cliff recession **Undefended:** This section is completely defended.
Sprey Point to	**Defended:** The majority of the cliffs along this	**Defended:** The defences along this section	**Defended:** No defences present. Cliff erosion

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Teignmouth Pier	section are prevented from significant erosion by the sea wall that protects the railway line, although infrequent landslides occur due to elevated groundwater. A small section of the defences would be expected to fail towards the end of this period (residual life 10-15 years). This is unlikely to result in any immediate significant erosion of the cliffs, but could trigger gradual failures in adjacent lengths of defence. If the defences were not present, then landslide events with a frequency of 10-100 years and a recession potential of less than 10m per event would be likely to occur (Halcrow, 2002). The beach that fronts the sea wall in the northern part of this section has gradually narrowed over the long term, whilst the beach towards Teignmouth Pier fluctuates as part of the cyclic sediment transport processes that occur in this area. On going narrowing and coastal squeeze very probable over this. **Undefended:** This section is completely defended.	would all be expected to fail during this period (residual lives 25-35 years). This would result in the resumption of cliff erosion at rates that occurred prior to the wall construction, assumed to occur as landslide events triggered by a combination of wave action and elevated groundwater levels. Such events would occur with a frequency of 10-100 years and a recession potential of less than 10m per event would be likely to occur (Halcrow, 2002). Total erosion of 0-10m is therefore predicted upon failure of defences by 2055. Cliff erosion would supply new sediment input to the beaches that have gradually narrowed over the long term. The beach towards the pier fluctuates as part of the cyclic sediment transport processes that occur in this area. This would continue, although the beach would become more mobile as defences fail in response to prevailing conditions. **Undefended:** This section is completely defended.	anticipated to occur as a result of combined wave action at the toe and elevated groundwater levels. Such events would occur with a frequency of 10-100 years and a recession potential of less than 10m per event would be likely to occur (Halcrow, 2002). Cliff erosion would supply new sediment input to the beaches that have gradually narrowed over the long term. Beaches would rollback in line with cliff recession. Total erosion of 0-10m is therefore predicted upon failure of defences by 2055. The beach towards the pier fluctuates as part of the cyclic sediment transport processes that occur in this area. This would continue, although the beach would become more mobile as defences fail in response to prevailing conditions. **Undefended:** This section is completely defended.
Teign Estuary	**Defended:** The beach towards the mouth of the Teign estuary fluctuates as part of the cyclic sediment transport processes that occur in this area. On going narrowing and coastal	**Defended:** The defences along both the open coast and within the estuary along this section would all be expected to fail during this period (residual lives 25-35 years).	**Defended:** No defences present. The beach towards the mouth of the Teign estuary fluctuates as part of the cyclic sediment transport processes that occur in this area.

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	squeeze very probable over this. The beach at Shaldon on the south side of the entrance to the Teign estuary has been stable over the past decade (ABPmer, 2007). Within the Teign estuary the northern side is completely defended by structures associated with both the railway line and the port. These serve to prevent flooding of low lying areas of land, although these areas are restricted by the steeply rising side of the estuary valley on the landward side of the defences. The defences also serve to restrict the lateral movement of the estuary. **Undefended:** Parts of the southern side of the Teign estuary west of Shaldon are undefended and so function naturally, although the sides of the estuary valley here rise steeply and so the lack of defences does not present a significant flood risk as areas of low lying land are limited.	The beach towards the mouth of the Teign estuary fluctuates as part of the cyclic sediment transport processes that occur in this area. This would continue, although the beach and spit would become more mobile as defences fail in response to prevailing conditions. The beach at Shaldon on the south side of the entrance to the Teign estuary has been stable over the past decade (ABPmer, 2007). Within the estuary, the loss of defences would lead to increased risk of flooding to the areas of low-lying land between the estuary and the higher ground provided by the steeply rising side of the estuary valley. **Undefended:** Parts of the southern side of the Teign estuary west of Shaldon are undefended and so function naturally, although the sides of the estuary valley here rise steeply and so the lack of defences does not present a significant flood risk as areas of low lying land are limited.	This would continue, although the beach and spit would become more mobile as defences fail in response to prevailing conditions. The beach at Shaldon on the south side of the entrance to the Teign estuary has been stable over the past decade (ABPmer, 2007). Within the estuary there would lead to increased risk of flooding to the areas of low-lying land between the estuary and the higher ground provided by the steeply rising side of the estuary valley. **Undefended:** Parts of the southern side of the Teign estuary west of Shaldon are undefended and so function naturally, although the sides of the estuary valley here rise steeply and so the lack of defences does not present a significant flood risk as areas of low lying land are limited.
Shaldon (The Ness) to Petit Tor Point	**Defended:** Short sections of defences at Watcombe, Babbacombe and Maidencombe are at the back of small pocket beaches and prevent erosion of the cliff toe locally. **Undefended:** There has been little historical erosion along this section over the past century (Halcrow, 2002) , with annual erosion less than 0.2m/yr occurring (SCOPAC, 2004).	**Defended:** Short sections of defences at Watcombe, Babbacombe and Maidencombe would fail during this period, resulting in the resumption of localised cliff erosion at rates similar to adjacent undefended cliffs, supplying new sediment to the small pocket beaches fronting the cliffs. **Undefended:** There has been little historical erosion along this section over the past	**Defended:** No defences present. Cliff recession at similar rates to undefended cliffs would occur, supplying sediment to local pocket beaches. **Undefended:** There has been little historical erosion along this section over the past century (Halcrow, 2002) , with annual erosion less than 0.2m/yr occurring (SCOPAC, 2004).

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	These are simple cliffs, which tend to recede through gradual erosion and small scale slides and cliff falls. These are likely to be affected by sea level rise therefore use Bruun Rule prediction. The frequency of landslide events is between 10-100 and 100-250 years, with a recession potential of less than 10m per event between Shaldon and Maidencombe, but 10-50m from Maidencombe to Petit Tor Point (Halcrow, 2002). Total erosion of about 2m predicted by 2025 along this entire section.	century (Halcrow, 2002) , with annual erosion less than 0.2m/yr occurring (SCOPAC, 2004). These are simple cliffs, which tend to recede through gradual erosion and small scale slides and cliff falls. These are likely to be affected by sea level rise therefore use Bruun Rule prediction. The frequency of landslide events is between 10-100 and 100-250 years, with a recession potential of less than 10m per event between Shaldon and Maidencombe, but 10-50m from Maidencombe to Petit Tor Point (Halcrow, 2002). Total erosion of 5-7m predicted by 2055 along this entire section.	These are simple cliffs, which tend to recede through gradual erosion and small scale slides and cliff falls. These are likely to be affected by sea level rise therefore use Bruun Rule prediction. The frequency of landslide events is between 10-100 and 100-250 years, with a recession potential of less than 10m per event between Shaldon and Maidencombe, but 10-50m from Maidencombe to Petit Tor Point (Halcrow, 2002). Total erosion of 10-24m predicted by 2105 along this entire section.
Petit Tor Point to Hope's Nose	**Defended:** Defences present along parts of Oddicombe and Anstey's Cove located at the back of beaches that show a long term trend of erosion. These also prevent erosion of the cliff toe locally and so reduce input of sediment to local beaches. Coastal squeeze possible in future. **Undefended:** Annual erosion in the region of 0.07-0.23m/yr occurs along this section, although the nature of the cliff recession varies. The cliffs at Oddicombe Bay and from Anstey's Cove to Hope's Nose are complex cliffs controlled by groundwater. Toe erosion is less	**Defended:** Defences along this section would fail during the early to middle part of this period (residual lives 15-35 years), leading to resumption of cliff erosion at rates similar to adjacent undefended cliffs. Beaches would be supplied with fresh inputs of sediment as a result. **Undefended:** Annual erosion in the region of 0.07-0.23m/yr occurs along this section, although the nature of the cliff recession varies. The cliffs at Oddicombe Bay and from Anstey's Cove to Hope's Nose are complex cliffs controlled by groundwater. Toe erosion is less	**Defended:** No defences present. Cliff recession at similar rates to undefended cliffs would occur, supplying sediment to local pocket beaches. **Undefended:** Annual erosion in the region of 0.07-0.23m/yr occurs along this section, although the nature of the cliff recession varies. The cliffs at Oddicombe Bay and from Anstey's Cove to Hope's Nose are complex cliffs controlled by groundwater. Toe erosion is less important in these areas and so sea level rise effects are outweighed by infrequent medium scale cliff failure events. Total erosion of 10-

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	important in these areas and so sea level rise effects are outweighed by infrequent medium scale cliff failure events. Total erosion of 3-10m predicted by 2025 in these areas. The cliffs at Walls Hill are simple cliffs which would tend to recede through gradual erosion and infrequent, small scale cliff failure events. As such these cliffs are likely to be affected by sea level rise, therefore use Bruun Rule prediction. Total erosion of about 3m is predicted by 2025. The frequency of landslide events is between 10-100 and 100-250 years, with a recession potential of less than 10m per event (Halcrow, 2002).	important in these areas and so sea level rise effects are outweighed by infrequent medium scale cliff failure events. Total erosion of 7-10m predicted by 2055 in these areas. The cliffs at Walls Hill are simple cliffs which would tend to recede through gradual erosion and infrequent, small scale cliff failure events. As such these cliffs are likely to be affected by sea level rise, therefore use Bruun Rule prediction. Total erosion of 7-9m is predicted by 2055. The frequency of landslide events is between 10-100 and 100-250 years, with a recession potential of less than 10m per event (Halcrow, 2002).	15m predicted by 2105 in these areas. The cliffs at Walls Hill are simple cliffs which would tend to recede through gradual erosion and infrequent, small scale cliff failure events. As such these cliffs are likely to be affected by sea level rise, therefore use Bruun Rule prediction. Total erosion of 15-25m is predicted by 2025. The frequency of landslide events is between 10-100 and 100-250 years, with a recession potential of less than 10m per event (Halcrow, 2002).
Hope's Nose to Livermead Head	**Defended:** Very little cliff recession due to presence of defences along the base of cliffs. The beaches fronting defences have been stable over the medium to long term. Coastal squeeze possible in the future. **Undefended:** These are composite cliffs which tend to recede through a range of mechanisms but are relatively resistant to change. Lower limit of annual erosion in the region of 0.27m/yr in the localised area at London Bridge (Halcrow, 2002) , whilst the remainder of this section has experienced slower recession over the past century, with annual erosion of about	**Defended:** Defences along this section would be expected to fail during this period (residual lives 15-35 years). Erosion of the cliffs would resume and likely achieve a rate of recession similar to that of adjacent undefended cliffs. The beaches fronting defences would rollback onto low-lying land at Torre Abbey, with increased flood risk in this area, but would be restricted in movement where backed by hard rock cliffs. **Undefended:** These are composite cliffs which tend to recede through a range of mechanisms but are relatively resistant to change.	**Defended:** No defences present. Increased flood risk to low-lying land as beach rollback occurs at Torre Abbey. Beaches fronting hard rock cliffs could reduce in response to sea level rise. Cliff recession would occur at a rate similar to adjacent undefended cliffs. **Undefended:** These are composite cliffs which tend to recede through a range of mechanisms but are relatively resistant to change. Lower limit of annual erosion in the region of 0.27m/yr in the localised area at London Bridge (Halcrow, 2002) , whilst the remainder of this

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	0.05m/yr. The frequency of landslide events is between 10-100 and 100-250 years, with a recession potential of less than 10m per event throughout this section (Halcrow, 2002). Total erosion along most of this section of 1-10m predicted by 2025. This rises to 5-10m predicted in the localised area around London Bridge.	Lower limit of annual erosion in the region of 0.27m/yr in the localised area at London Bridge (Halcrow, 2002) , whilst the remainder of this section has experienced slower recession over the past century, with annual erosion of about 0.05m/yr. The frequency of landslide events is between 10-100 and 100-250 years, with a recession potential of less than 10m per event throughout this section (Halcrow, 2002). Total erosion along most of this section of 2-10m predicted by 2055. This rises to 10-13m predicted in the localised area around London Bridge.	section has experienced slower recession over the past century, with annual erosion of about 0.05m/yr. The frequency of landslide events is between 10-100 and 100-250 years, with a recession potential of less than 10m per event throughout this section (Halcrow, 2002). Total erosion along most of this section of 5-10m predicted by 2105. This rises to 10-26m predicted in the localised area around London Bridge.
Livermead Head to Roundham Head	**Defended:** Most of the section is defended, with beaches fronting the defences having been highly stable over the long term (Halcrow, 2002). Coastal squeeze possible in the future in response to sea level rise. **Undefended:** Short sections of undefended rock headlands experience varying amounts of annual recession, with a maximum around Hollicombe Head in the region of 0-0.15m/yr (SCOPAC, 2004). These consist of simple cliffs that have experienced localised recession around Hollicombe Head headland although adjacent headlands have not retreated as much in the past. These could be affected in the future by sea level rise.	**Defended:** The range of defences would all be expected to fail during this period (residual lives 15-35 years). Reduced risk of coastal squeeze in the future in response to sea level rise as beaches could rollback onto low-lying land behind. Increased flood risk would result. **Undefended:** Short sections of undefended rock headlands experience varying amounts of annual recession, with a maximum around Hollicombe Head in the region of 0-0.15m/yr (SCOPAC, 2004). These consist of simple cliffs that have experienced localised recession around Hollicombe Head headland although adjacent headlands have not retreated as much in the past. These could be affected in the	**Defended:** No defences present. Beaches rollback onto low-lying land in response to sea level rise. Increased flood risk during this period. **Undefended:** Short sections of undefended rock headlands experience varying amounts of annual recession, with a maximum around Hollicombe Head in the region of 0-0.15m/yr (SCOPAC, 2004). These consist of simple cliffs that have experienced localised recession around Hollicombe Head headland although adjacent headlands have not retreated as much in the past. These could be affected in the future by sea level rise. Total erosion of 0-8m predicted by 2105 in

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	Total erosion of 0-1m predicted by 2025 in around Hollicombe Head. Other headlands have experienced negligible recession over the past 100 years and this would continue during this period.	future by sea level rise. Total erosion of 0-4m predicted by 2055 in around Hollicombe Head. Other headlands have experienced negligible recession over the past 100 years and this would continue during this period.	around Hollicombe Head. Other headlands have experienced negligible recession over the past 100 years and this would continue during this period.
Goodrington Sands to Broadsands	**Defended:** Sea wall located at the back of Broadsands Beach prevents erosion of cliff to and so restrict sediment supply to local beach. Wall at the back of Goodrington Sands fronts low-lying land. Both beaches have been stable over the long term. Parts of these sea walls would be expected to fail towards the end of this period (residual lives 10-15 years), although the majority would remain, with associated coastal squeeze possible in the future in response to sea level rise. **Undefended:** The cliffs along this section that are undefended have eroded very little over the long term. This is likely to continue in the future.	**Defended:** The defences at both Goodrington Sands and Broadsands would fail during the early to middle part of this period (residual lives 15-35 years). Reduced risk of coastal squeeze in the future in response to sea level rise as beaches could rollback onto low-lying land behind. Increased flood risk would result. **Undefended:** The cliffs along this section that are undefended have eroded very little over the long term. This is likely to continue in the future.	**Defended:** No defences present. Beaches rollback onto low-lying land in response to sea level rise. Increased flood risk during this period. **Undefended:** The cliffs along this section that are undefended have eroded very little over the long term. This is likely to continue in the future.
Broadsands to Churston Cove (East)	**Defended:** No defences present, although likely affected by Brixham Harbour breakwater. **Undefended:** The cliffs along this section have eroded very little over the long term. This is likely to continue in the future. The pocket beaches along this section are	**Defended:** No defences present, although likely affected by Brixham Harbour breakwater which could fail during this period, reducing its affect at the shoreline. This is unlikely to affect cliff erosion due to the resistant rock, although beaches could be affected.	**Defended:** Effect of Brixham Harbour breakwater is greatly reduced. This is unlikely to affect cliff erosion due to the resistant rock, although beaches could be affected. **Undefended:** The cliffs along this section have eroded very little over the long term. This is

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	stable, and have been slowly accreting over the long term.	**Undefended:** The cliffs along this section have eroded very little over the long term. This is likely to continue in the future. The pocket beaches along this section are stable, and have been slowly accreting over the long term.	likely to continue in the future. The pocket beaches along this section are stable, and have been slowly accreting over the long term.
Churston Cove (East) to Berry Head	**Defended:** Defences around Brixham prevent marine action at the base of the cliffs, although these are, in any case, very resistant to erosion. **Undefended:** The cliffs along this section have eroded very little over the long term. This is likely to continue in the future.	**Defended:** Defences around Brixham would fail during this period, although this is unlikely to result in any change in cliff position due to them being very resistant to erosion. **Undefended:** The cliffs along this section have eroded very little over the long term. This is likely to continue in the future.	**Defended:** No defences present at the base of the cliffs, although this is unlikely to result in any change in cliff position due to them being very resistant to erosion. **Undefended:** The cliffs along this section have eroded very little over the long term. This is likely to continue in the future.
Berry Head to Sharkham Point	**Defended:** No defences present. **Undefended:** This section consists of simple cliffs that erode as a result of marine action at the cliff toe and so are likely to be affected by sea level rise, therefore sue Bruun Rule prediction for upper limit. Lower limit of annual erosion in the region of 0 to 0.15m/yr, giving rise to total erosion of 1-2m predicted by 2025 along most of this section, up to about 3m in St Mary's Bay where there has historically been more recession (Halcrow, 2002; SCOPAC, 2004). The frequency of landslides is 10-100 years, with a recession potential of less than 10m per event (Halcrow, 2002).	**Defended:** No defences present. **Undefended:** This section consists of simple cliffs that erode as a result of marine action at the cliff toe and so are likely to be affected by sea level rise, therefore sue Bruun Rule prediction for upper limit. Lower limit of annual erosion in the region of 0 to 0.15m/yr, giving rise to total erosion of 4-7m predicted by 2055 along most of this section, rising to 7-10m in St Mary's Bay where there has historically been more recession (Halcrow, 2002; SCOPAC, 2004). The frequency of landslides is 10-100 years, with a recession potential of less than 10m per event (Halcrow, 2002).	**Defended:** No defences present. **Undefended:** This section consists of simple cliffs that erode as a result of marine action at the cliff toe and so are likely to be affected by sea level rise, therefore sue Bruun Rule prediction for upper limit. Lower limit of annual erosion in the region of 0 to 0.15m/yr, giving rise to total erosion of 8-28m predicted by 2055 along most of this section, rising to 15-35m in St Mary's Bay where there has historically been more recession (Halcrow, 2002; SCOPAC, 2004). The frequency of landslides is 10-100 years, with a recession potential of less than 10m per event (Halcrow, 2002).

Location	Data Assessment for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
Sharkham Point to Blackstone Point	**Defended:** No defences present. **Undefended:** Lower limit of annual erosion in the region of 0.05m/yr. This section is comprised of composite cliffs which are generally very resistant to erosion, but with the occasional pockets of slightly softer rocks. In general, sea level rise is unlikely to affect the rate of erosion. The frequency of landslides is 10-100 years, with a recession potential of less than 10m per event (Halcrow, 2002). Total erosion is predicted to be 1-10m by 2025.	**Defended:** No defences present. **Undefended:** Lower limit of annual erosion in the region of 0.05m/yr. This section is comprised of composite cliffs which are generally very resistant to erosion, but with the occasional pockets of slightly softer rocks. In general, sea level rise is unlikely to affect the rate of erosion. The frequency of landslides is 10-100 years, with a recession potential of less than 10m per event (Halcrow, 2002). Total erosion is predicted to be 2-10m by 2055.	**Defended:** No defences present. **Undefended:** Lower limit of annual erosion in the region of 0.05m/yr. This section is comprised of composite cliffs which are generally very resistant to erosion, but with the occasional pockets of slightly softer rocks. In general, sea level rise is unlikely to affect the rate of erosion. The frequency of landslides is 10-100 years, with a recession potential of less than 10m per event (Halcrow, 2002). Total erosion is predicted to be 5-10m by 2105.
Blackstone Point to Stoke Fleming	**Defended:** No defences present. **Undefended:** Lower limit of annual erosion in the region of 0.18-0.3m/yr (Halcrow, 2002; SCOPAC, 2004). This section is comprised of composite cliffs which are generally very resistant to erosion, but with the occasional pockets of slightly softer rocks. In general, sea level rise is unlikely to affect the rate of erosion. The frequency of landslides is 10-100 years, with a recession potential of less than 10m per event (Halcrow, 2002). Total erosion is predicted to be 2-10m by 2025.	**Defended:** No defences present. **Undefended:** Lower limit of annual erosion in the region of 0.18-0.3m/yr (Halcrow, 2002; SCOPAC, 2004). This section is comprised of composite cliffs which are generally very resistant to erosion, but with the occasional pockets of slightly softer rocks. In general, sea level rise is unlikely to affect the rate of erosion. The frequency of landslides is 10-100 years, with a recession potential of less than 10m per event (Halcrow, 2002). Total erosion is predicted to be 4-10m by 2055.	**Defended:** No defences present. **Undefended:** Lower limit of annual erosion in the region of 0.18-0.3m/yr (Halcrow, 2002; SCOPAC, 2004). This section is comprised of composite cliffs which are generally very resistant to erosion, but with the occasional pockets of slightly softer rocks. In general, sea level rise is unlikely to affect the rate of erosion. The frequency of landslides is 10-100 years, with a recession potential of less than 10m per event (Halcrow, 2002). Total erosion is predicted to be 9-10m by 2105.

Location	Data Assessment for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
Stoke Fleming to Strete	**Defended:** Defences at Blackpool Sands located at the back of the beach, which has slowly narrowed and eroded over the long term. Coastal squeeze possible in the future in response to sea level rise. **Undefended:** Lower limit of annual erosion in the region of 0.3m/yr (SCOPAC, 2004). This section is comprised of composite cliffs which are generally very resistant to erosion, but with the occasional pockets of slightly softer rocks. In general, sea level rise is unlikely to affect the rate of erosion. The frequency of landslides is 10-100 years, with a recession potential of less than 10m per event (Halcrow, 2002). Total erosion is predicted to be 2-10m by 2025.	**Defended:** Defences at Blackpool Sands located at the back of the beach would fail during this period. Increased flood risk to low-lying land behind. Beach could rollback in response to sea level rise. **Undefended:** Lower limit of annual erosion in the region of 0.3m/yr (SCOPAC, 2004). This section is comprised of composite cliffs which are generally very resistant to erosion, but with the occasional pockets of slightly softer rocks. In general, sea level rise is unlikely to affect the rate of erosion. The frequency of landslides is 10-100 years, with a recession potential of less than 10m per event (Halcrow, 2002). Total erosion is predicted to be 4-10m by 2055.	**Defended:** No defences. Beach rollback onto low-lying land behind. **Undefended:** Lower limit of annual erosion in the region of 0.3m/yr (SCOPAC, 2004). This section is comprised of composite cliffs which are generally very resistant to erosion, but with the occasional pockets of slightly softer rocks. In general, sea level rise is unlikely to affect the rate of erosion. The frequency of landslides is 10-100 years, with a recession potential of less than 10m per event (Halcrow, 2002). Total erosion is predicted to be 9-10m by 2105.
Strete to Limpet Rocks (Torcross)	**Defended:** The shingle barrier beach is defended by a range of structures, and the crest has the A379 coast road along its length. Beach levels fluctuate significantly in response to storm conditions (Scott Wilson, 2006). Long term trends are for accretion at the northern end of the beach and erosion at the southern end. Coastal squeeze possible in response to sea level rise in defended areas around Torcross, whilst the section with only the road would rollback (Halcrow, 2002).	**Defended:** The defences along this section would fail during this period, allowing the beach to rollback in a similar way to which the section with only the road would rollback. **Undefended:** Short section of cliffs from Strete Gate to Strete at the north end of this section is undefended. Lower limit of annual erosion in the region of 0.3m/yr (SCOPAC, 2004). This section is comprised of composite cliffs which are generally very resistant to erosion, but with	**Defended:** No defences. Rollback of the beach during this period into the Ley behind. **Undefended:** Short section of cliffs from Strete Gate to Strete at the north end of this section is undefended. Lower limit of annual erosion in the region of 0.3m/yr (SCOPAC, 2004). This section is comprised of composite cliffs which are generally very resistant to erosion, but with the occasional pockets of slightly softer rocks. In general, sea level rise is unlikely to affect the

Location	Data Assessment for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	Undefended: Short section of cliffs from Strete Gate to Strete at the north end of this section is undefended. Lower limit of annual erosion in the region of 0.3m/yr (SCOPAC, 2004). This section is comprised of composite cliffs which are generally very resistant to erosion, but with the occasional pockets of slightly softer rocks. In general, sea level rise is unlikely to affect the rate of erosion. The frequency of landslides is 10-100 years, with a recession potential of less than 10m per event (Halcrow, 2002). Total erosion is predicted to be 2-10m by 2025.	the occasional pockets of slightly softer rocks. In general, sea level rise is unlikely to affect the rate of erosion. The frequency of landslides is 10-100 years, with a recession potential of less than 10m per event (Halcrow, 2002). Total erosion is predicted to be 4-10m by 2055.	rate of erosion. The frequency of landslides is 10-100 years, with a recession potential of less than 10m per event (Halcrow, 2002). Total erosion is predicted to be 9-10m by 2105.
Limpet Rocks (Torcross) to Tinsey Head	**Defended:** Defences located at the back of the beach along part of this section at Beesands prevent rollback of the beach locally onto low-lying land behind. Beach levels along this section fluctuate in response to storm events, but long term trend is for narrowing and steepening of the beach, particularly in front of the defences (Halcrow, 2002). Coastal squeeze probable in response to sea level rise. **Undefended:** Lower limit of annual erosion of the cliffed headlands at either end of this section in the region of 0.2-0.3m/yr (SCOPAC,	**Defended:** Defences located at the back of the beach along part of this section at Beesands could fail during this period, allowing rollback of the beach locally onto low-lying land behind whilst the beach profile adjusts to become more natural (wider and less steep). **Undefended:** Lower limit of annual erosion of the cliffed headlands at either end of this section in the region of 0.2-0.3m/yr (SCOPAC, 2004). These are comprised of simple cliffs which are generally relatively resistant to erosion, but very localised small scale rock falls may occur.	**Defended:** No defences. Previously defended beach would rollback onto low-lying land behind at a similar rate as the adjacent undefended section. **Undefended:** Lower limit of annual erosion of the cliffed headlands at either end of this section in the region of 0.2-0.3m/yr (SCOPAC, 2004). These are comprised of simple cliffs which are generally relatively resistant to erosion, but very localised small scale rock falls may occur. The frequency of landslides is 10-100 years, with a recession potential of less than 10m per

Location	Data Assessment for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	2004). These are comprised of simple cliffs which are generally relatively resistant to erosion, but very localised small scale rock falls may occur. The frequency of landslides is 10-100 years, with a recession potential of less than 10m per event (Halcrow, 2002). Total erosion in these areas of 4-10m predicted by 2025. The undefended beach north of Beesands could rollback onto low-lying land behind.	The frequency of landslides is 10-100 years, with a recession potential of less than 10m per event (Halcrow, 2002). Total erosion in these areas of 10-12m predicted by 2055. The undefended beach north of Beesands could rollback onto low-lying land behind.	event (Halcrow, 2002). Total erosion in these areas of 10-24m predicted by 2105. The undefended beach north of Beesands could rollback onto low-lying land behind.
Tinsey Head to Start Point	**Defended:** No defences present. **Undefended:** The cliffs along this section have eroded very little over the long term (Halcrow, 2002). This is likely to continue in the future.	**Defended:** No defences present. **Undefended:** The cliffs along this section have eroded very little over the long term (Halcrow, 2002). This is likely to continue in the future.	**Defended:** No defences present. **Undefended:** The cliffs along this section have eroded very little over the long term (Halcrow, 2002). This is likely to continue in the future.
Start Point to Prawle Point	**Defended:** Small section of defence at the back of Lannacombe Beach which has been stable over the long term but fluctuates seasonally. Coastal squeeze possible in response to sea level rise. **Undefended:** The cliffs along this section have eroded very little over the long term (Halcrow, 2002). This is likely to continue in the future, although infrequent landslide events with a frequency of 10-100 years and a recession potential of less than 10m per event	**Defended:** Small section of defence at the back of Lannacombe Beach expected to fail during this period, resulting in increased flood risk to the small area of low-lying land behind. The beach could roll back on to the low-lying land in response to sea level rise. **Undefended:** The cliffs along this section have eroded very little over the long term (Halcrow, 2002). This is likely to continue in the future, although infrequent landslide events with a frequency of 10-100 years and a recession potential of less than 10m per event	**Defended:** No defences present resulting in an increasing risk of flooding to the small area of low-lying land behind Lannacombe Beach. The beach could roll back in response to sea level rise. **Undefended:** The cliffs along this section have eroded very little over the long term (Halcrow, 2002). This is likely to continue in the future, although infrequent landslide events with a frequency of 10-100 years and a recession potential of less than 10m per event

<table>
<tr><th rowspan="2">Location</th><th colspan="3">Data Assessment for 'No Active Intervention'</th></tr>
<tr><th>Short Term (to 2025)</th><th>Medium Term (to 2055)</th><th>Long Term (to 2105)</th></tr>
<tr><td></td><td>can occur (Halcrow, 2002).
Total erosion of 0-10m predicted along this section by 2025.</td><td>can occur (Halcrow, 2002).
Total erosion of 0-10m predicted along this section by 2055.</td><td>can occur (Halcrow, 2002).
Total erosion of 0-10m predicted along this section by 2105.</td></tr>
<tr><td>Prawle Point to Bolt Head</td><td>Defended: Small sections of defence at the back of pocket beaches near Salcombe. These beaches have been stable over the long term but fluctuate seasonally. Coastal squeeze possible in response to sea level rise.
Undefended: The cliffs along this section have eroded very little over the long term (Halcrow, 2002) , with localised annual rates of erosion in the region of 0.1m/yr, giving rise to total erosion of 1-2m predicted by 2025 (Halcrow, 2002).
This is likely to continue in the future, although infrequent landslide events with a frequency of 10-100 years and a recession potential of less than 10m per event can occur (Halcrow, 2002). Total erosion of 0-10m predicted along this section by 2025.
Small pocket beaches that indent undefended cliffs have been stable over the long term but fluctuate seasonally.</td><td>Defended: Defences expected to fail during this period resulting in increased flood risk during storm events. Pocket beaches fronting areas of low-lying land could roll-back in response to sea level rise.
Undefended: The cliffs along this section have eroded very little over the long term (Halcrow, 2002) , with localised annual rates of erosion in the region of 0.1m/yr, giving rise to total erosion of 2-4m predicted by 2055 (Halcrow, 2002).
This is likely to continue in the future, although infrequent landslide events with a frequency of 10-100 years and a recession potential of less than 10m per event can occur (Halcrow, 2002). Total erosion of 0-10m predicted along this section by 2055.
Small pocket beaches that indent undefended cliffs have been stable over the long term but fluctuate seasonally.</td><td>Defended: No defences present during this period resulting in increased flood risk during storm events. Pocket beaches fronting areas of low-lying land could roll-back in response to sea level rise.
Undefended: The cliffs along this section have eroded very little over the long term (Halcrow, 2002) , with localised annual rates of erosion in the region of 0.1m/yr, giving rise to total erosion of 4-6m predicted by 2105 (Halcrow, 2002).
This is likely to continue in the future, although infrequent landslide events with a frequency of 10-100 years and a recession potential of less than 10m per event can occur (Halcrow, 2002). Total erosion of 0-10m predicted along this section by 2105.
Small pocket beaches that indent undefended cliffs have been stable over the long term but fluctuate seasonally.</td></tr>
<tr><td>Bolt Head to Bolt Tail</td><td>Defended: No defences present.
Undefended: The cliffs along this section have eroded very little over the long term (Halcrow, 2002) , with localised annual rates of erosion in the region of 0.1m/yr, giving rise to</td><td>Defended: No defences present.
Undefended: The cliffs along this section have eroded very little over the long term (Halcrow, 2002) , with localised annual rates of erosion in the region of 0.1m/yr, giving rise to</td><td>Defended: No defences present.
Undefended: The cliffs along this section have eroded very little over the long term (Halcrow, 2002) , with localised annual rates of erosion in the region of 0.1m/yr, giving rise to</td></tr>
</table>

Location	Data Assessment for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	total erosion of 1-2m predicted by 2025 (Halcrow, 2002). This is likely to continue in the future, although infrequent landslide events with a frequency of 10-100 years and a recession potential of less than 10m per event can occur (Halcrow, 2002). Total erosion of 0-10m predicted along this section by 2025.	total erosion of 2-4m predicted by 2055 (Halcrow, 2002). This is likely to continue in the future, although infrequent landslide events with a frequency of 10-100 years and a recession potential of less than 10m per event can occur (Halcrow, 2002). Total erosion of 0-10m predicted along this section by 2055.	total erosion of 4-6m predicted by 2105 (Halcrow, 2002). This is likely to continue in the future, although infrequent landslide events with a frequency of 10-100 years and a recession potential of less than 10m per event can occur (Halcrow, 2002). Total erosion of 0-10m predicted along this section by 2105.
Bolt Tail to Avon Estuary (East)	**Defended:** Small section of defence at the back of Thurlestone Beach that protects low-lying land, has been stable over the long term but fluctuates seasonally. Coastal squeeze possible in response to sea level rise, along with increased risk of flooding during storm events (Halcrow, 2002). **Undefended:** The cliffs along this section have eroded very little over the long term (Halcrow, 2002) , with localised annual rates of erosion in the region of 0.1m/yr (Halcrow, 2002). This is likely to continue in the future, although infrequent landslide events with a frequency of 10-100 years and a recession potential of less than 10m per event can occur (Halcrow, 2002). Total erosion of 0-10m predicted by 2025.	**Defended:** Small section of defence at the back of Thurlestone Beach that protects low-lying land is expected to fail during this period, resulting in an increased risk of flooding during storm events. Beach could also roll back in response to sea level rise. **Undefended:** The cliffs along this section have eroded very little over the long term (Halcrow, 2002) , with localised annual rates of erosion in the region of 0.1m/yr (Halcrow, 2002). This is likely to continue in the future, although infrequent landslide events with a frequency of 10-100 years and a recession potential of less than 10m per event can occur (Halcrow, 2002). Total erosion of 0-10m predicted by 2055.	**Defended:** No defences at the back of Thurlestone Beach, with increased flooding as a result during this period. Beach could also roll back in response to sea level rise. **Undefended:** The cliffs along this section have eroded very little over the long term (Halcrow, 2002) , with localised annual rates of erosion in the region of 0.1m/yr (Halcrow, 2002). This is likely to continue in the future, although infrequent landslide events with a frequency of 10-100 years and a recession potential of less than 10m per event can occur (Halcrow, 2002). Total erosion of 0-10m predicted by 2105.
Avon Estuary (East) to	**Defended:** Small section of defence at the back	**Defended:** Small section of defence at the back	**Defended:** No defences at the back of

Location	Data Assessment for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
Challaborough (West)	of Challaborough Beach that protects low-lying land, has been stable over the long term but fluctuates seasonally. Coastal squeeze possible in response to sea level rise, along with increased risk of flooding during storm events (Halcrow, 2002). The beaches and tombolo at Bigbury have also been stable over the long term. Possible erosion and narrowing of tombolo and beaches in response to sea level rise. **Undefended:** The cliffs along this section have eroded very little over the long term and this is likely to continue in the future (Halcrow, 2002).	of Challaborough Beach that protects low-lying land is expected to fail during this period, resulting in an increased risk of flooding during storm events. Beach could also roll back in response to sea level rise. The beaches and tombolo at Bigbury have also been stable over the long term. Possible erosion and narrowing of tombolo and beaches in response to sea level rise. **Undefended:** The cliffs along this section have eroded very little over the long term and this is likely to continue in the future (Halcrow, 2002).	Challaborough Beach, with increased flooding as a result during this period. Beach could also roll back in response to sea level rise. The beaches and tombolo at Bigbury have also been stable over the long term. Possible erosion and narrowing of tombolo and beaches in response to sea level rise. **Undefended:** The cliffs along this section have eroded very little over the long term and this is likely to continue in the future (Halcrow, 2002).
Challaborough (West) to Wembury Point	**Defended:** No defences present. **Undefended:** The small pocket beaches that indent the cliffs along this section have been stable over the long term. The cliffs along this section have also eroded very little over the long term over the long term (Halcrow, 2002) , with localised annual rates of erosion in the region of 0.1m/yr (Halcrow, 2002). This is likely to continue in the future, although infrequent landslide events with a frequency of 10-100 years and a recession potential of less than 10m per event can occur (Halcrow, 2002).	**Defended:** No defences present. **Undefended:** The small pocket beaches that indent the cliffs along this section have been stable over the long term. The cliffs along this section have also eroded very little over the long term over the long term (Halcrow, 2002) , with localised annual rates of erosion in the region of 0.1m/yr (Halcrow, 2002). This is likely to continue in the future, although infrequent landslide events with a frequency of 10-100 years and a recession potential of less than 10m per event can occur (Halcrow, 2002).	**Defended:** No defences present. **Undefended:** The small pocket beaches that indent the cliffs along this section have been stable over the long term. The cliffs along this section have also eroded very little over the long term over the long term (Halcrow, 2002) , with localised annual rates of erosion in the region of 0.1m/yr (Halcrow, 2002). This is likely to continue in the future, although infrequent landslide events with a frequency of 10-100 years and a recession potential of less than 10m per event can occur (Halcrow, 2002).

Location	Data Assessment for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	Total erosion of 0-10m predicted by 2025.	Total erosion of 0-10m predicted by 2055.	Total erosion of 0-10m predicted by 2105.
Wembury Point to Mount Batten Breakwater	**Defended:** No defences present along the shoreline prior to reaching Mount Batten Breakwater, although part of this section is affected by the presence of the Plymouth Breakwater. **Undefended:** The cliffs along this section have eroded very little over the long term and This is likely to continue in the future, although infrequent landslide events with a frequency of 10-100 years and a recession potential of less than 10m per event can occur (Halcrow, 2002). Total erosion of 0-10m predicted by 2025.	**Defended:** Loss of the Mount Batten breakwater during this period would lead to increased wave exposure in the outer part of the Plym estuary, which could lead to increased flood risk. **Undefended:** The cliffs along this section have eroded very little over the long term and This is likely to continue in the future, although infrequent landslide events with a frequency of 10-100 years and a recession potential of less than 10m per event can occur (Halcrow, 2002). Total erosion of 0-10m predicted by 2055.	**Defended:** Increased exposure of the outer parts of the Plym estuary to wave action could lead to increased flood risk. **Undefended:** The cliffs along this section have eroded very little over the long term and This is likely to continue in the future, although infrequent landslide events with a frequency of 10-100 years and a recession potential of less than 10m per event can occur (Halcrow, 2002). Total erosion of 0-10m predicted by 2105.
Mount Batten Breakwater to Devil's Point	**Defended:** Defences prevent erosion at cliff toe, although it is unlikely that erosion at any significant rate would occur due to the resistance of underlying geology. **Undefended:** This section is completely defended.	**Defended:** Defences along the cliff toe could fail in the middle to end of this period, although it is unlikely that erosion at any significant rate would occur due to the resistance of underlying geology. **Undefended:** This section is completely defended.	**Defended:** Further loss of defences along the cliff toe, although it is unlikely that erosion at any significant rate would occur due to the resistance of underlying geology. **Undefended:** This section is completely defended.
Devil's Point to Mount Edgcumbe (Tamar Estuary)	**Defended:** South of the Tamar bridge, the estuary is heavily modified by dredging activity associated with the development of the port and naval dockyard on the eastern shore. The defences and other structures associated with these developments serve to constrain the estuary in this area, as well as providing	**Defended:** South of the Tamar bridge, the estuary is heavily modified by dredging activity associated with the development of the port and naval dockyard on the eastern shore. The ongoing presence of defences and other structures will continue serve to constrain the estuary in this area, as well as providing flood	**Defended:** South of the Tamar bridge, the estuary is heavily modified by dredging activity associated with the development of the port and naval dockyard on the eastern shore. It is anticipated that defences along the eastern side of the estuary would fail during this period, which would result in an increased risk

Location	Data Assessment for 'No Active Intervention'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	flood protection to the small areas of low lying land between the estuary and higher ground to the east. This situation is expected to continue during this period. **Undefended:** Tamar estuary is largely undefended north of the Tamar bridge and so the estuary functions naturally in its upper part. Areas of intertidal flats are present in the upper part of the Tamar and its tributaries, although flood plains are limited in size by steeply rising valley sides through which they flow. South of the Tamar bridge, the estuary is heavily modified by dredging activity associated with the port and naval dockyard on the eastern shore. However the western side of the estuary is largely undefended. As with the upper Tamar, there are large areas of intertidal flats, particularly at St John's Lake. This side of the estuary in its lower reaches are also flanked by steeply rising land.	protection to the small areas of low lying land between the estuary and higher ground to the east, during this period. **Undefended:** Tamar estuary is largely undefended north of the Tamar bridge and so the estuary functions naturally in its upper part. Areas of intertidal flats are present in the upper part of the Tamar and its tributaries, although flood plains are limited in size by steeply rising valley sides through which they flow, resulting in limited opportunity for lateral migration of the estuary in response to sea level rise. South of the Tamar bridge, the estuary is heavily modified by dredging activity associated with the port and naval dockyard on the eastern shore. However the western side of the estuary is largely undefended. As with the upper Tamar, there are large areas of intertidal flats, particularly at St John's Lake. This side of the estuary in its lower reaches are also flanked by steeply rising land resulting in limited opportunity for lateral migration of the estuary in response to sea level rise.	of flooding to small areas of low-lying land during period of extreme water level. **Undefended:** Tamar estuary is largely undefended north of the Tamar bridge and so the estuary functions naturally in its upper part. Areas of intertidal flats are present in the upper part of the Tamar and its tributaries, although flood plains are limited in size by steeply rising valley sides through which they flow, resulting in limited opportunity for lateral migration of the estuary in response to sea level rise. South of the Tamar bridge, the estuary is heavily modified by dredging activity associated with the port and naval dockyard on the eastern shore. However the western side of the estuary is largely undefended. As with the upper Tamar, there are large areas of intertidal flats, particularly at St John's Lake. This side of the estuary in its lower reaches are also flanked by steeply rising land resulting in limited opportunity for lateral migration of the estuary in response to sea level rise.
Mount Edgcumbe to Kingsand	**Defended:** Defences prevent erosion at cliff toe around Picklecombe Point, although it is unlikely that erosion at any significant rate would occur due to the resistance of	**Defended:** Defences at Picklecombe Point would fail during this period, although this would result in negligible erosion as per the adjacent undefended cliff.	**Defended:** No defences. **Undefended:** The cliffs along this section have eroded very little over the long term and This is likely to continue in the future, although

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	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	underlying geology. **Undefended:** The cliffs along this section have eroded very little over the long term and This is likely to continue in the future, although infrequent landslide events with a frequency of 10-100 years and a recession potential of less than 10m per event can occur (Halcrow, 2002). Total erosion of 0-10m predicted by 2025.	**Undefended:** The cliffs along this section have eroded very little over the long term and This is likely to continue in the future, although infrequent landslide events with a frequency of 10-100 years and a recession potential of less than 10m per event can occur (Halcrow, 2002). Total erosion of 0-10m predicted by 2055.	infrequent landslide events with a frequency of 10-100 years and a recession potential of less than 10m per event can occur (Halcrow, 2002). Total erosion of 0-10m predicted by 2105.
Kingsand/Cawsand	**Defended:** Defences located at the back of pocket beaches could fail by the end of this period in places. The pocket beaches have been stable over the long term. Coastal squeeze possible in response to sea level rise in areas where defences remain. **Undefended:** This section is completely defended.	**Defended:** Remaining defences would fail during this period leading to increased risk of flooding during high water level and storm events. Failure of defences is unlikely to result in significant erosion of hard rock cliffs behind. **Undefended:** This section is completely defended.	**Defended:** No defences remain. Significant erosion of hard rock cliffs is unlikely. Increasing risk of flooding during high water level and storm events during this period. **Undefended:** This section is completely defended.
Cawsand to Rame Head	**Defended:** No defences present. **Undefended:** The cliffs along this section have eroded very little over the long term and This is likely to continue in the future, although infrequent landslide events with a frequency of 1-10 years and a recession potential of less than 10m per event can occur (Halcrow, 2002). Total erosion of 0-10m predicted by 2025.	**Defended:** No defences present. **Undefended:** The cliffs along this section have eroded very little over the long term and This is likely to continue in the future, although infrequent landslide events with a frequency of 1-10 years and a recession potential of less than 10m per event can occur (Halcrow, 2002). Total erosion of 0-10m predicted by 2055.	**Defended:** No defences present. **Undefended:** The cliffs along this section have eroded very little over the long term and This is likely to continue in the future, although infrequent landslide events with a frequency of 1-10 years and a recession potential of less than 10m per event can occur (Halcrow, 2002). Total erosion of 0-10m predicted by 2105.

C.5 Baseline Case 2 – With Present Management (WPM)

C.5.1 Introduction

This report provides analysis of shoreline response conducted for the scenario of 'With Present Management'. This has considered that all existing defence practices are continued, accepting that in some cases this will require considerable improvement to present defences to maintain their integrity and effectiveness and has taken account of the information about the defences contained in the Defence Assessment (see Section C.2).

The analysis has been developed using the understanding of coastal behaviour from both Futurecoast and the baseline understanding report produced (see Section C.1), existing coastal change data (see Section C.5.4) and information on the nature and condition of existing coastal defences.

C.5.2 Summary

The following text provides a summary of the analysis of shoreline response, with details specific to each location and epoch contained within the Scenario Assessment Table.

C.5.2.1 Short Term (to 2025)

In terms of defences, this coast is characterised by long stretches of undefended cliffed coastlines, small stretches of defences within pocket bays (which in places form part of the infrastructure rather than performing a defence role), and longer stretches of seawalls and revetments along the key towns and villages. The coastline in general is poorly connected, meaning that often the impact of defences is only very localised; the main exceptions are Lyme Bay, Chesil Beach and Weymouth Bay.

During this period, there would be a continuation of present day trends throughout the SMP area. Defences, such as seawalls would continue to prevent cliff erosion, whilst other structures such as rock revetments only limit the rate of cliff retreat. Historically it has been estimated that these reduce erosion rates by up to about two-thirds, and over this period it is expected that they would perform to a similar effectiveness. As the coastal system continues to transgress as a result of rising sea levels, this would squeeze the intertidal zone as nearshore areas deepen and defences prevent natural landward movement of the shoreline. In places, where defences front resistant cliff lines, this situation would not differ from the natural situation.

A number of the defences along the SMP area would require updating during this period as they are presently in a poor condition and would fail to provide adequate protection against flooding by 2025. Continued beach management activity in areas where this is presently undertaken would be required throughout this period as any cessation could lead to the loss of beaches in these areas and increase the risk of flooding of low-lying land. It is therefore assumed under this scenario, that beach management would retain beaches in their current state and plan-form position.

Along the undefended coast, cliff erosion would continue at rates experienced historically, with ongoing periodic cliff failures and landslides occurring to both supply new beach material and to form temporary barriers to longshore sediment transport. In areas where undefended cliffs are located adjacent to defended cliffs, particularly where the cliffs are comprised of soft, rapidly eroding muds and clays, there would be a risk of outflanking of defended areas towards the end of this period.

The estuaries along the SMP area would not be expected to change significantly and so would maintain their current form during this period.

C.5.2.2 Medium Term (to 2055)

During this period, the effect of rising sea levels will become more important. The increased exposure would impact both defended and undefended coastlines, although the nature of this coastline means that in general the impact of defences would tend to felt relatively locally due to the limited littoral drift.

Where defences exist, beaches would become increasingly narrow and unless there is beach management, there would need to be significant improvements made to prevent undermining and increased overtopping of defences.

Along defended lengths of shoreline, the natural retreat of the shoreline will be inhibited, therefore beaches will have narrowed, steepened and lowered considerably; in some areas they will have disappeared altogether. This will be exacerbated by accelerated sea level rise; without the ability of the shoreline to respond by moving landward, there will be deeper water and greater wave exposure at the seawalls and revetments. These conditions will not be conducive to beach retention and any sediment arriving on these frontages is likely to be rapidly transported offshore again. This will also increase the vulnerability of these defence structures to both undermining and overtopping and more frequent work to maintain their integrity will be required, to prevent erosion and maintain the shoreline in its present position. Such work may also require the construction of new defences, including the control structures along the shoreline combined with beach recharge. Where beach management is part of the management strategy, there could need to be increased frequency of works to maintain the beaches in their current state.

The majority of the defences throughout the SMP area are likely to require replacing or upgrading during this period as existing structures reach the end of their effective life, and the effects of sea level rise and increased storminess caused by climate change increase the risk of flooding and erosion. In some areas it will become increasingly technically difficult to provide adequate defences in present positions.

At a couple of locations defended areas may become more prominent, where defended stretches are adjacent to non-defended stretches which would continue to retreat. These promontories could inhibit sediment transfer between areas and become more exposed to wave action, which in turn will require additional defence measures to be taken to ensure the integrity of the defences against more waves and to prevent against outflanking of the defences by erosion of adjacent cliffs.

Along undefended sections of coastline, erosion of the softer cliffs will accelerate in response to sea level rise, periodic cliff failures and landslides occurring to form new temporary barriers to longshore sediment transport as existing lobes are removed by wave action. Harder, more resistant rock cliffs would be unaffected by sea level rise and continue to retreat at historical rates, failing only as a result of infrequent, geologically controlled event. Where beaches front cliffs that contain sufficient coarse sediment they will be maintained as narrow beaches despite sea level rise. Where there is insufficient coarse sediment supply to beaches from local cliff erosion, then beaches will narrow further as sea levels rise and could disappear in places along with shore platforms. The fact that many of the beaches along the eastern portion of this SMP area are relict would therefore become increasingly important during this period as there would be very limited input of comparable material and therefore the features may not be able to keep pace with sea level rise, particularly where retreat is prevented either by defences or the backing natural topography. Where beaches are unable to roll landwards there would be an increased tendency for sediment to be drawn-down the beach during storms and through this process the beaches could gradually become denuded of sediment.

Breaches and tidal inundation of defended flood risk areas would be averted under this scenario, although natural defences are likely to be frequently breached and require intervention to repair the breaches.

The estuaries along the SMP area would be affected by sea level rise in a number of ways. Where estuaries are largely natural and undeveloped, they are likely to respond by transgressing landwards and so conserving inter-tidal areas, although where there is high ground this may not be possible and inter-tidal areas could narrow and disappear. In estuaries that have been extensively developed, landward transgression is constrained by defences and so estuaries would accrete vertically to keep pace with sea level rise whilst maintaining their current form (assuming continued supplies of riverine sediment).

C.5.2.3 Long Term (to 2105)

Along much of this coastline there would be little difference from the future under a scenario of no active intervention due to the fact that long stretches of coast are undefended and the poor connectivity in terms of littoral drift.

Where defences are predominantly short stretches at the back of pocket beaches, they would only have a localised impact although by this period there would be little or no beach fronting the defences.

At other locations, such as Lyme Regis, the defended stretches of coast could now stand several meters proud of the adjacent undefended shorelines and there would be an increasing risk of outflanking. The increased exposure of these defences would also require substantial and longer extents of defences to be constructed. Without beach management there would be no beach present at the toe and even where beach management activities take place it would technically become very difficult. There would be an impact on adjacent beaches, through interruption of sediment drift. The deeper water at these artificial headlands could also result in any sediment reaching these points being deflected offshore rather than moving down the coast.

Along undefended sections of coastline, erosion of the softer cliffs would accelerate in response to sea level rise, periodic cliff failures and landslides occurring to form new temporary barriers to longshore sediment transport as existing lobes are removed by wave action. Harder, more resistant rock cliffs would be unaffected by sea level rise and continue to retreat at historical rates, failing only as a result of infrequent, geologically controlled event. Where beaches front cliffs that contain sufficient coarse sediment they will be maintained as narrow beaches despite sea level rise. Where there is insufficient coarse sediment supply to beaches from local cliff erosion, then beaches will become increasingly narrow as sea levels rise and an increasing number would disappear in places along with shore platforms by 2105.

Breaches and tidal inundation of defended flood risk areas would continue to be averted under this scenario, although much more substantial defences would be required, as beaches will be increasingly narrowed and lost from in front of these structures. The technical viability of providing defences in present positions would become increasingly difficult in a number of areas during this period.

Barrier beaches and spits that are undefended and not subject to management activities would continue to adapt and retreat in response to sea level rise. If not already happened in the medium term, then the risk of a significant storm event causing substantial rollback of these features onto low-lying land would increase throughout this period. A number of these natural defences are also likely to be frequently breached and require intervention to repair the breaches. These breaches are especially likely to occur where discontinuities in beach plan form develop as a result of the partial defence of a beach whilst the remaining beach is able to retreat.

The largely natural, undeveloped estuaries along the SMP area would be likely to continue to respond by transgressing landwards and so conserving inter-tidal areas, although where there is high ground this may not be possible and there could be further losses of inter-tidal areas in some parts. In estuaries where such landward transgression is constrained by defences, there would be continued vertical accretion to keep pace with sea level rise whilst maintaining their current form (assuming continued supplies of riverine sediment).

C.5.3 WPM Scenario Assessment Table

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
Durlston Head to St Alban's Head	There are no defences present along this section.	No defences.	No defences.
	Continued very slow erosion of the resistant limestone cliffs, confined to joint planes or as a result of wave undercutting. Negligible cliffline movement is predicted.	Very slow erosion of the cliffs would continue at the same rates as today, therefore negligible change in cliffline position is predicted. Under accelerated sea level rise any beaches could become submerged.	Very slow erosion of the cliffs would continue at the same rates as today, therefore negligible change in cliffline position is predicted. No beaches would be expected to remain at the toe of the cliff due to higher sea levels.
St Alban's Head to Worbarrow Tout	A largely undefended section except for a short section of sea wall along the eastern part of Kimmeridge Bay, which is protecting a small car park and facilities.	No defences over majority of frontage. Short section within Kimmeridge Bay is assumed to remain and could need to be upgraded during this period to maintain current levels of protection.	No defences over majority of frontage. Short section within Kimmeridge Bay is assumed to remain and could need to be upgraded during this period to maintain current levels of protection.
	The complex, clay-dominated cliffs that make up the majority of this section, such as at Gadd Cliff, Honnstant Cliff and St. Alban's Head, will continue to erode landwards as a result of episodic complex landslide events at a frequency of between 1 to 10 (majority of this section) and 10 to 100 years (on the western side of St Alban's Head). It is assumed that one such event could occur at anytime, and so total erosion of 0 to 50m is predicted over this period. Along Kimmeridge Ledges, where there has been very slow erosion historically, only about 1m of recession is predicted. Coarser material derived from this erosion will be retained within local pocket beaches at Brandy Bay, Hobarrow Bay, Kimmeridge Bay, Egmont	The clay rich cliffs that dominate much of this section are very sensitive to climate change and the rate of erosion could increase both due to sea level rise and an increase in rainfall. Due to uncertainty in the possible future changes in precipitation, no direct account has been taken of this in the predictions. Sea level rise will also result in the submergence of shore platforms, resulting in more rapid erosion of the cliffs behind where the cliffs are of simple type such as at Kimmeridge Ledges. Here total recession of 2 to 4m is predicted by 2055. Cliff failure through complex landslide events would continue elsewhere along this section. These would be less affected by sea level rise as they are controlled more by groundwater. Total	Total erosion by 2105 is predicted to be between 10 and 100m between Worbarrow Tout and Hobarrow Bay, and 30-100m between Kimmeridge Bay and Broad Bench. Between St. Alban's Head and Egmont Point there may be a large landslide event during this period, and so total erosion of 0 to 50m may occur in this area. The simple cliffs along Kimmeridge Ledges are more likely to be affected by sea level rise than the complex cliffs along the rest of this section. Here recession of 5 to 12m by 2105 is predicted. The short section of defence is likely to only have a very localised impact, but there may be issues with its maintenance due to erosion of the adjacent cliffs and it is likely to become an

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	Bight and Chapman's Pool. Finer material will be transported offshore in suspension. It is predicted that erosion of between 2 and 20m will occur over this period between Worbarrow Tout and Hobarrow Bay. Between Kimmeridge Bay and Broad Bench, erosion in the region of between 5 and 20m is predicted. The short stretch of sea wall at Kimmeridge is only likely to have a localised impact.	erosion by 2055 is predicted to be between 5 and 50m between Worbarrow Tout and Hobarrow Bay, and 14 to 50m between Kimmeridge Bay and Broad Bench. Between St. Alban's Head and Egmont Point there may be a large landslide event during this period, and so total erosion of 0 to 50m may occur. The short section of defence is likely to only have a very localised impact and would become increasingly technically difficult to maintain. During any landslide events a lobe of debris will be released, which could temporarily affect the longshore transport of sediment before being gradually eroded by wave action. Any sediment released through cliff erosion will tend to be either retained very locally in the pocket beaches (in the case of sand and shingle), or washed offshore (in the case of fines).	unviable defence. As a result of high sea levels beaches are expected to narrow and in places may disappear as the rock platforms become submerged.
Worbarrow Tout to Lulworth Cove (East)	There are no defences present along this section.	No defences.	No defences.
	The geology of the cliffs changes significantly along this stretch. Within Worbarrow and Mupe Bays, the clay-rich cliffs will continue to erode landwards as a result of episodic landslide events with a frequency of 1 to 10 years. It is predicted that underlying erosion of 1 to 2m will occur in this area over this period. Erosion of the chalk cliffs that extend from Mupe Bay to Lulworth Cove (East) would continue to be negligible, but infrequent cliff falls resulting	Erosion of the cliffs will continue as observed historically at a rate of about 0.1m/yr. Erosion of the chalk cliffs in the western part of this section tends to be geologically controlled so there is not expected to be a noticeable increase in erosion rates due to sea level rise. Therefore erosion of between 0 and 1m is expected by the end of this period, although there could be localised cliff falls resulting in the loss of 10 to 50m in a single event. This will release sediment, which will be gradually	Erosion of the cliffs will continue as observed historically at a rate of about 0.1m/yr along the western part of this section, but rates could increase along the clay-rich cliffs due to accelerated sea level rise. This would be exacerbated in areas that are currently protected by shore platforms, as submergence of these platforms would result in increased wave exposure. Total erosion by 2105 within Worbarrow and

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	from wave undercutting could occur, resulting in the loss of 10 to 50m of land in one go. The frequency of these events sizeable events is likely to be 10 to 100 years, although smaller scale events occur every 1 to 10 years, with events as recent as 2001. These events will tend to affect very localised areas, but it is not possible to predict where the next events will occur. During these landslide events a lobe of chalk debris will be released, which could temporarily affect the longshore transport of sediment. These lobes will gradually be eroded by wave action, with material eventually being lost offshore rather than being retained on the beaches.	removed offshore by wave action, but could affect longshore drift temporarily. Ultimately these cliff failures are unlikely to be a significant contribution to the beach budget. Within Worbarrow and Mupe Bays, the clay-rich cliffs are expected to be more sensitive to sea level rise, particularly those cliffs in the western part of the bay, and any increased in precipitation. Total erosion by 2055 within Worbarrow and Mupe Bays is predicted to be between 5 and 6m, although along localised sections cliff falls could occur resulting in several tens of metres of erosion. Erosion of these cliffs will provide some sediment to the beaches, but the majority is fine sediment which will be lost offshore. Therefore beaches remain within the pocket bays, but are unlikely to increase in volume. Cliffs in the eastern part of Worbarrow Bay are less likely to be affected by sea level rise and so total erosion of 0 to 5m is predicted by 2055.	Mupe Bays is predicted to be between 10 and 17m in the western part of the bay, but 0 to 10m in the eastern part of the bay. Towards Lulworth Cove (East), total erosion by 2105 is predicted to be between 0 and 8m. Very narrow beaches may remain as local pocket beaches, particularly where cliff erosion contributed to the beach budget.
Lulworth Cove	A largely undefended section except for a short length of seawall at the pedestrian entrance to the cove.	Short section of sea wall assumed to remain and could need to be upgraded during this period to maintain current levels of protection.	Short section of sea wall assumed to remain and could need to be upgraded during this period to maintain current levels of protection.
	Small scale cliff failure events occur every 1 to 10 years, causing the loss of less than 10m per event. Underlying erosion of the softer clays, marls and sandstones that lie within Lulworth Cove is predicted to be about 2m during this period. The beach will remain as at present.	The low rates of cliff retreat would continue as observed historically at about 0.12m/yr. The rate of erosion could increase slightly due to accelerated sea level rise but the net effect is likely to be negligible due to the resistant nature of the cliffs.	As for the medium term, an acceleration in sea level rise may result in a very small increase in the rate of erosion, but the net erosion will remain small due to the resistance of the cliffs. Total erosion within Lulworth Cove is predicted to be about 6m between 2055 and 2105.

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
		Total erosion within Lulworth Cove is predicted to be about 4m between 2025 and 2055. Beaches are expected to remain, but may narrow due to high sea levels. The short section of sea wall will not have a significant effect, although sea level rise could, increase flood risk at this location.	Beaches are expected to remain, but may narrow due to high sea levels. The short section of sea wall will not have a significant effect, although sea level rise could, increase flood risk at this location.
Lulworth Cove (West) to White Nothe	There are no defences present along this section.	No defences.	No defences.
	The vertical chalk cliffs that dominate this section are receding at varying rates, with infrequent cliff failure events causing loss of less than 10m per event typically occurring every 1 to 10 years, although towards White Nothe this frequency is more like 10 to 100 years. This trend is expected to continue during this period. Underlying erosion of between 2 and 10m is predicted between White Nothe and Bat's Head during this period. Between Bat's Head and Lulworth Cove erosion of between 0 and 6m is predicted over the same period.	Erosion of the chalk cliffs is expected to continue as observed historically at between 0.05 and 0.3m/yr (with the higher rate only likely to occur as a result of localised cliff failure events). The net rate of retreat is not expected to increase significantly as a result of sea level rise, due to the natural resistance of the cliffs. Total erosion by 2055 of 7 to 10m is predicted between White Nothe and Bat's Head, whilst between Bat's Head and Lulworth Cove erosion of between 0 and 16m is predicted. Beaches may narrow along the more exposed sections due to higher sea levels, but pocket beaches will remain in the more sheltered bays.	Erosion of the chalk cliffs is expected to continue as observed historically at between 0.05 and 0.3m/yr (with the higher rate only likely to occur as a result of localised cliff failure events). The net rate of retreat is not expected to increase significantly as a result of sea level rise, due to the natural resistance of the cliffs. Total erosion by 2105 of 14 to 20m is predicted between White Nothe and Bat's Head, whilst between Bat's Head and Lulworth Cove erosion of between 0 and 32m is predicted. High sea levels may result in the loss of beaches along some sections, but cliff erosion will contribute and maintain some narrow beaches, particularly in the more sheltered locations.
White Nothe to Redcliff Point	Mainly undefended coastline, but a short length of rock revetment and rock groyne present within Ringstead Bay.	Upgrade of defences within Ringstead Bay likely to be required during this period to maintain the current levels of protection, possibly including further beach recharge. The remainder of the	Further upgrade of defences within Ringstead Bay may be required during this period to maintain the current levels of protection, possibly including further beach recharge. The remainder of the

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
		shoreline is undefended.	shoreline is undefended.
	The clay cliffs that dominate this section experience episodic landslide events including mudflows and rotational land slips as a result of groundwater conditions, with instability being maintained by ongoing toe erosion by marine action. This trend is expected to continue in the future, with an average retreat of approximately 8.5m predicted to occur over this period. Episodic events occur about every 10-100 years, with a significant event having occurred at Black Head between 1910 and 1914. It is possible that another significant event could occur during this period, resulting in the erosion of 10 to 50m of land in a single event. It is difficult, without further, more detailed technical appraisal, however, to predict where a landslip could occur. Such landslides can impact locally by interrupting sediment drift, which is predominately from east to west. The rock groyne and revetment in Ringstead Bay will reduce the frequency of cliff failure events locally by preventing erosion of the cliff toe by marine action and so delaying on-set of instability within the clay cliffs, which is largely controlled by groundwater. Average retreat in this area will be less than the 8.5m predicted over this period for the undefended cliffs. Although the cliffs are	Along the majority of the shoreline, the cliff erosion trend is likely to continue as historically up to a rate of about 0.5m/yr. The simple cliffs at Ringstead Bay are more likely to be affected by sea level rise and so total erosion of about 25 to 30m is predicted by 2055 in this area. There is also the risk of a large scale event occurring along the Osmington to Redcliff Point section, which could result in a localised loss of cliff top in the region of 10 to 50m. These cliffs are also sensitive to climate change and in particular increased precipitation, although due to uncertainty in the prediction of future precipitation, this has not been included in calculation of erosion rates. Total recession by 2055 in this area is predicted to be between 25 and 50m. There could be beach narrowing as a result of sea level rise, particularly as shore platforms become submerged. Although any material released from the cliffs would be likely to remain locally, this would tend to be mainly fines, which will be moved offshore. Within Ringstead Bay, there may be a need to upgrade defences to counter-act this effect. There is also the possibility that erosion of adjacent unprotected cliffs could start to outflank the defended section, making this area more of a	The cliff erosion trend along the whole of this frontage is likely to continue as historically up to a rate of about 0.5m/yr. The simple cliffs within Ringstead Bay would be likely to be affected by sea level rise and total erosion in this area by 2105 of 50 to 70m is predicted. There is also the risk of a large scale event occurring along the Osmington to Redcliff Point section, which could result in a localised loss of cliff top in the region of 10 to 50m. These cliffs are also sensitive to climate change and in particular increased precipitation, although due to uncertainty in the prediction of future precipitation, this has not been included in calculation of erosion rates. Total recession by 2105 in this area is predicted to be between 50 and 100m. There could be further beach narrowing during this period as sea levels rise. As for the medium-term, this could have implications for the management of Ringstead Bay, which could become technically very difficult. Any upgrade of defences could have a detrimental impact on adjacent beaches by interrupting sediment drift, however this impact would not extend beyond Redcliff Point to the west.

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	unlikely to be a significant contributor of sediment to the beaches due to them being low in height and their composition, the rock groyne could impact on adjacent beaches by interrupting sediment drift.	promontory and so requiring more robust defences. With sea level rise the influence of the offshore ledges could also be reduced, which could increase exposure along this section. Any improvement to the rock groyne could increasingly impact on adjacent beaches. However, Redcliff Point will continue to interrupt sediment transfer towards Weymouth.	
Redcliff Point to Preston Beach (Rock Groyne)	Various structures, including revetments, seawalls and gabions are present. These could require maintenance to ensure current level of protection is maintained. Further beach recharge could also likely towards the end of this period.	Upgrade of existing defences could be required during this period to maintain current levels of protection.	Upgrade of existing defences could be required during this period to maintain current levels of protection.
	The clay cliffs at Redcliff and Furzy Cliff erode as a result of episodic events every 10 to 100 years, eroding between 10 and 50m of cliff per event. This trend is expected to continue in the future, with an average recession of 13 to 50m of Furzy Cliff and 11 to 50m of Redcliff over this period. Defences along the cliff toe at Bowleaze Cove and the north and south ends of Furzy Cliff prevent localised cliff toe erosion. Ongoing beach management activities along Preston Beach prevent breaching of the sea defences and so reduce flood risk of low-lying land behind. Due to the longshore drift of sediment to the north-east and south-west, it is likely that further beach recharge will be required at Preston Beach towards the end of this period	Along the undefended section of coast, cliff erosion would be likely to occur as historically, with total erosion of Furzy Cliff by 2055 predicted to be between 35 to 50m, whilst at Redcliff it is predicted to be between 30 to 50m. These cliffs would mainly contribute fines to the system therefore would not build beaches along this section. There is the possibility of cliff erosion causing outflanking of defended parts of the cliffs, leading to these areas becoming more of a promontory, particularly at the north end of Preston Beach. This would have a significant effect upon littoral drift processes at the northern end of Weymouth Bay. New defences and control structures are likely to	Cliff erosion is likely to occur as historically, with total erosion of Furzy Cliff by 2105 predicted to be between 70 and 100m, whilst at Redcliff it is predicted to be between 60 and 100m. Redcliff will therefore continue to interrupt any sediment exchange between this and the stretch of coast to the east. Cliff erosion, would not, however, significantly contribute to the beach budget therefore there would be a continued trend of beach steepening and narrowing, with the area around Lodmoor becoming increasingly vulnerable due to the apparent drift divide at this location. The risk of outflanking of defences would increase during this period, which would put increased pressure on defences. Therefore defences could

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	to maintain the standard of protection. This area could be affected by any change in the Portland Harbour Breakwaters, which are believed to have a sheltering effect and also influence sediment circulation within Weymouth Bay.	be required to retain standard of protection at Preston Beach during this period, in response to coastal squeeze caused by sea level rise. This area could be affected by any change in the Portland Harbour Breakwaters, which are believed to have a sheltering effect and also influence sediment circulation within Weymouth Bay.	potentially require further upgrading to maintain the current level of protection. This area could be affected by any change in the Portland Harbour Breakwaters, which are believed to have a sheltering effect and also influence sediment circulation within Weymouth Bay.
Preston Beach (Rock Groyne) to Weymouth Harbour (Stone Pier)	Upgrade of sea wall and promenade, as well as part of the inner harbour defences required during this period to maintain current levels of protection.	Remaining defences around Weymouth Harbour likely to be required during the middle of this period to maintain current levels of protection.	Upgrade of existing defences could be required during this period to maintain current levels of protection.
	The coastal defences comprise a sea wall and promenade constructed some 100 years ago. It is anticipated that this would need to be upgraded towards the end of this period, both to replace/repair the aging structure, and increase the size of the defence to take account of future sea level rise and so maintain current levels of protection. This will continue to prevent flooding of the low-lying hinterland. Within Weymouth Harbour, a section of the inner harbour wall will need to be upgraded by the middle of this period in order to maintain current levels of protection. The shingle beach at the northern end of this section would be likely to undergo gradual erosion, whilst sand would be likely to continue to accumulate in the southern end of Weymouth	Sea level rise could continue to cause coastal squeeze, with the narrowing of the beach and an increase in flood risk along this section. The section in the vicinity of Lodmoor would be an area of key risk as there is believed to be a drift divide at this location. New defences with possibly control structures and/or beach recharge could therefore be required during this period to maintain current levels of protection and prevent flooding of the low-lying hinterland. The beach at Weymouth should still be retained, due to sediment feed from the north, but this will start to diminish during this period as the stretch in front of Lodmoor becomes increasingly exposed (unless beach recharge is undertaken).	Sea level rise could continue to cause coastal squeeze, with the narrowing of the beach and an increase in flood risk along this section. The stretch in the vicinity of Lodmoor is a key hot spot. New defences with possibly control structures and/or beach recharge could therefore be required during this period to maintain current levels of protection. A beach is still likely to exist at Weymouth, but would be narrower unless beach recharge is undertaken. This area could be affected by any change in the Portland Harbour Breakwaters, which are believed to have a sheltering effect and also influence sediment circulation within Weymouth

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	Bay due to the presence of the northern harbour pier. Where the beach is eroded, coastal squeeze could become increasingly significant as sea levels rise, as there is very little new sediment input to the beach. This area could be affected by any change in the Portland Harbour Breakwaters, which are believed to have a sheltering effect and also influence sediment circulation within Weymouth Bay.	This area could be affected by any change in the Portland Harbour Breakwaters, which are believed to have a sheltering effect and also influence sediment circulation within Weymouth Bay.	Bay.
Weymouth Harbour (Stone Pier) to Portland Harbour (North Breakwater)	The short section of defence between the 2002 Newton's Cove Scheme and the rock armour around the Nothe Fort will require upgrading in the early part of this period.	Upgrade of defences may be required by the end of this period to maintain current levels of protection.	Upgrade of defences may be required by the end of this period to maintain current levels of protection.
	Clay-rich cliffs that are located behind the defences along this section are susceptible to landsliding as a result of groundwater conditions. Landslide events occur with a frequency of 10 to 100 years and can cause loss of less than 10m of land per event. The last significant event occurred in the late 1980's and it is possible that another significant event could occur during this period, most likely in the area behind the section of defences that are in a poor condition.	The rate of erosion of the cliff top due to groundwater conditions could increase due to an increase in rainfall resulting from future climate change. However, due to uncertainty in the possible future changes in precipitation, no direct account has been taken of this in the predictions. Sea level rise will also result in the submergence of shore platforms that front this section, and a narrowing of the small pocket beach at Newton's Cove, resulting in increased exposure of the defences to wave action.	The rate of erosion due to groundwater conditions could increase due to an increase in rainfall resulting from future climate change. Due to uncertainty in the possible future changes in precipitation, no direct account has been taken of this in the predictions. As a result of high sea levels beaches are expected to narrow and in places may disappear as the rock platforms become submerged, resulting in increased exposure of the defences to wave action.
Portland Harbour (North	Short sections of low-level rock revetment along the cliff toe in localised areas would need to be	Upgrade of existing shoreline defences could be required during this period to maintain protection	Upgrade of existing shoreline defences could be required during this period to maintain protection

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
Breakwater) to Small Mouth	upgraded during this period to prevent erosion of the cliff toe. It is also possible that there would be a need to maintain or even upgrade Portland Harbour breakwaters towards the end of this period.	of the cliff toe. It is also possible that there would be a need to maintain or even upgrade Portland Harbour breakwaters during this period.	of the cliff toe. It is also possible that there would be a need to maintain or even upgrade Portland Harbour breakwaters during this period.
	The cliffs along this section include actively landsliding clay-rich cliffs that are primarily controlled by groundwater levels, and more resistant sandstones that form headlands and which are more geologically controlled and fail as a result of wave undercutting at the base. The cliff toe along this section is defended in places by ad hoc structures that offer varying degrees of protection to the cliff toe from wave action. These serve to reduce the rate of instability in the clay-rich cliffs by preventing cliff toe erosion, although failures do still occur due to the groundwater conditions being the controlling factor. Wave action at the cliff toe becomes increasingly important in maintaining cliff instability towards the Small Mouth end of this section, where fetch lengths across Portland Harbour are greatest. Total erosion along this section is predicted to be between 5 and 10m during this period, inclusive of episodic landslide events, which occur between 1-10 years in the more active cliff areas, and between 10-100 years in the slightly more	Despite the presence of defences, erosion of the cliffs will continue as observed historically with total erosion by 2055 predicted to be between 15 and 25m, although along localised sections cliff falls could occur resulting in several tens of metres of erosion. Erosion of the more resistant sandstone cliffs tends to be geologically controlled so there is not expected to be a noticeable increase in erosion rates due to sea level rise. However, the clay-rich cliffs are expected to be more sensitive to sea level rise and any increased in precipitation. The rate of erosion due to groundwater conditions within the clay-rich cliffs could increase due to an increase in rainfall resulting from future climate change. Due to uncertainty in the possible future changes in precipitation, no direct account has been taken of this in the predictions. Sea level rise would also result in the submergence of shore platforms that front this section, and a possible narrowing of the small pocket beaches, although this effect may be reduced by sand sediment released from the cliffs tending to remain locally within the pocket	Despite the presence of defences, cliff erosion would continue as observed historically, with total erosion by 2105 predicted to be between 30 and 50m, although along localised sections cliff falls could occur resulting in several tens of metres of erosion. The rate of erosion due to groundwater conditions could increase due to an increase in rainfall resulting from future climate change. Due to uncertainty in the possible future changes in precipitation, no direct account has been taken of this in the predictions. As a result of high sea levels beaches are expected to narrow and in places may disappear as the rock platforms become submerged, resulting in increased exposure of the defences and cliff toe to wave action. This assumes that the Portland Harbour breakwaters are retained, as these prevent significant wave action at the toe of the cliffs from causing greater rates of erosion. In order to ensure the breakwaters are retained, it could be necessary to undertake maintenance works

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	**Medium Term (to 2055)**	**Long Term (to 2105)**
	resistant cliff areas. This assumes that the Portland Harbour breakwaters are retained, as these prevent significant wave action at the toe of the cliffs from causing greater rates of erosion. In order to ensure the breakwaters are retained, it could be necessary to undertake maintenance works during this period.	beaches, whilst fines would be lost offshore. This assumes that the Portland Harbour breakwaters are retained, as these prevent significant wave action at the toe of the cliffs from causing greater rates of erosion. In order to ensure the breakwaters are retained, it could be necessary to undertake maintenance works during this period.	during this period.
Small Mouth to Osprey Quay (Portland Harbour)	The short lengths of low-level rock revetment along this section would need to be upgraded towards the end of this period to maintain current levels of protection and prevent erosion leading to an increased risk of flooding to low-lying land behind. It is also possible that there would be a need to maintain or even upgrade Portland Harbour breakwaters towards the end of this period.	Upgrade of existing shoreline defences could be required during this period to maintain current levels of protection. It is also possible that there would be a need to maintain or even upgrade Portland Harbour breakwaters during this period.	Upgrade of existing shoreline defences could be required during this period to maintain current levels of protection. It is also possible that there would be a need to maintain or even upgrade Portland Harbour breakwaters during this period.
	There is likely to be little change in the shingle barrier Ham Beach that dominates the central part of this section, as there has been little change over the past century. This is as a result of reduced wave exposure along the beach during this time resulting from the presence of the Portland Harbour breakwaters. This situation is expected to remain during this period. Due to the importance of the breakwaters on maintaining the stability of the beach, it could be	Assuming the continued presence of the Portland Harbour breakwaters is retained by maintenance or upgrade works that would be required during this period, Ham Beach would remain largely stable as it has done historically. Sea level rise combined with a lack of new sediment input could begin to result in the narrowing of the beach and an increased risk of flooding to the low-lying land behind.	As a result of high sea levels and a lack of new sediment input, Ham Beach could become narrower and in places may disappear as it becomes submerged, resulting in increased risk of flooding to the low-lying land behind.

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	**Medium Term (to 2055)**	**Long Term (to 2105)**
	necessary to undertake maintenance works during this period to maintain the current levels of protection they provide.		
Osprey Quay (Portland Harbour) to Grove Point	Defences along this section include rock revetment and quay walls associated with Portland Port, as well as the Portland Harbour breakwaters, which may need to be maintained or even upgraded towards the end of this period.	Upgrade of existing defences could be required during this period to maintain current levels of protection. It is also possible that there would be a need to maintain or even upgrade Portland Harbour breakwaters during this period.	Upgrade of existing defences could be required during this period to maintain current levels of protection. It is also possible that there would be a need to maintain or even upgrade Portland Harbour breakwaters during this period.
	The ongoing defence of this section would continue to prevent any discernable erosion of the cliffs that back them, with negligible recession having occurred over the past century this will continue to be the case over this period.	Much as for the Short Term, the continued presence of defences would lead to the continuation of negligible cliff recession as has occurred historically. Sea level rise could result in an increased risk of flooding to the low-lying land behind some of the defences, and it may be necessary to upgrade existing defences during this period to maintain the current levels of protection.	Much as for the Short and Medium Term, the continued presence of defences would lead to the continuation of negligible cliff recession as has occurred historically. Sea level rise could result in an increased risk of flooding to the low-lying land behind some of the defences, and it may be necessary to upgrade existing defences during this period to maintain the current levels of protection.
Grove Point to West Weare	There are no defences present along this section.	No defences.	No defences.
	The majority of this section is dominated by very resistant limestone cliffs that experience only infrequent localised cliff failures. Continued very slow erosion of these resistant limestone cliffs, confined to joint planes or as a result of wave undercutting would occur during this period. Negligible cliffline movement is predicted for these areas. The north-west part of this section (around West	Cliff recession as has occurred historically will continue during this period for the resistant limestone cliffs. Negligible cliffline movement is predicted for these areas. Localised rock falls may occur although it is not possible to predict where these may occur. These are geologically controlled events and are unlikely to be affected by sea level rise. Erosion of the more erodible West Weare cliffs	Very slow erosion of the resistant limestone cliffs would continue at the same rates as today, therefore negligible change in cliffline position is predicted. The more erodible West Weare cliffs would be predicted to erode between 10 and 15m by 2105, although these cliffs are very sensitive to climate change and the rate of erosion could increase both due to sea level rise and an increase in

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	Weare) the lower part of the cliffs are formed of clay, capped by limestone, and these experience landslide events with a frequency of about 100 years or so, although the underlying erosion in this area is predicted to be between 2 and 10m during this period. Any sediment released through cliff erosion will tend to be either retained very locally in the pocket beaches that indent the limestone cliffs (in the case of sand and shingle), or washed offshore (in the case of fines).	by 2055 is predicted to be between 5 and 10m at a rate of about 0.11m/yr as has occurred historically. However, these clay rich West Weare cliffs are very sensitive to climate change and the rate of erosion could increase both due to sea level rise and an increase in rainfall. Due to uncertainty in the possible future changes in precipitation, no direct account has been taken of this in the predictions. Sea level rise would also result in the submergence of shore platforms that front this section, and a possible narrowing of the small pocket beaches.	rainfall. As a result of high sea levels beaches are expected to narrow and in places may disappear as the rock platforms become submerged, resulting in increased exposure of the cliff toe to wave action.
Chiswell to Chesil Beach (Northern end of Osprey Quay)	Seawalls and revetments protect the toe of the cliff at the eastern end of this section, and also provide flood defence to the low-lying land located behind Chesil Beach. The crest of Chesil Beach is also protected for a short length by gabions, whilst behind the beach there is an interceptor drain that diverts water coming over and through Chesil Beach into Portland Harbour. This also forms part of the sea defence along with the seawall. Parts of the defences along the eastern end that front the cliffs by West Weare would need to be upgraded towards the end of this period.	Upgrade of existing defences could be required during this period to maintain current levels of protection.	Upgrade of existing defences could be required during this period to maintain current levels of protection.
	The short section of undefended Chesil Beach that extends north-west from the gabions that	The crest of Chesil Beach is predicted to move towards Portland Harbour by 2 and 4m between	The crest of Chesil Beach is predicted to move towards Portland Harbour by between 3 and 6m

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	stabilise the crest at Chiswell is able to respond naturally to storm events. It is predicted that the crest of the beach could migrate towards Portland Harbour by between 1 and 2m by 2025. The probability of a significant storm/swell wave event occurring that could cause more extensive rollback of the beach is low. However, should such an event occur during this period, then the beach could roll-back further and affect the defences and low-lying land behind, as well as cause the defended part of the beach at Chiswell to become more prominent and so increasingly exposed to wave action.	2025 and 2055. Where the shingle barrier fronts defences, particularly at the southern end, there could be beach steepening and narrowing during this time. The probability of a significant storm/swell wave event occurring that could cause more extensive rollback of the beach would increase during this period as a result of climate change impacts.	between 2055 and 2105. Where the shingle barrier fronts defences, particularly at the southern end, there could be beach steepening and narrowing during this time. The probability of a significant storm/swell wave event occurring that could cause more extensive rollback of the beach would increase during this period as a result of climate change impacts.
Chesil Beach (Northern end of Osprey Quay) and The Fleet	There are no defences present along this section.	No defences.	No defences.
	It is predicted that the crest of the beach could migrate towards The Fleet by between 1 and 2m by 2025. The probability of a significant storm/swell wave event occurring that could cause more extensive rollback of the beach is low. However, should such an event occur during this period, then the beach could roll-back further and encroach upon The Fleet, and possibly (although unlikely during this period) become attached to the mainland in the vicinity of Wyke Narrows, effectively cutting off The Fleet to tidal influence from Portland Harbour.	The crest of Chesil Beach is predicted to move towards The Fleet by 2 and 4m between 2025 and 2055. The probability of a significant storm/swell wave event occurring that could cause more extensive rollback of the beach would increase during this period. As such, the risk of The Fleet being cut-off at Wyke Narrows increases slightly during this period. The coastal slopes that are located on the landward side of The Fleet experience only small scale, very infrequent landslides, thought likely to be the result of groundwater conditions. These	The crest of Chesil Beach is predicted to move towards The Fleet by 3 and 6m between 2055 and 2105. The probability of a significant storm/swell wave event occurring that could cause more extensive rollback of the beach would increase during this period. As such, the risk of The Fleet being cut-off at Wyke Narrows increases further during this period. The coastal slopes that are located on the landward side of The Fleet experience only small scale, very infrequent landslides, thought likely to be the result of groundwater conditions. These

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	The coastal slopes that are located on the landward side of The Fleet experience only small scale, very infrequent landslides, thought likely to be the result of groundwater conditions. These events would continue to occur at similar frequencies and scales as has occurred historically, with total erosion of 0 to 10m predicted to occur in localised areas by 2025.	events would continue to occur at similar frequencies and scales as has occurred historically, although possible future changes in precipitation could cause an increase in the frequency of event. However, due to uncertainty about future precipitation, no direct account has been taken of this in the predictions. Total erosion of 0 to 10m predicted to occur in localised areas by 2055.	events would continue to occur at similar frequencies and scales as has occurred historically, although possible future changes in precipitation could cause an increase in the frequency of event. However, due to uncertainty about future precipitation, no direct account has been taken of this in the predictions. Total erosion of 0 to 10m predicted to occur in localised areas by 2105.
Abbotsbury to Cogden Beach	There are no defences present along this section.	No defences.	No defences.
	This section has remained largely unchanged over the past century, and it is predicted that this will remain the case during this period to 2025. The extensive shingle barrier beach will continue to prevent erosion and flooding of the low cliffs, slopes and lowlands behind. The probability of a significant storm/swell wave event occurring that could cause more extensive rollback of the beach is low. However, should such an event occur during this period, then the beach could roll-back further and encroach upon the low-lying land, although the extent of roll-back would be restricted by the gradual rising of the coastal slopes that are located behind the beach.	This section has remained largely unchanged over the past century due to a net balance of longshore sediment transport, and it is predicted that this will remain the case during this period to 2055, although at the same time the beach could also retreat slightly over this period. The probability of a significant storm/swell wave event occurring that could cause more extensive rollback of the beach would increase during this period as a result of climate change impacts.	This section has remained largely unchanged over the past century due to a net balance of longshore sediment transport, and it is predicted that this will remain the case during this period to 2105. The effect of sea level rise could lead to an acceleration in the rate of retreat during this period, as well as an increased risk of flooding of the lowland marshes and lagoons, such as Burton Mere, that back this section of beach. The probability of a significant storm/swell wave event occurring that could cause more extensive rollback of the beach would increase during this period as a result of climate change impacts.
Cogden Beach to Burton Cliff (West)	There are no defences present along this section.	No defences.	No defences.
	This section is dominated in its western part by bedded sandstone cliffs up to 40m high. These sandstone cliffs fail as a result of wave	Erosion of the sandstone cliffs is expected to continue as observed historically at a rate of about 0.14m/yr as a minimum, although this could	Erosion of the sandstone cliffs is expected to continue as observed historically at a rate of about 0.14m/yr as a minimum, although this could

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	undercutting at the toe about every 10 years. These cause localised small scale losses. It is predicted that between 2 and 3m of sandstone cliff could be lost to erosion by 2025. The simple low clay cliffs at the eastern end of this section would retreat a similar amount during this period. The section is fronted by Chesil Beach which narrows in front of the sandstone cliffs compared to the much wider beach that fronts the low-lying area at Burton Bradstock in the east of this section. The beach has shown negligible change over the past 100 years, although short-term fluctuations as a result of storms do occur. It is predicted that the beach will continue to experience similar stability during this period to 2025. The probability of a significant storm/swell wave event occurring that could cause more extensive rollback of the beach on to the low-lying part of this section is low.	accelerate in response to rising sea levels, with total erosion by 2055 predicted to be between 7 and 10m. The simple clay cliffs at the eastern end of this section would be expected to erode between 7 and 13m by 2055. As a result of accelerated sea level rise, the historical trend of stability could change to one of erosion. Where the beaches are backed by cliffs, the beaches would be unable to retreat in response to the sea level rise therefore there could be beach steepening and narrowing along this section. This, in turn, could slightly increase the rate of cliff toe erosion and therefore failure. Along the low-lying sections of coast, the natural trend would be for barrier roll-back and the probability of a significant storm/swell wave event occurring that could cause more extensive rollback of the beach on to the low-lying part of this section would increase during this period.	accelerate in response to rising sea levels, with total erosion by 2105 predicted to be between 14 and 35m. The simple clay cliffs at the eastern end of this section would be expected to erode between 14 and 53m by 2105. As a result of high sea levels the beach fronting the sandstone cliffs are expected to narrow further and in places may disappear. This could result in a slight increase in the rate of cliff erosion, although the rate of erosion will be restricted due to the resistance of the cliffs. Along the low-lying sections of coast there would be beach roll-back and the probability of a significant storm/swell wave event occurring that could cause more extensive rollback of the beach on to the low-lying part of this section would increase during this period.
Freshwater Beach	This section of coast has no hard defences, but is subject to regular beach re-cycling and re-profiling as part of ongoing beach management practices.	Ongoing beach management activities.	Ongoing beach management activities.
	The beach levels along this section fluctuate over time, although the very recent past has seen a trend of accretion, although the effect of ongoing beach management activities help to keep the beach relatively stable. This is unlikely to change	Ongoing beach management activities will continue to retain the beach in about its present position. Erosion of the adjacent cliffs over this period may	Ongoing beach management activities will continue to retain the beach in about its present position. Erosion of the adjacent cliffs over this period may

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	by 2025. The discharge of the River Bride through and over the beach at the eastern end of this section is intermittent, with beach material periodically closing the river mouth off (although this is now largely a managed process). The probability of a significant storm/swell wave event occurring that could cause rollback of the beach on to the low-lying land that lies behind the beach is low during this period.	lead to the slight increase in exposure of the defended beach to wave action, as it becomes slightly more prominent along the shoreline. The probability of a significant storm/swell wave event occurring that could cause rollback of the beach on to the low-lying land that lies behind the beach would increase during this period as a result of climate change impacts. However, any such effects would be temporary as intervention would quickly restore the beach to its preferred (managed) position.	lead to the slight increase in exposure of the defended beach to wave action, as it becomes slightly more prominent along the shoreline. The probability of a significant storm/swell wave event occurring that could cause rollback of the beach on to the low-lying land that lies behind the beach would increase during this period. However, any such effects would be temporary as intervention would quickly restore the beach to its preferred (managed) position.
East Cliff (West Bay)	There are no defences present along this section.	No defences.	No defences.
	This section is dominated in its western part by bedded sandstone cliffs up to 40m high. These sandstone cliffs fail as a result of wave undercutting at the toe about every 10 years. These cause localised small scale losses. It is predicted that between 2 and 3m of sandstone cliff could be lost to erosion by 2025. The section is fronted by Chesil Beach which narrows in front of the sandstone cliffs compared to the much wider beach that fronts the adjacent sections. The beach has shown negligible change over the past 100 years, although short-term fluctuations as a result of storms do occur. It is predicted that the beach will continue to experience similar stability during this period to 2025.	As a result of accelerated sea level rise, the historical trend of stability could change to one of erosion. As the beaches are backed by relatively resistant cliffs, the beaches would be unable to retreat in response to the sea level rise therefore there could be beach steepening and narrowing along this section. This, in turn, could slightly increase the rate of cliff toe erosion and therefore failure, although ultimately the rate of erosion will be restricted due to the natural resistance of the cliffs. The total erosion of the sandstone cliffs by 2055 is predicted to be between 7 and 10m. This cliff erosion will contribute to the beach sediment budget both locally and to adjacent beaches, although drift rates tend to be low along	Beach narrowing and steepening would continue, with erosion of the sandstone cliffs continuing, with total erosion by 2105 predicted to be between 14 and 35m. There would be a feed of sediment to the beaches, but the accelerated rate of sea level rise is likely to mean that only very narrow beaches would remain.

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
		this frontage.	
West Bay (East Beach to eastern pier)	This section of coast has no hard defences along most of its length, but is subject to regular beach re-cycling and re-profiling as part of ongoing beach management practices. At the western end, the beach is controlled by the eastern pier of West Bay Harbour entrance.	Ongoing beach management activities. Possibility that the harbour pier may need to be upgraded towards the end of this period.	Ongoing beach management activities. Possibility that the harbour pier may need to be upgraded during this period.
	Beach management activities are undertaken to maintain the beach for sea defence purposes and so reduce the risk of flooding to the low-lying land behind. The result of this ongoing practice is that there has been very little net change in beach position, although the beach can fluctuate by up to 60m in between management activities being undertaken. The probability of a significant storm/swell wave event occurring that could cause either rollback of the beach on to the low-lying land that lies behind the beach, or draw-down and loss of material to the offshore, is low during this period.	Ongoing beach management activities will continue to retain the beach in about its present position. Erosion of the adjacent cliff to the east over this period may lead to the slight increase in exposure of the defended beach to wave action, as it becomes slightly more prominent along the shoreline. The probability of a significant storm/swell wave event occurring that could cause rollback of the beach on to the low-lying land that lies behind the beach, or draw-down and loss of material to the offshore, would increase during this period.	Ongoing beach management activities will continue to retain the beach in about its present position. Erosion of the adjacent cliff to the east over this period may lead to the slight increase in exposure of the defended beach to wave action, as it becomes slightly more prominent along the shoreline. This would have issues for the technicality of maintaining a beach in its current state. The probability of a significant storm/swell wave event occurring that could cause rollback of the beach on to the low-lying land that lies behind the beach, or draw-down and loss of material to the offshore, would increase during this period.
West Bay (West Beach from eastern pier) to West Cliff (East)	There a range of defences within this section that primarily provides defence against flooding, including seawalls, rock groynes and sluices to control the discharge of the River Brit through West Bay Harbour itself. The cliff toe at the eastern part of this section is	Upgrade of the seawall and promenade is likely to be required during the early part of this period in order to maintain the current level of protection.	Upgrade of all of the defences is likely to be required during this period in order to maintain the current level of protection. Possibility that the harbour pier may need to be upgraded during this period.

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	protected from erosion by a seawall and promenade.		
	The piers at the entrance to West Bay Harbour are a significant influence upon littoral processes, as are the rock groynes to the west of the harbour, preventing influx of new material to this section from either east or west. The seawall prevents wave action from eroding the toe of the eastern part of West Cliff, which is a degraded sandstone cliff. The beach fronting the seawall along this section has eroded significantly during the past century, and experiences scour during storm events due to the effect of the seawall. Coastal squeeze as a result of sea level rise could become increasingly significant as there is very little new sediment input to the beach.	Sea level rise could continue to cause coastal squeeze, with the narrowing of the beach and an increase in flood risk along this section. It is not likely that there will be any increased feed of sediment into this area during this period. It is anticipated that there will be a need to increase the size of the seawall along this section in the early part of this period to take account of future sea level rise and so maintain current levels of protection. Other new defences such as possibly control structures and/or beach recharge could also be required during this period to maintain current levels of protection. This would be unlikely to impact on East Beach or the coast to the east due to the impact of the pier on sediment linkages.	As a result of high sea levels the beach fronting the defences is expected to narrow further and in places may disappear. New defences with possibly control structures and/or beach recharge could therefore be required during this period to maintain current levels of protection. This would be unlikely to impact on East Beach or the coast to the east due to the impact of the pier on sediment linkages.
West Cliff (East) to Thorncombe Beacon	There are no defences present along this section.	No defences.	No defences.
	West Cliff is undefended along this section and is predicted to erode between 5 and 50m by 2025. Cliff failures along West Cliff occur about every 10 years and cause the loss of between 10 and 50m of cliff top in a single event. The clay-rich cliffs towards the west of this section experience failures at a similar frequency as West Cliff although with a lesser magnitude	West Cliff is predicted to erode as historically during the period 2025 and 2055 by between 15 and 125m, whilst the cliffs to the western end of this section are predicted to erode between 10 and 50m over the same period. There would be a feed of coarse sediment from erosion of cliffs to the west, which should help retain a small beach at Eype although this would	West Cliff is predicted to erode as historically during the period 2055 and 2105 by between 35 and 250m, whilst the cliffs to the western end of this section are predicted to erode between 25 and 100m over the same period. There would be an input of coarser sediment from the east which will feed beaches here, although this would be hindered by the continued

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	per event. The underlying rate of erosion of these more cliffs is also similar to West Cliff, although with greater uncertainty, giving rise to total erosion of between 5 and 20m predicted along this part by 2025. Coastal squeeze as a result of sea level rise could become increasingly significant, particularly in the area fronting the seawall, as there is very little new sediment input to the beach.	be hindered by the continued presence of the headland at Thorncombe Beacon. The clay rich cliffs are very sensitive to climate change and the rate of erosion could increase both due to sea level rise and an increase in rainfall. Due to uncertainty in the possible future changes in precipitation, no direct account has been taken of this in the predictions.	presence of the headland at Thorncombe Beacon. The clay rich cliffs are very sensitive to climate change and the rate of erosion could increase both due to sea level rise and an increase in rainfall. Due to uncertainty in the possible future changes in precipitation, no direct account has been taken of this in the predictions.
Thorncombe Beacon to Seatown (East)	There are no defences present along this section, although this section does cover the car park at Seatown, on the eastern side of the River Winniford that discharges to the sea at this location, which is only protected by naturally functioning cliffs.	No defences.	No defences.
	The clay-rich cliffs along this section experience complex landslide behaviour with cyclic backscar retreats as a result of short (episodic) events causing rapid retreat by rotational landsliding. These episodic events along this section occur about every 10 years on a small scale, although the underlying erosion is predicted to be as historically and result in total average erosion of between 10 and 20m by 2025.	These clay rich cliffs are very sensitive to climate change and the rate of erosion could increase both due to sea level rise and an increase in rainfall. Due to uncertainty in the possible future changes in precipitation, no direct account has been taken of this in the predictions. Therefore the rate of cliff erosion is likely to increase from that observed historically, with total erosion of this section between 2025 and 2055 predicted to be between 30 and 50m, although the effects of sea level rise would be outweighed by large landslide events that could occur during this period. Any coarse sediment released through cliff	These clay rich cliffs are very sensitive to climate change and the rate of erosion could increase both due to sea level rise and an increase in rainfall. Due to uncertainty in the possible future changes in precipitation, no direct account has been taken of this in the predictions. Therefore the rate of cliff erosion is likely to increase from that observed historically, with total erosion of this section between 2055 and 2105 predicted to be between 70 and 100m, although the effects of sea level rise would be outweighed by large landslide events that could occur during this period. The beach at Eype will be fed by any release of

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
		erosion should feed the beach at Eype, meaning that a beach should be retained here. Thorncombe Beacon acts as a barrier to drift therefore there is no sediment interaction with the beaches to the east.	coarse sediment from cliff erosion, with any fines being lost offshore. Thorncombe Beacon would continue to act as a barrier to drift to the east.
Seatown	A rock revetment extends along the toe of part of the cliff that fronts the western part of Seatown. This prevents wave action from eroding the cliff toe in this area.	Upgrade of the defences is likely to be required during this period to maintain the current level of protection.	Upgrade of the defences is likely to be required during this period to maintain the current level of protection.
	Despite the presence of defences along the toe of the cliff at Seatown, erosion still occurs as a result of groundwater conditions as episodic events, all be it at a lower average rate than the adjacent undefended cliffs to the east and west of Seatown. Cliff erosion would continue to occur as historically, with total erosion of between 5 and 20m predicted by 2025. By the end of this period, the greater erosion of the adjacent cliffs could lead to the Seatown frontage becoming slightly more prominent along the shoreline and as such, increasingly exposed to wave action. The retention of defences here could also lead to narrowing and loss of the beach towards the end of this period.	These clay rich cliffs are very sensitive to climate change and the rate of erosion could increase both due to sea level rise and an increase in rainfall. Due to uncertainty in the possible future changes in precipitation, no direct account has been taken of this in the predictions. Cliff erosion would continue at a faster rate than historically, with total erosion of up to 50m predicted by 2055, although the effects of sea level rise would be outweighed by large landslide events that could occur during this period. During this period, the greater erosion of the adjacent cliffs could lead to Seatown becoming increasingly more prominent along the shoreline and as such, increasingly exposed to wave action. The beaches will receive some sediment from the cliff erosion, although any fines will be lost offshore. It is anticipated that additional sediment input will enter Seatown beach from the west as erosion of the lobe of sediment at Thorncombe	These clay rich cliffs are very sensitive to climate change and the rate of erosion could increase both due to sea level rise and an increase in rainfall. Due to uncertainty in the possible future changes in precipitation, no direct account has been taken of this in the predictions. Cliff erosion would therefore continue to occur at increased rates from historically, with total erosion of up to 100m predicted by 2105, although the effects of sea level rise would be outweighed by large landslide events that could occur during this period. During this period, the greater erosion of the adjacent cliffs could lead to Seatown becoming increasingly more prominent along the shoreline and as such, increasingly exposed to wave action. This would also result in increased beach erosion in front of the defences. Therefore upgrade of the defences would be necessary, but could

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
		Beacon is removed, however increased exposure around Seatown could counter-act this sediment input and result in net beach erosion and therefore increased pressure on existing defences as a result of a narrower fronting beach.	increasingly become technically difficult.
Seatown (West) to Golden Cap	There are no defences present along this section.	No defences.	No defences.
	The clay-rich cliffs along this section experience complex landslide behaviour with cyclic backscar retreats as a result of short (episodic) events causing rapid retreat by rotational landsliding. These episodic events along this section occur about every 10 years on a small scale, although the underlying erosion is predicted to be as historically at a rate of about 0.7m/yr, resulting in total erosion of between 10 and 20m by 2025. This erosion would result in some beach feed although fines would be lost offshore. Therefore beaches would be maintained at the toe of the cliffs. A previous landslide event has resulted in a lobe of debris cutting off longshore sediment transport feeding beaches to the east. It is anticipated that this will gradually erode and be largely removed as a barrier to transport by 2025.	These clay rich cliffs are very sensitive to climate change and the rate of erosion could increase both due to sea level rise and an increase in rainfall. Due to uncertainty in the possible future changes in precipitation, no direct account has been taken of this in the predictions. Cliff erosion is likely to occur at a faster rate than historically, with total erosion of this section by 2055 predicted to be between 35 and 50m, although the effects of sea level rise would be outweighed by large landslide events that could occur during this period. Any large scale events that occur during this period could result in a lobe of sediment interrupting the sediment drift, which could impact on adjacent beaches.	These clay rich cliffs are very sensitive to climate change and the rate of erosion could increase both due to sea level rise and an increase in rainfall. Due to uncertainty in the possible future changes in precipitation, no direct account has been taken of this in the predictions. Cliff erosion is likely to occur at a faster rate than historically, with total erosion of this section by 2105 predicted to be between 70 and 100m, although the effects of sea level rise would be outweighed by large landslide events that could occur during this period.
Golden Cap to Charmouth (East)	There are no defences present along this section.	No defences.	No defences.
	The clay-rich cliffs along this section experience complex landslide behaviour with cyclic backscar retreats as a result of short (episodic) events	These clay rich cliffs are very sensitive to climate change and the rate of erosion could increase both due to sea level rise and an increase in rainfall. Due to uncertainty in the possible future	Cliff erosion is likely to occur at faster rates than historically, although the effects of sea level rise would be outweighed by large landslide events that could occur during this period, with total

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	**Medium Term (to 2055)**	**Long Term (to 2105)**
	causing rapid retreat by rotational landsliding. The frequency and magnitude of these events varies depending upon specific local geology that comprise each individual cliff, although large events occur about every 100 years or so. Throughout this section, erosion would continue as historically, with variable erosion occurring along the shoreline at rates ranging from 0.1 to 1.0m/yr. At Golden Cap, total erosion of between 3 and 50m is predicted by 2025, whilst at Stonebarrow erosion of 7 to 50m is predicted, and 17 to 50m of erosion is predicted at Broom Hill over the same period.	changes in precipitation, no direct account has been taken of this in the predictions. Cliff erosion is likely to occur at faster rates than historically, although the effects of sea level rise would be outweighed by large landslide events that could occur during this period, with total erosion of this section by 2055 predicted to be between 8 and 50m at Golden Cap; 20 to 50m at Stonebarrow, and 40 to 50m at Broom Hill. These varying rates of erosion would lead to Golden Cap developing into a more defined headland, with the cliffs to the west becoming more set-back forming a shallow embayment. This is not likely to affect adjacent beaches, as Golden Cap is already a barrier to littoral transport.	erosion of this section by 2105 predicted to be between 17 and 50m at Golden Cap; 40 and 50 at Stonebarrow, and 50 and 100m at Broom Hill. These varying rates of erosion would lead to Golden Cap developing into a more defined headland, with the cliffs to the west becoming increasingly set-back forming a deepening embayment. This is not likely to affect adjacent beaches, as Golden Cap is already a barrier to littoral transport.
Charmouth (East) to East Cliff (Lyme Regis)	Defences are present at the eastern end of this section at Charmouth, where a short length of seawall and promenade provides flood protection. It is probable that upgrade of these defences would be required towards the end of this period in order to maintain the current level of protection.	Upgrade of the defences at Charmouth may be required during this period in order to maintain the current level of protection.	Upgrade of the defences at Charmouth may be required during this period in order to maintain the current level of protection.
	The seawall at Charmouth backs a sandy beach and protects low-lying land behind from flooding. The majority of this section consists of clay-rich cliffs that experience complex landslide behaviour with cyclic backscar retreats as a result of short	Due to the sensitivity of these cliffs to climate change, cliff erosion is likely to increase from rates observed historically. Although the rate of erosion could increase both due to sea level rise and an increase in rainfall, due to uncertainty in	Due to the sensitivity of these cliffs to climate change, cliff erosion is likely to increase from rates observed historically. Although the rate of erosion could increase both due to sea level rise and an increase in rainfall, due to uncertainty in

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	(episodic) events causing rapid retreat by rotational landsliding. The frequency and magnitude of these events varies depending upon specific local geology that comprise each individual cliff, although large events occur about every 100 years or so causing recession of more than 50m per event. The most recent event occurred in May 2008 within The Spittles complex, and resulted in around 50m of cliff top recession along a 400m length, and which was considered to be the largest event in this area for around 25 years. Throughout this section, erosion would continue as historically, with variable erosion occurring along the shoreline at rates ranging from 0.2 to 3.3m/yr, although rates vary greatly depending upon the time period looked at as a result of landslide events causing distortions in the data. By 2025, the east and central parts of Black Ven are predicted to erode between 7 and 50m. Over this same period, Black Ven West is predicted to erode by 10 to 50m, whilst The Spittles is predicted to erode by about 10m. However it is possible that landslide events may periodically occur that cause greater amounts of recession although it is not possible to predict this. Continued beach narrowing as a result of sea level rise could become increasingly significant as there is very little new sediment input to the beach. The large scale landslides also act as a	the possible future changes in precipitation, no direct account has been taken of this in the predictions. Sea level rise would result in the submergence of the fronting beaches and shore platforms (ledges), resulting in more rapid erosion of the cliffs behind. However the effects of sea level rise are likely to be outweighed by large landslide events that could occur during this period, The east and central parts of Black Ven are predicted to experience total erosion of between 20 and 50m over this period, whilst Black Ven West is predicted to erode by 30 to 50m, and The Spittles by 25 to 50m. However it is possible that landslide events may periodically occur that cause greater amounts of recession although it is not possible to predict this. A larger amount of recession could occur during this period as a result of large landslide events that occur about every 100 years or so causing recession of more than 50m per event. However, without further detailed investigation, it is uncertain as to exactly where and when such a large scale event would occur. These effects may be mitigated by the release of beach building material from the significant erosion along this section, particularly at Black Ven West, which would release suitable beach material from the Upper Greensands.	the possible future changes in precipitation, no direct account has been taken of this in the predictions. Sea level rise would result in the submergence of the fronting beaches and shore platforms (ledges), resulting in more rapid erosion of the cliffs behind. Due to differences in cliff composition, total erosion by 2105 would occur at variable rates. The east and central parts of Black Ven are predicted to have eroded between 40 and 50m over this period, whilst Black Ven West is predicted to have eroded by 50 to 60m, and The Spittles by about 50m. However it is possible that landslide events may periodically occur that cause greater amounts of recession although it is not possible to predict this. If not already happened in the medium term, a larger amount of recession could occur during this period as a result of large landslide events that occur about every 100 years or so causing recession of more than 50m per event. However, without further detailed investigation, it is uncertain as to exactly where and when such a large scale event would occur. These effects may be mitigated by the release of beach building material from the significant erosion along this section, particularly at Black Ven West, which would release suitable beach material from the Upper Greensands that would also be available to be transported to beaches to

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	barrier to any sediment transport along this section. Locally there could be beach building sediment released from the cliffs, in particular Black Ven West cliffs. The defended section could also begin to become outflanked by the continued erosion of the undefended cliffs by the end of this period.	Sea level rise could also continue to cause coastal squeeze in the section fronting the seawall at Charmouth, with the narrowing of the beach and an increase in flood risk along this section. The risk of the defended part of this section becoming outflanked by the continued erosion of the undefended cliffs will increase throughout this period.	the east. Any large scale landslide events, could, however, result in sediment drift being interrupted. New defences with possibly control structures and/or beach recharge could therefore be required during this period to maintain current levels of protection. The risk of the defended part of this section becoming outflanked by the continued erosion of the undefended cliffs will increase throughout this period.
East Cliff (Lyme Regis) to Broad Ledge (Lyme Regis)	Defences are present along the length of this section which covers East and Church Cliffs at Lyme Regis, where a seawall protects the cliff toe from erosion. It is probable that upgrade of these defences would be required towards the end of this period in order to maintain the current level of protection.	Upgrade of the defences along this section may be required during this period in order to maintain the current level of protection.	Upgrade of the defences along this section may be required during this period in order to maintain the current level of protection.
	The seawall at Lyme Regis prevents erosion of the cliff toe and since its construction has prevented any significant landslide activity. The continued presence of the seawall at Lyme Regis will continue to limit landslide activity over this period. Continued beach narrowing as a result of sea level rise could become increasingly significant as there is very little new sediment input to the	Sea level rise could result in the submergence of the rock platform and beach at Lyme Regis leading to a coastal squeeze problem in this area. The risk of this defended section becoming outflanked by the continued erosion of the undefended cliffs to the east will increase throughout this period.	As a result of high sea levels the beach fronting the defences along this section is expected to narrow further and in places may disappear. New defences with possibly control structures and/or beach recharge could therefore be required during this period to maintain current levels of protection. The risk of this defended section becoming outflanked by the continued erosion of the

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	beach. This defended section could also begin to become outflanked by the continued erosion of the undefended cliffs to the east by the end of this period.		undefended cliffs to the east will increase throughout this period.
Broad Ledge (Lyme Regis) to The Cobb (Lyme Regis)	This section is entirely defended by a range of structures including seawalls and rock groynes, as well as ongoing beach management activities including beach recharge.	Upgrade of the defences could be required during this period to maintain the current levels of protection.	Upgrade of the defences could be required during this period to maintain the current levels of protection.
	The defences along this section prevent cliff erosion, and their continued presence would result in no change in cliff position by 2025. The various control structures along this section, along with ongoing beach management activities also serve to maintain a stable beach. However, coastal squeeze as a result of sea level rise could become increasingly significant and require additional beach recharge towards the end of this period.	The continued defence and management of this section means that there would be very little change in shoreline position. Increased sea levels would, however result in increased exposure of the beaches and therefore further works could be required to maintain the current beach.	The continued defence and management of this section means that there would be very little change in shoreline position. As a result of high sea levels the beach fronting the defences along this section would be increasingly exposed, with additional recharge required to maintain a beach to a similar standard to current. In addition defences may need to be upgraded to maintain current levels of protection.
The Cobb (Lyme Regis) to Seven Rock Point	The eastern part of this section is protected by a seawall that runs along the cliff toe. The immediate eastern end is The Cobb breakwater.	Upgrade of the defences in the early to middle part of this period is expected to be required in order to maintain the current level of protection.	Upgrade of the defences could be required during this period in order to maintain the current level of protection.
	The seawall prevents erosion of the cliff toe along the eastern part of this section, and has resulted in no significant cliff recession in this area, although Monmouth Beach that fronts the defences has, over the past 100 to 150 years experienced a long term trend of erosion and	The continued presence of defences along the cliff toe at Monmouth Beach will prevent any significant change in cliffline position. Sea level rise would continue to cause coastal squeeze, particularly in the area fronting the seawall, with the narrowing of the beach and an	The continued presence of defences along the cliff toe at Monmouth Beach will prevent any significant change in cliffline position. As a result of high sea levels beaches are expected to narrow and in places may disappear as the rock platforms become submerged,

Location	Predicted Change for 'With Present Management'		
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	steepening, except at the very eastern end where some limited accretion occurs against The Cobb. Beach narrowing is predicted to continue as a result of sea level rise. West of the defended part of this section, cliffs are unprotected and so erosion of the cliff base here is expected to continue as historically at a rate of about 0.2m/yr, although no cliff top recession is predicted by 2025.	increase in flood risk along resulting. There would be an increasing risk of the defended eastern part of this section becoming outflanked by the continued erosion of the undefended cliffs during this period. These cliffs are sensitive to climate change and therefore the rate of erosion of the cliff base would increase from that observed historically, in response to rising sea levels (this does not take account of any increase due to increased precipitation). The cliff top is unlikely to erode by 2055. These clay-rich cliffs are unlikely to significantly contribute to the beach budget. Therefore both in front of the cliffs at the western end and remains of defences and infrastructure at Monmouth Beach, sea level rise would continue to cause beach narrowing along the whole of this stretch.	resulting in increased exposure of the defences and cliff toe to wave action. The undefended cliffs in the western part of this section would erode at faster rates than historically along the cliff base, due to sea level rise. However it is unlikely that recession of the cliff top would occur by 2105. There would therefore be an increasing risk of the defended eastern part of this section becoming outflanked by the continued erosion of the undefended cliffs during this period.
Seven Rock Point to Haven Cliff (West)	There are no defences present along this section.	No defences.	No defences.
	The clay-rich cliffs along this section experience complex landslide behaviour with cyclic backscar retreats as a result of short (episodic) events causing rapid retreat by rotational landsliding. The frequency and magnitude of these events varies along this section due to changes in geology. Along the eastern stretch there is a risk of large scale landslide events occurring, but the frequency of these is low; every 250 years or more. Whereas along the western section of this	These clay rich cliffs are very sensitive to climate change and the rate of erosion could increase both due to sea level rise and an increase in rainfall. Due to uncertainty in the possible future changes in precipitation, no direct account has been taken of this in the predictions. Taking account of rising sea levels alone, the rate of cliff erosion would be expected to be higher than experienced historically, although it is likely to be outweighed by the occurrence of landslide	These clay rich cliffs are very sensitive to climate change and the rate of erosion could increase both due to sea level rise and an increase in rainfall. Due to uncertainty in the possible future changes in precipitation, no direct account has been taken of this in the predictions. Taking account of rising sea levels alone, the rate of cliff erosion would be expected to be higher than experienced historically, although it is likely to be outweighed by the occurrence of landslide

Location	Predicted Change for 'With Present Management'		
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	frontage, smaller, more frequent, landslides are characteristic. On average by 2025 between 3 and 10m of erosion is expected to occur towards the western end of this section, as has been experienced historically at a rate of about 0.2m/yr, supplying sediment to local beach stocks. No recession is predicted towards the eastern end of this section. Due to natural barriers to littoral drift it is unlikely that this stretch would be affected by management changes along adjacent sections.	events, with about 10m of cliff top recession predicted by 2055. The supply of sediment across the mouth of the Axe is expected to continue as at present.	events, with between 10 and 20m of cliff top recession predicted by 2105. This could be much greater in some areas should a large landslide event occur during this period, the probability of which would increase towards 2105 as the last such event occurred in 1839. Should such an event occur, then it would form a lobe of debris that would inhibit littoral transport processes.
Haven Cliff (West) to Seaton Hole	Defences along the toe of the cliff from Seaton to Seaton Hole include both seawalls and rock revetment.	Upgrade of the defences would likely be required during this period in order to maintain the current level of protection.	Upgrade of the defences may be required during this period in order to maintain the current level of protection.
	The defences along the toe of the cliff have caused the rate of cliff erosion to be reduced over the recent past. This has been aided by natural beach accumulation in the very recent past, although beach levels have fluctuated in this area, historically the trend is one of accretion and so it is thought that the recent lower rate of recession would continue until 2025, with total erosion of 3 to 5m predicted over this period. As these cliffs are mudstones, this erosion will not significantly contribute to the beaches. There could be beach narrowing in front of the defences due to continued west to east transport of sediment and lack of new input to the system.	Where the cliffs are protected by rock revetment, cliff erosion would continue to be reduced, with a total erosion of between 5 and 10m expected between 2025 and 2055. However, due to sea level rise, the rock revetment would require upgrading in order to maintain current levels of protection. There would be no change in cliff position where the cliffs have been re-graded and are protected by a sea wall. There could be beach narrowing in front of the defences due to continued west to east transport of sediment and lack of new input to the system.	The rock revetment, if improved, could continue to provide some protection, but by this period beaches are expected to be very narrower, if existent, along this western stretch. Therefore further defences would probably be required to prevent/ reduce cliff erosion at this location. There could still be between 10 and 15m erosion during this period, assuming a similar level of protection is provided. Narrowing beaches due to limited contemporary input of sediment and continued west to east littoral transport, coupled with higher sea levels would cause similar defence issues along the section of sea wall. New defences could therefore

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	Sediment transport along the frontage from west to east would continue to maintain the spit that extends across the mouth of the Axe estuary and here beaches would be stable and may continue to accrete.	This could be exacerbated by sea level rise, resulting in a need for new defences with possibly control structures and/or beach recharge being required during this period to maintain current levels of protection. Beaches to the east would continue to receive sediment moved alongshore and should remain stable during this period. There could be elongation with re-curving of the spit into the harbour and under sea level rise beach steepening could occur together along the length of the spit as material is pushed onshore by overwashing storm waves.	be required during this period to maintain current levels of protection. There would be continued sediment moved alongshore towards the Axe estuary which should help maintain the spit in a similar form to today, assuming no cross-shore defences are constructed which would interrupt sediment drift. The tendency of the spit will be to migrate inland in response to sea level rise,; if the training walls are improved to prevent this there would be narrowing of the spit during this period, with a pinch point occurring where the river channel is deflected. Defences here would need upgrading to counter the increase risk of overtopping and breach.
Seaton Hole to Beer Head	There are no defences present along this section, although there are structures, such as the car park, along a short stretch at Beer that also have some limited defence function.	No defences, apart from a short stretch at Beer.	No defences, apart from a short stretch at Beer.
	Chalk cliffs that are largely resistant to erosion dominate this section. There has been negligible erosion of this section over the past 100 years, with only very localised small to medium sized rock falls occurring every 10 to 100 years. This pattern of recession is expected to continue over this period to 2025, with total erosion of between 0 and 50m possible depending on whether or not a cliff failure event occurs.	The resistant nature of the chalk cliffs will continue to result in negligible cliff recession, except for very infrequent localised rock falls; it is not, however, possible to predict the exact locations of these. Total erosion of between 0 and 50m is possible by 2055, depending on whether or not a cliff failure event occurs. The pocket beaches would continue to experience narrowing and steepening during this	The resistant nature of the chalk cliffs will continue to result in negligible cliff recession, except for very infrequent localised rock falls; it is not, however, possible to predict the exact locations of these. Total erosion of between 0 and 50m is possible by 2105, depending on whether or not a cliff failure event occurs. The pocket beaches would continue to experience narrowing and steepening during this period due to accelerated sea level rise, but a

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	There are isolated pocket beaches at Beer and Pound's Pool. The low rate of cliff erosion means that there is little or no contemporary sediment input to these beaches. During this period the beaches may remain quite stable, but may start to experience some narrowing and steepening towards the end of the period. At Beer there could be some leakage of sediment at the eastern end of the beach.	period due to accelerated sea level rise.	beach should still be present at Beer due to the indented nature of this frontage. The short stretch of defences here may need to be upgraded.
Beer Head to Salcombe Hill (West)	There are no defences present along this section, apart from very localised rock placement at Branscombe.	No defences, apart from very localised rock placement at Branscombe.	No defences, apart from very localised rock placement at Branscombe.
	The long term trend of the beaches that front the cliffs along this section has been one of slight accretion towards Beer Head and erosion towards Salcombe Hill, with the intervening beach having been relatively stable, due to the west to east drift of sediment. This situation is predicted to continue in to the future. The beach erosion at the western end of this section is related to the presence of control structures in front of Sidmouth (see section below) that prevent littoral drift from bringing sediment to the beaches in this area. It is assumed that these structures would remain during this period, and so the beach in this area will continue to erode. The varying beach levels contribute to varying rates of cliff recession by permitting varying	Cliff recession of the chalk cliffs at Beer would continue as has occurred historically at rates of between 0.05 and 0.35m/yr combined with infrequent small scale cliff fall events, with total erosion by 2055 of 8 to 10m predicted towards Beer Head. The softer cliffs composed of sandstone and marl, which characterise the remainder of this stretch are more sensitive to climate change and therefore, taking account of sea level rise, these are expected to erode between 14 and 18m during this period. These cliffs are prone to small but frequent mudslides, but whilst these would remain as lobes on the beach for a while, they do not contribute to the shingle beach (although any sands may remain on the intertidal beach). East of Branscombe the cliffs are vulnerable to complex, large scale landslides, where the chalk sits on top	Cliff recession of the chalk cliffs at Beer would continue as historically at rates of between 0.05 and 0.35m/yr combined with infrequent small scale cliff fall events, with total erosion by of 10 to 17m predicted towards Beer Head by 2105. The softer clay-rich cliffs to the west are more sensitive to climate change and therefore, taking account of sea level rise, these are expected to erode between 29 and 53m during this period. Superimposed on these rates are the possibility of large scale failures, which would be localised but could cause several metres of erosion in one event. There would be continued alongshore transport from west to east, but beaches would be expected to narrow and steepen due to higher sea levels, particularly in the western part of this

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	amount of cliff toe erosion. The rate of cliff erosion is also due to the varying geologies along this stretch. At Beer Head the cliffs are composed of chalk, but this is replaced by sandstone and marl cliffs towards the east. Towards Beer Head, total cliff erosion by 2025 is predicted to be between 3 and 10m, whilst towards Salcombe Hill, total erosion over the same period is predicted to be 5 to 6m at a rate of about 0.3m/yr as observed historically with possible cliff fall events towards Beer Head resulting in localised increases in recession.	of the marl. These events could cause several metres of erosion, but would tend to be very localised. There would be continued feed of sediment alongshore due to the west to east littoral drift, which would help maintain beaches along this stretch. Any larger scale landslide event could interrupt this and impact on downdrift beaches such as Branscombe, but the location of future failures is difficult to predict. At the western end of this stretch the littoral input would be reduced by defences at Sidmouth and here beaches could narrow, potentially resulting in increased cliff erosion.	section, as a result of a lack of shingle to this area. A beach is expected to remain at Branscombe, but is likely to be narrower and will have been pushed inland slightly. The rock placed on the beach at Branscombe is likely to be ineffective unless upgraded and extended to counteract both the effects of outflanking and the potential increased risk of overtopping.
Sidmouth	Defences along this section include rock groynes and offshore rock breakwaters, as well as seawalls. This is supported by ongoing beach management activities.	Upgrade of the defences is anticipated to be required during this period in order to maintain the current level of protection.	Upgrade of the defences may be required during this period in order to maintain the current level of protection.
	The seawall along this section protects low-lying land from flooding, whilst the shoreline structures, offshore breakwaters and ongoing beach management serve to retain beach material in front of the seawall. Despite the shoreline structures and ongoing beach management activities, the beach has experienced a slight long term trend of erosion. This is due to the cross-shore movement of material during storm events that is not completely returned by post-storm action.	Ongoing beach management activities means there would be no change in shoreline position, however beach narrowing would be an issue due to the limited input of shingle from the west and the impact of rising sea levels. This would increase flood risk along this section. It is therefore anticipated that there will be a need to increase the size of the seawall along this section during this period to take account of future sea level. Other new defences and/or beach recharge could also be required during this period to maintain current levels of protection. This would	There would be no change in shoreline position due to the existing defences, but these would require upgrading to maintain the current level of protection. As a result of high sea levels the beach fronting the defences is expected to narrow further and in places may disappear (unless beach recharge was undertaken). Any works along this stretch would impact the coast to the east.

Location	Predicted Change for 'With Present Management'		
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	The defences prevent material from being transported eastwards by littoral drift to the adjacent undefended section. The continued presence of the defences along this section and ongoing beach management activities would keep the beach relatively stable up to 2025 and there would be no change in shoreline position, although coastal squeeze as a result of sea level rise could become increasingly important towards the end of this period.	have an impact on beaches and cliffs to the east.	
Chit Rocks to Big Picket Rock	There are no defences present along this section.	No defences.	No defences.
	Cliff erosion along this section has historically occurred very slowly as a result of small scale events every 10 years or so, controlled by the local geology. This would continue during this period, with total erosion by 2025 of between 3 and 5m predicted. Cliff erosion does not contribute any shingle to the beach, but sands may remain on the lower foreshore, which would help to maintain the upper shingle beach. The beaches will retreat with the cliff, although there could be some slight narrowing and steepening towards the end of this period.	Continued cliff recession as has occurred historically at a rate of about 0.2m/yr, although sea level rise could begin to lead to this rate increasing during this period, and it is predicted to result in total erosion of between 9 and 11m by 2055. Sea level rise would lead to the narrowing of the beach and submergence of the rock platforms that front the cliffs along this section. This would lead to increased wave exposure, although it would be unlikely to significantly increase the rate of cliff recession as this is pre-dominantly controlled by local geological factors. A shingle beach with sandy foreshore would remain and retreat with the cliffs. There could be some erosion of the shingle beach due to increased exposure as sea level rises and greater	Erosion of the cliffs would continue as observed historically at a rate of about 0.2m/yr, although sea level rise is likely to result in this rate increasing during this period, with total erosion by 2105 of 20 to 30m predicted. As a result of high sea levels the beach along this section is expected to narrow, and the rock platforms would become increasingly submerged. This would result in increased exposure of the cliff toe to wave action, although it would be unlikely to significantly increase the rate of cliff recession as this is pre-dominantly controlled by local geological factors. Shingle beaches would increasingly become confined to little pockets that may develop as the cliffs erode.

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
		drawdown rates.	
Big Picket Rock to Otterton Ledge	There are no defences present along this section.	No defences.	No defences.
	The cliffs along this section are composed of more resistant sandstone. Erosion of the cliffs that extend along this section would continue to occur as historically, with infrequent, small scale cliff falls resulting from wave undercutting occurring with a frequency of about 10 years. These events tend to affect very localised areas, but it is not possible to predict where the next events will occur. The underlying rate of recession is predicted to result in cliff erosion of 3 to 5m by 2025. Any sediment released from the cliffs will tend to remain locally, within the pocket beaches.	Cliff erosion would continue as observed historically at a rate of about 0.2m/yr, although sea level rise could begin to lead to this rate increasing during this period, with total erosion of between 9 and 13m predicted by 2055. Material from cliff erosion would not contribute to the shingle beaches, therefore local pocket beaches may narrow.	Erosion would continue as observed historically at a rate of about 0.2m/yr, although sea level rise could begin to lead to this rate increasing during this period, with total erosion of 20 to 40m predicted to occur by 2105. Local pocket beaches, such as Ladram Bay, would steepen and narrow due to sea level rise. The more exposed ones could disappear.
Otterton Ledge to Budleigh Salterton (West)	Seawall and gabions extend along the cliff toe along the western part of this section, up to the landward end of the spit that extends across the mouth of the Otter estuary. It is anticipated that these defence would need to be upgraded towards the end of this period in order to maintain current levels of protection.	Upgrade of the defences could be required during this period in order to maintain current levels of protection.	Upgrade of the defences could be required during this period in order to maintain current levels of protection.
	The presence of the defences along the toe of the cliff that forms the western part of this section has resulted in there being negligible cliff recession over the long term. The continued presence of these defences would result in there	The continued presence of defences along the toe of the cliff would result in negligible cliff recession in this area between 2025 and 2055. This will restrict some inputs of sediment into the system, but the cliffs here are low and therefore not a	Cliff erosion would continue to be negligible as a result of the continued protection of the cliff toe between 2055 and 2105. As sea levels rise, beach narrowing could continue even though sediment should continue

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	being negligible cliff erosion to 2025. The beach fronting this section, including the spit that extends across the mouth of the Otter estuary, has been stable over the long term as a result of continued sediment supply from cliff erosion to the west. The spit should continue to be stable in the future. The spit across the Otter estuary is subject to temporary breaching during high river flow events every 20-30 years. As such, the probability of such an event occurring could increase throughout this period.	significant source of sediment. Sediment will continue to be supplied from the west, but due to sea level rise there could be beach steepening and narrowing in front of the seawall. It is anticipated that there will be a need to increase the size of the seawall along this section during this period to take account of future sea level. Other new defences with possibly control structures and/or beach recharge could also be required during this period to maintain current levels of protection. Any cross-shore structures would, however, have an impact on the spit. The probability of a high river flow event causing a temporary breach of the spit across the mouth of the Otter estuary would increase during this period. Where gabions are present, these would help reduce this risk.	to be supplied from the west (up to Straight Point). New defences with control structures and/or beach recharge could be required during this period in order to maintain current levels of protection. There would be continued transport of sediment toward the spit resulting in elongation and recurve into the estuary. The probability of a high river flow event causing a temporary breach of the spit across the mouth of the Otter estuary would continue to increase during this period. Migration of the spit in response to sea level rise would be prevented along the gabion-protected section. There could be an increased risk of breach between the defended section and mobile section.
Budleigh Salterton (West) to Straight Point	There are no defences present along this section.	No defences.	No defences.
	The cliffs along this section are up to 130m at the western end and experience very infrequent complex landslide failures every 100 to 250 years. The majority of this section experiences small scale failures much more frequently, with events less than every 10 years occurring as a result of geological factors and undercutting by wave action at the cliff toe. The underlying rate of recession along this section is predicted to result in the erosion of about 7m of cliff by 2025.	Cliff erosion is expected to continue as historically, although sea level rise could begin to lead to this rate increasing during this period, with total erosion by 2055 of about 20m predicted along much of this section. Towards Straight Point, the nature of cliffs changes and recession is only as a result of infrequent small scale cliff falls, and so in this area 0 to 10m of recession is predicted by 2055.	Erosion of the cliffs would continue as observed historically, although sea level rise is likely to lead to this rate increasing during this period, with total erosion of 40 to 55m predicted by 2105. Towards Straight Point, the nature of cliffs changes and recession is only as a result of infrequent small scale cliff falls, and so in this area 0 to 10m of recession is predicted by 2105. Beaches are likely to be maintained by the input

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	Towards Straight Point, the nature of cliffs changes and recession is only as a result of infrequent small scale cliff falls, and so in this area 0 to 10m of recession is predicted by 2025. The continued erosion of mudstones, sandstones and pebbles beds provides material to the local beach stock that is then transported eastwards along the shoreline by littoral processes to the spit across the mouth of the Otter estuary.	Sea level rise would lead to the narrowing of the beach, which in turn would result in increased wave exposure of the cliff toe and therefore in a slightly increased rate of erosion. This erosion would supply beach sediment to the beaches, thus maintaining beaches and reducing the rate of erosion slightly. Erosion of these cliffs is also an important source of sediment to the Budleigh Salterton frontage. The clay-rich cliffs towards the western end of this section are expected to be more sensitive to sea level rise and any increased in precipitation, and the frequency of cliff failure events in this area could increase in the future.	of new sediment though cliff erosion, although some narrowing could occur. The clay-rich cliffs towards the western end of this section are expected to be more sensitive to sea level rise and any increase in precipitation, potentially leading to an increase in the frequency of cliff failure events in this area in the future, resulting in additional localised loss of less than 10m per event. There is a risk that relict landslides could be reactivated.
Straight Point to Orcombe Rocks	There are no defences present along this section.	No defences.	No defences.
	The beaches along this stretch to the west are a different composition from those to the east in that they are predominantly composed of sand. The cliffs along this section experience slow erosion as a result of small scale cliff failure events about every 10 years. This is expected to continue to 2025, with erosion of the cliffs at the back of Sandy Bay predicted to erode by 3 to 5m over this period. The cliffs at Orcombe Rocks have historically eroded slightly more rapidly, possibly as a result of reduced cliff toe protection by a lack of beach compared to the rest of this section. As such these cliffs are predicted to erode by about 5m by	Continued cliff recession would occur as historically at a rate of up to about 0.4m/yr, although sea level rise could begin to lead to this rate increasing during this period, with total erosion of the cliffs at the back of most of Sandy Bay predicted to be between 10 and 15m by 2055, whilst towards Orcombe Rocks, total erosion of about 15m is predicted over the same period. The erosion of the cliffs would continue to supply sediment to the local beach, therefore a narrow beach is likely to remain, despite rising sea levels.	Continued cliff recession would occur as historically at a rate of up to about 0.4m/yr, although sea level rise could begin to lead to this rate increasing during this period, with total erosion of the cliffs along this section predicted to be between 19 and 46m by 2105. The erosion of the cliffs would continue to supply sand to the local beach stock, helping to maintain a narrow beach at the toe of the cliffs.

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	2025. Here, the erosion of the cliffs would continue to supply sediment to the local sandy beaches, therefore a beach will be maintained here despite little or no littoral input.		
Orcombe Rocks to Exmouth Point	Seawalls and esplanade protect both the cliff toe and areas of low-lying land, including two small areas of relict dune systems, along the length of the Exmouth part of this section.	Upgrade of the seawalls along the Exmouth part of this section is anticipated to be required during this period in order to maintain current levels of protection.	Upgrade of the seawalls along the Exmouth part of this section could be required during this period in order to maintain current levels of protection.
	The seawall at Exmouth at its eastern end prevents erosion of the cliff toe. This has resulted in negligible recession of the cliffs over the past century. Towards the Exe estuary, the seawall fronting Exmouth protects low-lying land from flooding. There will therefore be no change in shoreline position during this period. The defences have also prevented the local input of sediment to the beach system from cliff erosion. There is also limited sediment input from the east (with Orcombe Rocks reducing some transport, but also Straight Point being a barrier to littoral drift). The beach levels that front the seawalls at Exmouth have historically fluctuated, although in recent years has experienced a trend of erosion. This trend is expected to continue.	There would continue to be a lack of sediment input from cliff erosion at Exmouth and littoral transport from the east. Along the Exmouth frontage coastal squeeze is predicted due to the lack of sediment input and increasing sea levels. New defences possibly including control structures and/or beach recharge would be likely to be required during this period in order to maintain current levels of protection. This could have an impact on the estuary by restricting its ability to adapt to rising sea levels and changes in hydrology resulting from future climate change.	Rising sea levels combined with a lack of sediment input would be expected to cause narrowing and steepening of the beach fronting Exmouth. New defences possibly including control structures and/or beach recharge may be likely to be required during this period in order to maintain current levels of protection.
Exe Estuary	Within the Exe estuary, some defences may need to be upgraded towards the end of this period in	Upgrade of the majority of defences within the Exe estuary is anticipated to be required during	Upgrade of the defences within the Exe estuary could be required during this period in order to

<table>
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<tr><td></td><td>order to maintain current levels of protection.</td><td>this period in order to maintain current levels of protection.</td><td>maintain current levels of protection.</td></tr>
<tr><td></td><td>The Exe Estuary is also believed to be a sink for sediment, with Pole Sand having steadily increased in size since 1853. It is anticipated that there would be continued feed to the flood and ebb deltas at the mouth of the estuary and therefore these are likely to remain stable.

There is likely to be a need to construct new defences within the Exe estuary during this period in order to maintain current levels of protection. This could have an impact on the estuary by restricting its ability to adapt to rising sea levels and changes in hydrology resulting from future climate change, although it is unlikely to be significant during this period.</td><td>New defences within the estuary would be likely to be required during this period in order to maintain current levels of protection. This could have an impact on the estuary by restricting its ability to adapt to rising sea levels and changes in hydrology resulting from future climate change. This could result in the loss of intertidal areas if sedimentation is unable to keep pace with rising sea levels.

There would be continued feed to the flood and ebb deltas at the mouth of the estuary and therefore these are likely to remain stable.</td><td>New defences within the Exe estuary may be likely to be required during this period in order to maintain current levels of protection. This could have an impact on the estuary by restricting its ability to adapt to rising sea levels and changes in hydrology resulting from future climate change. This could result in the loss of intertidal areas if sedimentation is unable to keep pace with rising sea levels.

There would be continued feed to the flood and ebb deltas at the mouth of the estuary and therefore these are likely to remain stable.</td></tr>
<tr><td rowspan="2">Dawlish Warren to Langstone Rock</td><td>The proximal end and central section of Dawlish Warren spit is presently protected by groynes and gabions (some of which are currently buried). These could also require upgrading during this period.

Between Dawlish Warren and Langstone Rock the coast is protected by a sea wall and rock armour.</td><td>The defences at the proximal end of Dawlish Warren could also require upgrading during this period in order to hold this part of the spit in its present location.</td><td>The defences at the proximal end of Dawlish Warren could also require upgrading during this period in order to hold this part of the spit in its present location.</td></tr>
<tr><td>The Dawlish Warren spit across the western part of the mouth of the Exe estuary is defended at its proximal end, effectively anchoring the spit to the land. The distal end is practically undefended, with former defences having been buried, and so</td><td>The natural response of the Dawlish Warren spit would be to migrate landwards, although further elongation and re-curving of the spit would be prevented by the fast ebb tide flows. There would be continued erosion of the spit at the proximal</td><td>Rising sea levels combined with a lack of sediment input would be expected to cause narrowing and steepening of the beach at the western end of Dawlish Warren.</td></tr>
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<tr><td></td><td>behaves more naturally. Historically this spit has fluctuated greatly, and although the distal end has been accreting in recent years due to west to east sediment drift, its evolution is strongly linked to complex nearshore sediment circulation patterns.

The erosional trend at the western end of the spit is expected to continue due to the net west to east littoral drift and lack of sediment input from the east. Continued accretion of the spit is predicted at the distal end, however further elongation and re-curving of the spit would be prevented by the fast ebb tide flows that are caused by the presence of the docks on the Exmouth side of the estuary mouth.

However, the distal end has historically been shown to experience periodic rapid erosion in response to south-easterly storm events. Whilst it is not possible to predict if such an event would occur during this period, if it were to occur then there would be an increased risk of flooding to the land behind the spit within the Exe estuary due to greater exposure to wave action.

To the south-west of Dawlish Warren, erosion is prevented by the seawall and rock armour therefore there will be no change in shoreline position.

There is also little or no sediment input from the west past Langstone Rock</td><td>end with accretion at the distal end.

However, the distal end has historically been shown to experience periodic rapid erosion in response to south-easterly storm events. Whilst it is not possible to predict if such an event would occur during this period, if it were to occur then there would be an increased risk of flooding to the land behind the spit within the Exe estuary due to greater exposure to wave action.

The landward migration of the spit would be prevented along the defended section resulting in a potential pinch point where defences stop. This corresponds with the narrowest part of the spit, and it is possible that a breach could occur during this period, although it is uncertain exactly when this may occur at this time.

To the south-west of Dawlish Warren, erosion is prevented by the seawall and rock armour therefore there will be no change in shoreline position, although these defences may need upgrading to maintain the current level of protection. These defences and the breakwater at Langstone Point prevent alongshore feed to this frontage.</td><td>New defences possibly including control structures and/or beach recharge may be likely to be required during this period in order to maintain current levels of protection. Along Dawlish Warren any improvement of defences along the western stretch could increase the pressure along the central section, where defences stop. A breach is likely to occur between the eastern and western sections of the spit during this period.

The distal end has historically been shown to experience periodic rapid erosion in response to south-easterly storm events. Whilst it is not possible to predict if such an event would occur during this period, if it were to occur then there would be an increased risk of flooding to the land behind the spit within the Exe estuary due to greater exposure to wave action.

To the south-west of Dawlish Warren, erosion is prevented by the seawall and rock armour therefore there will be no change in shoreline position, although these defences may need upgrading to maintain the current level of protection. These defences and the breakwater at Langstone Point prevent alongshore feed to this frontage.</td></tr>
<tr><td>Langstone Rock</td><td>A seawall extends along this section as protection</td><td>Upgrade of the defences is likely to be required at</td><td>Upgrade of the defences could be required during</td></tr>
</table>

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
to Coryton Cove	to the railway line. The beach fronting the seawall is controlled by groynes and breakwaters.	the beginning of this period in order to maintain the current level of protection.	this period in order to maintain the current level of protection.
	The presence of the seawall prevents erosion of the cliff toe along this section and has resulted in negligible cliff recession occurring over the past century or more. Therefore there will be no change in shoreline position, and in turn a lack of sediment supply to the local beaches. Despite the presence of the control structures, the beach fronting this section has a long term trend of erosion and narrowing. The defences along this section have prevented any input of sediment through cliff erosion, but also sit several metres in front of the natural cliffline. The trend of erosion and narrowing would continue during this period.	There would be no change in shoreline position, due to the defences. The issue of beach narrowing will continue to be an important, with most of the beach likely to disappear during this period, due to lack of sediment input, sea level rise and the defences preventing any shoreline retreat. Defences will have to be upgraded to cope with the increased pressure and risk of overtopping which will result.	There would be no change in shoreline position, due to the defences. It is unlikely that any beaches would be present by this period and therefore there would be increased exposure and therefore pressure on existing defences. New defences would therefore be required during this period in order to reduce the risk to the defences. There is already limited interaction with adjacent shorelines therefore this would not have an impact up or downdrift.
Coryton Cove to Holcombe	Short lengths of seawall that protect the railway line are located at the backs of small pocket beaches that indent this section.	Upgrade of the defences is likely to be required during this period in order to maintain the current level of protection.	Upgrade of the defences could be required during this period in order to maintain the current level of protection.
	This section consists of small cliffed headlands indented with small pocket beaches. These beaches have been stable over the loner term and this is expected to continue to 2025, although coastal squeeze could become increasingly important towards the end of this period. The cliffed headlands are undefended and expected to continue to erode as historically as a result of infrequent small scale cliff failures events,	The cliffed headlands would continue to erode as historically at a rate of about 0.1m/yr due to infrequent small scale cliff failure events, although sea level rise could begin to lead to an increase in this rate during this period, with total erosion of 2 to 6m predicted by 2055. Along the rest of the coast erosion would be prevented by the presence of seawalls. It is likely that the small pocket beaches would narrow as a result of lack of sediment input,	Continued erosion of the cliffed headlands as a result of infrequent small scale cliff failure events is expected to occur, although sea level rise could begin to lead to an increase in this rate during this period, with total erosion of 5 to 30m predicted by 2105. Along the rest of the coast erosion would be prevented by the presence of seawalls. As sea levels rise, the small pocket beaches could narrow and in places disappear as a result of lack of sediment input, defences preventing retreat

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	**Medium Term (to 2055)**	**Long Term (to 2105)**
	with total erosion of 1 to 2m predicted by 2025.	defences preventing retreat and sea level rise. This would increase exposure of the defences.	and sea level rise. This would increase exposure of the defences and mean that they would require upgrading to provide current levels of protection.
Holcombe to Sprey Point	A seawall extends along this section as protection to the railway line, which sits at the toe of the cliffs.	Upgrade of the defences is likely to be required at the beginning of this period in order to maintain the current level of protection.	Upgrade of the defences could be required during this period in order to maintain the current level of protection.
	The presence of the seawall prevents erosion of the cliff toe along this section and has resulted in negligible cliff recession occurring over the past century or more, and in turn a lack of sediment supply to the local beaches. This situation is expected to continue to 2025. The beach fronting the seawall has a long term trend of erosion and narrowing. Coastal squeeze as a result of sea level rise is therefore likely to become increasingly significant during this period to 2025.	Continued defence of the cliff toe would result in negligible cliff recession between 2025 and 2055 and so provide no sediment to the local beach. Sea level rise could cause further narrowing of the beach. This would put increased pressure on the existing defences and new defences, possibly including control structures and/or beach recharge, would likely be required in the early part of this period.	Continued defence of the cliff toe would result in negligible cliff recession between 2055 and 2105 and so provide no sediment to the local beach. Due to sea level rise it is expected that there would be no beach fronting the defences, which would have obvious impacts on the current defences. Therefore, new defences possibly including control structures and/or beach recharge could be required during this period.
Sprey Point to Teignmouth Pier	A seawall protects the railway line along the northern part of this section, and provides flood protection to low-lying land towards Teignmouth Pier.	Upgrade of the defences is likely to be required during this period in order to maintain the current level of protection.	Upgrade of the defences could be required during this period in order to maintain the current level of protection.
	The presence of the seawall prevents erosion of the cliff toe along this section and has resulted in negligible cliff recession occurring over the past century or more, and in turn a lack of sediment supply to the local beaches. This situation is expected to continue to 2025, although very small scale, localised landslides could occur as a result	The continued protection of the cliff toe in the northern part of this section would result in negligible cliff recession, although some localised small scale cliff failures could occur as a result of elevated groundwater. The beach along the northern part would be expected to narrow as sea levels rise, and new	Much as for the Short and Medium Term. Negligible cliff recession would be expected, other than occasional localised small scale cliff failures as a result of elevated groundwater levels. As sea levels rise, the beaches along this section backed by seawalls are expected to narrow and steepen, and could possibly disappear in places

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	of elevated groundwater conditions. The beach fronting the seawall in the northern part of this section has a long term trend of erosion and narrowing. Coastal squeeze as a result of sea level rise is therefore likely to become increasingly significant during this period to 2025. The beach towards the Teignmouth Pier has historically fluctuated as part of a cyclic sediment transport regime that exists in this area. This is expected to continue to 2025.	defences possibly including control structures and/or beach recharge are anticipated to be required during this period in order to reduce the risk to the defences. The beach fronting Teignmouth towards the pier would be expected to continue to fluctuate as part of the cyclic sediment transport system, although sea level rise could cause some narrowing of the beach in the longer term as it is prevented from adapting by the seawall that backs it.	due to insufficient input of new sediment and the fact that their seaward migration is prevented. New defences including possibly control structures and/or beach recharge may be required during this period in order to maintain current levels of protection.
Teign Estuary	A seawall protects the railway line along the northern side of the Teign estuary, whilst along the open coast a separate seawall provides flood protection to low-lying land towards the mouth of the Teign estuary.	Upgrade of the defences is likely to be required during this period in order to maintain the current level of protection.	Upgrade of the defences could be required during this period in order to maintain the current level of protection.
	The beach towards the Teign estuary mouth has historically fluctuated as part of a cyclic sediment transport regime that exists in this area. This is expected to continue to 2025. The Teign Estuary itself is likely to maintain its current form during this period, assuming continued riverine sediment inputs continue.	The beach fronting Teignmouth towards the mouth of the Teign estuary would be expected to continue to fluctuate as part of the cyclic sediment transport system, although sea level rise could cause some narrowing of the beach in the longer term as it is prevented from adapting by the seawall that backs it. The Teign Estuary would be unable to translate landwards in response to sea level rise during this period due to the constraints of human intervention and steeply rising valley sides where no defences are present. It is therefore anticipated that the estuary would accrete	As sea levels rise, the beaches along this section backed by seawalls are expected to narrow and steepen, and could possibly disappear in places due to insufficient input of new sediment and the fact that their seaward migration is prevented. New defences including possibly control structures and/or beach recharge may be required during this period in order to maintain current levels of protection. The Teign Estuary would be unable to translate landwards in response to sea level rise during this period due to the constraints of human

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
		vertically at a rate keeping pace with sea level rise whilst maintaining its present form during this period.	intervention and steeply rising valley sides where no defences are present. It is therefore anticipated that the estuary would accrete vertically at a rate keeping pace with sea level rise whilst maintaining its present form during this period.
Shaldon (The Ness) to Petit Tor Point	The majority of the coast is undefended but there are several short lengths of wall, associated with provision of facilities, located at the back of small pocket beaches along this section.	It is anticipated that the short lengths of wall along this section would require upgrading during this period in order to maintain current levels of protection.	Upgrade of the walls at the back of pocket beaches could be required during this period in order to maintain current levels of protection.
	Much of this section consists of relatively resistant rock that has eroded very little over the past century. This is expected to continue in the short term, with total erosion of about 2m predicted by 2025. The short lengths of wall located at the back of small pocket beaches that indent this section serve to prevent erosion of the cliff toe very locally, although they are unlikely to significantly inhibit supply of sediment to the local beaches. Narrow beaches may be retained as small pocket beaches, if there is sufficient local sediment input from the sandstone cliffs.	Slow cliff erosion would continue as historically at a rate of about 0.2m/yr, although the effect of sea level rise could result in this rate increasing during this period, with total erosion of up to 7m predicted by 2055. As sea levels rise some of the pocket beaches could become submerged as the rate of cliff erosion does not keep pace with the accelerated rate of sea level rise. Other beaches may remain if there is sufficient local erosion to maintain the beaches.	Slow cliff erosion would continue as historically at a rate of about 0.2m/yr, although the effect of sea level rise could result in this rate increasing during this period, with total erosion of 10 to 25m predicted by 2105. Many of the small pocket beaches will have become submerged due to accelerated sea level rise meaning that cliffs here will plunge directly into the sea. This may result in a slight increase in erosion rates, but in general the rate of erosion is determined by the relatively resistant geology.
Petit Tor Point to Hope's Nose	Much of this cliffed frontage is unprotected, but within the small pocket beaches there are a range of structures including seawalls and revetments.	Upgrade of defences is anticipated to be required during this period in order to maintain current levels of protection.	Upgrade of defences may be required during this period in order to maintain current levels of protection.
	The unprotected sandstone cliffs have eroded slowly in the past as a result of infrequent and	Slow erosion of the unprotected cliffs would continue as historically at a rate of about	Slow erosion of the unprotected cliffs would continue as historically at a rate of about

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	small scale cliff failures. This is expected to continue during this period, with total erosion of between 3 and 10m predicted by 2025 along this section. Along Oddicombe Beach there are defences in front of the cliff toe which protects the lift and facilities at the back of the beach. These also serve to prevent any local release of sediment from cliff erosion. Here beaches will continue to narrow and steepened, as experienced historically. There is a similar situation at Redgate Beach. Any impacts if defences are only felt very locally as these pocket beaches are not connected.	0.15m/yr, although the effect of rising sea level would have varying impacts depending upon the nature of the cliffs, with total erosion of between 7 and 10m predicted by 2055. Narrowing beaches in front of the existing defences would become an increasing issue due to accelerated sea level rise. This could necessitate upgrading of the defences.	0.15m/yr, although the effect of rising sea level would have varying impacts depending upon the nature of the cliffs, with total erosion of 10 to 15m predicted by 2105 along most of this section, but rising to 15 to 25m of predicted erosion at Walls Hill by 2105. As sea levels rise and with insufficient input of sediment from cliff erosion, the beaches are likely to disappear with water levels up to the toe of the defences, due to accelerated sea level rise. This could result in further improvements to the defences being required.
Hope's Nose to Livermead Head	A range of defences and other structures are located along parts of the cliff toe throughout this section, including seawalls, revetments and breakwaters associated with Torquay Marina.	Upgrade of defences along this section is likely to be required during this period in order to maintain current levels of protection.	Upgrade of defences along this section could be required during this period in order to maintain current levels of protection.
	There has been very little recession of the cliffs that are protected at the base by the various defences located along this section. The unprotected cliffs consist of relatively resistant rocks that have historically eroded very slowly. This is expected to continue to 2025, with total erosion of 1 to 10m predicted over this period at rates of about 0.05 to 0.25m/yr, depending upon specific local geology and the occurrence of small scale, localised cliff failure	Cliff erosion of the unprotected cliffs along this section would continue only very slowly as has occurred historically, with total erosion of 2 to 13m predicted by 2055 depending upon specific local geology and the occurrence of small scale, localised cliff failure events. The continued presence of defences along the remaining parts of this section of coast would result in no change in cliff position over this period in these areas.	Continued slow cliff erosion of the unprotected cliffs would continue as historically, with total erosion of between 5 and 30m predicted by 2105 depending upon specific local geology and the occurrence of small scale, localised cliff failure events. The continued presence of defences along the remaining parts of this section of coast would result in no change in cliff position over this period in these areas.

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	events. The beaches along this section of coast have been relatively stable over the long term, and this is expected to continue during this period. Coastal squeeze as a result of sea level rise could however become increasingly an issue towards the end of this period.	Sea level rise would be expected to cause narrowing and steepening of the beaches along this section where they are prevented from retreating by defences and receive no new sediment input from local cliff erosion. This could result in an increased flood risk to areas where defences are backed by low-lying land, and new defences possibly including beach recharge may be required during this period to maintain current levels of protection.	As sea levels rise, it is expected that there would be further narrowing and steepening of the beaches along this section due to no new inputs of sediment. Unless defences were upgraded (possibly including beach recharge), this could increase flood risk to areas where defences are backed by low-lying land. It is unlikely that any changes along this frontage would impact adjacent stretches of coast, as Livermead Head and Hope's Nose prevent sediment transport out of this frontage.
Livermead Head to Roundham Head	Defences are located along the majority of this section that protect low-lying land from flooding.	Upgrade of the defences is anticipated to be required during this period to maintain current levels of protection.	Upgrade of the defences could be required during this period to maintain current levels of protection.
	The majority of this section is defended, preventing flooding of the low-lying land behind. The beaches that front the defences have mainly been stable over the long term despite receiving little new sediment from erosion of adjacent cliffs. This situation is expected to continue to 2025, although coastal squeeze as a result of sea level rise could become increasingly important during this period. The beaches are divided by small rock headlands that prevent transport of beach material between adjacent beaches. These rock headlands are cliffed and have historically eroded very slowly with only localised erosion of between 0 and 1m predicted by 2025 around Hollicombe Head.	Sea level rise would lead to the continued narrowing and steepening of the beaches fronting the defences and an associated increase in risk of flooding of low-lying land behind. New defences possibly including beach recharge would likely be required during this period in order to maintain current levels of protection. The cliffed headlands that divide the beaches along this section would be expected to continue to experience negligible recession as has occurred historically, with only localised erosion of 0 to 4m predicted by 2055 around Hollicombe Head	As sea levels rise, there is expected to be further narrowing and steepening of the beaches along this section due to no new inputs of sediment. This could result in an increased flood risk to areas where defences are backed by low-lying land, and further upgrade of defences possibly including beach recharge may be required during this period to maintain current levels of protection. The cliffed headlands that divide the beaches along this section would be expected to continue to experience negligible recession as has occurred historically, with only localised erosion of 0 to 8m predicted by 2105 around Hollicombe Head.

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
Goodrington Sands to Broadsands	Seawalls are located at the back of the two beaches along this section. At Goodrington the wall protects low-lying land from flooding whilst at Broadsands it serves to protect the cliff toe from erosion. It is anticipated that parts of the seawalls at both Goodrington and Broadsands would need to be upgraded by the end of this period in order to maintain current levels of protection.	Upgrade of the remaining defences located at the back of the two beaches along this section is anticipated to be required during this period in order to maintain current levels of protection.	Upgrade of the defences along this section may be required during this period in order to maintain current levels of protection.
	The beaches at Goodrington Sands and Broadsands have been relatively stable over the long term and this is expected to continue to 2025, although beach narrowing as a result of sea level rise could become increasingly important during this period due to a lack of new sediment input from local cliff erosion and the defences preventing landward migration of the beach. The cliffs along this section very resistant and have eroded very little over the long term. This is expected to continue to 2025, with negligible cliff recession predicted.	Sea level rise would lead to the continued narrowing and steepening of the beaches fronting the defences and an associated increase in risk of flooding of low-lying land behind Goodrington Sands. New defences possibly including beach recharge would likely be required during this period in order to maintain current levels of protection. Cliff recession would continue to occur very slowly as historically, with negligible erosion predicted between 2025 and 2055.	As sea levels rise, there is expected to be further narrowing and steepening of the beaches along this section due to no new inputs of sediment and the beaches being prevented from migrating landwards due to the defences. . This could result in an increased flood risk to areas where defences are backed by low-lying land. Therefore, new defences possibly including beach recharge would likely be required during this period in order to maintain current levels of protection. Cliff recession would continue to occur very slowly as historically, with negligible erosion predicted between 2055 and 2105.
Broadsands to Churston Cove (East)	There are no defences present along the shoreline of this section, although the eastern part of this section may be affected by the presence of the Brixham Harbour breakwater farther east.	No defences.	No Defences.

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	**Medium Term (to 2055)**	**Long Term (to 2105)**
	The majority of this section consists of hard rock cliffs that plunge directly into the sea and that are resistant to erosion and have eroded very little over the long term. This is expected to continue to 2025, with negligible cliff recession predicted. The very small pocket beaches at Elberry and Churston Coves have been stable and slowly accreting over the long term, with material likely derived from local cliff erosion. This is expected to continue to 2025.	There would continue to be negligible erosion of the hard rock cliffs between 2025 and 2055. Depending upon the rate of sediment supply from cliff erosion to the two pocket beaches along this section, sea level rise could cause some narrowing and steepening of the beaches.	There would continue to be negligible erosion of the hard rock cliffs between 2055 and 2105. As sea levels rise, the small pocket beaches could become narrower and steeper if there is insufficient material supplied from erosion of local cliffs in the future.
Churston Cove (East) to Berry Head	A range of defences are located around Brixham, including the Brixham Harbour breakwater that influences wave action along the western part of this section.	Upgrade of the defences along this section is anticipated to be required during this period in order to maintain current levels of protection.	Upgrade of the defences along this section may be required during this period in order to maintain current levels of protection.
	Within Brixham Harbour the cliffline has been modified by quarrying and defences and defences are in place to protect assets between the coast and the quarried cliff face. The presence of defences along this section prevents wave action at the base of the cliffs and protects the properties constructed in front of the cliffs. These backing cliffs consist of hard rock and are very resistant to erosion. The undefended cliffs that make up the rest of this section also consist of very hard rock and have eroded very little over the long term. This is expected to continue to 2025, with negligible cliff recession predicted.	There would continue to be very little erosion of the hard rock cliffs that make up this section, with negligible cliff recession predicted between 2025 and 2055. Erosion of the defended sections would be prevented, but rising sea levels could mean improvements to the defences would be required to prevent increased overtopping.	There would continue to be very little erosion of the hard rock cliffs that make up this section, with negligible cliff recession predicted between 2055 and 2105. Erosion of the defended sections would be prevented, but rising sea levels could mean improvements to the defences would be required.

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
Berry Head to Sharkham Point	There are no defences present along this section.	No defences.	No defences.
	The cliffs along this section vary in character from resistant limestones to more erodible shales. Small scale landslide events occur about every 10-100 years within the shale cliffs as a result of marine action at the cliff toe and elevated groundwater conditions. This situation is expected to continue during this period, with total erosion along the shale cliffs of between 1 and 3m predicted by 2025, but negligible change expected along the limestone cliff sections. The small pocket beach at St Mary's Bay is fed by sediment derived from local cliff erosion as there is no other sediment source available. This would be expected to continue to 2025.	Erosion of the shale cliffs that back St Mary's Bay is driven by both marine erosion of the toe and heavy rain, so they are sensitive to both changes in precipitation and sea level. Due to uncertainty in the possible future changes in precipitation, however, no direct account has been taken of this in the predictions. Although sea level rise could increase the rate of cliff erosion, release of beach material will help to counter this effect and should ensure that a narrow beach remains at this location. Total erosion of between 7 and 10m is predicted along St Mary's Bay by 2055, with the remaining shale cliffs along this frontage experiencing erosion of 4 to 7m by 2055, although the limestone headlands of Sharkham Point and Durl Head are expected to experience negligible change.	The more erodible shale cliffs that occur along St Mary's Bay are sensitive to climate change and the rate of erosion could increase both due to sea level rise and an increase in rainfall. Due to uncertainty in the possible future changes in precipitation, no direct account has been taken of this in the predictions. As sea levels rise, the beach may narrow and result in increased erosion of the backing cliffs. This, in turn, will release beach sediment and reduce cliff exposure. This may slow erosion, but erosion is still likely to be at a greater rate than historically, due to the acceleration of sea level rise proposed during this period. Total erosion of between 15 and 35m is predicted along St Mary's Bay by 2105, with the remaining shale cliffs along this frontage experiencing erosion of 8 to 28m by 2105, although the limestone headlands of Sharkham Point and Durl Head are expected to experience negligible change.
Sharkham Point to Blackstone Point	There are no defences present along this section.	No defences.	No defences.
	This section is largely cliffed with isolated pocket beaches separated by rocky headlands, which plunge into the sea. The cliffs are relatively resistant to erosion and have undergone only very slow recession over	Very slow cliff erosion would continue by 2055, with total erosion of between 2 and 10m predicted over this period depending on the occurrence of small scale cliff failure events during this period.	Erosion of the cliffs would continue to occur at historically slow rates, with total erosion of between 5 and 10m predicted by 2105 depending on the occurrence of small scale cliff failure events during this period.

<table>
<tr><th rowspan="2">Location</th><th colspan="3">Predicted Change for 'With Present Management'</th></tr>
<tr><th>Short Term (to 2025)</th><th>Medium Term (to 2055)</th><th>Long Term (to 2105)</th></tr>
<tr><td></td><td>the long term. This is expected to continue during this period with total erosion of between 1 and 10m predicted by 2025 depending on the occurrence of small scale cliff failure events during this period.

The small pocket beaches that indent this section of coast are supplied with sediment from local cliff erosion as there is no other sediment source available.

The Dart Estuary is a ria estuary characterised by a deep channel confined by steep resistant cliffs. Therefore, no change in the estuary form is predicted.</td><td>Sea level rise could also result in the narrowing and steepening of the small pocket beaches along this section as it is unlikely that sufficient sediment would be released from the relatively resistant backing cliffs.

At Man Sands, beach narrowing could result in more frequent localised flooding of the low-lying area behind.

There would be no change to the Dart Estuary.</td><td>As sea levels rise, the small pocket beaches along this section could narrow further and ultimately could be lost where they are backed by steep resistant cliffs.

At Man Sands, there could be some rollback possible in front of the low-lying hinterland, but beach narrowing could result in more frequent localised flooding of this low-lying area behind.

There would be no change to the Dart Estuary.</td></tr>
<tr><td rowspan="2">Blackstone Point to Stoke Fleming</td><td>There are no defences present along this section.</td><td>No defences.</td><td>No defences.</td></tr>
<tr><td>This section is largely cliffed with isolated pocket beaches separated by rocky headlands.

The cliffs historically have experienced varying rates of recession, dependent upon local geological characteristics. This is expected to continue during this period with total erosion of between 2 and 10m predicted by 2025 at rates of about 0.2 to 0.3 m/yr combined with the occurrence of infrequent, small scale cliff failure events that result in localised increases in recession.

The small pocket beaches that indent this section of coast are supplied with sediment from local cliff erosion as there is no other sediment source</td><td>Slow, variable rates of cliff erosion, as has occurred historically, with total erosion of between 4 and 10m predicted by 2055 depending on the occurrence of small scale cliff failure events during this period.

Sea level rise could also result in the narrowing of the small pocket beaches along this section as it is unlikely that sufficient material would be supplied by the backing resistant cliffs. This would not result in more rapid erosion of the cliffs, which are relatively resistant to erosion with cliff failures controlled by geological factors.</td><td>Erosion of the cliffs would continue to occur at historically slow rates, with total erosion of about 10m predicted by 2105 depending on the occurrence of small scale cliff failure events during this period.

As sea levels rise, the small pocket beaches along this section could narrow and possibly become submerged as it is unlikely that sufficient material would be supplied by the backing resistant cliffs. This would not result in more rapid erosion of the cliffs, which are relatively resistant to erosion with cliff failures controlled by geological factors.</td></tr>
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<tr><td rowspan="2">Stoke Fleming to Strete</td><td>The only defences along this section are located at the back of Blackpool Sands.</td><td>Upgrade of the defences at Blackpool Sands could be required during this period in order to maintain current levels of protection.</td><td>Upgrade of the defences at Blackpool Sands could be required during this period in order to maintain current levels of protection.</td></tr>
<tr><td>This section is largely cliffed with isolated pocket beaches separated by rocky headlands, the largest of which is Blackpool Sands, which fronts a small area of low-lying land which is protected against flooding by a short length of defence.

The beach here has gradually narrowed over the long term, suggesting a trend of erosion as a result of insufficient sediment supply from local cliff erosion, but rising sea levels.

It is predicted that this would continue to occur to 2025, and that coastal squeeze as a result of sea level rise would be likely to become increasingly important during this period.

The cliffs historically have experienced varying rates of recession, dependent upon local geological characteristics. This is expected to continue during this period with total erosion of between 2 and 10m predicted by 2025.</td><td>Sea level rise would continue to cause narrowing and steepening of the beaches along this section. It is possible that the very small pocket beaches that are backed by resistant cliffs could disappear.

At Blackpool Sands the narrowing trend is expected to continue and may accelerate as sea level rises and this could result in an increased risk of localised flooding unless the defences are upgraded in response. Any potential roll back of the beach in response to higher sea levels would be prohibited by the current defences and therefore the issue of beach narrowing would be exacerbated slightly.

Cliff erosion would be expected to continue at similar rates to historically, with total erosion of between 4 and 10m predicted by 2055.</td><td>As sea levels rise it is expected that the beaches along this section would narrow further and could disappear in places due to insufficient sediment supply and the resistant nature of the backing cliffs. At Blackpool Sands, beach narrowing and higher sea levels would increase the risk of localised flooding, unless defences were improved in response.

Erosion of the cliffs would continue at similar rates to historically, with total erosion of about 10m predicted by 2105.</td></tr>
<tr><td>Strete to Limpet Rocks (Torcross)</td><td>This section is protected in parts by a range of defences including revetments and seawalls. These defences could require upgrading towards the end of this period in order to maintain current levels of protection.

The A379 coast road extends along the crest for</td><td>Upgrade of the defences along this section could be required during this period in order to maintain current levels of protection.

It may become necessary to provide an alternative route to the A379 as unprotected</td><td>Upgrade of the defences along this section could be required during this period in order to maintain current levels of protection.

Rerouting of the A379 would probably be required, if not already undertaken in the medium</td></tr>
</table>

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	the length of this section, although it is not all protected by defences.	sections are eroded.	term.
	The dominant feature of this section is the shingle barrier beach of Slapton Sands that fronts freshwater lagoons that are backed by higher ground. The water level within the lagoons is higher than the sea level on the seaward side of the barrier beach. The defences protect against flooding and also prevent the beach from rolling back. Beach levels fluctuate greatly over short time scales. However the overall trend is for a small net drift of material from south to north along this section, resulting in a long term trend of accretion towards the northern end of the beach, and a long term trend of erosion at the southern end. There is no contemporary sediment supply to the beach and no links to adjacent sections of coast and so coastal squeeze as a result of sea level rise is likely to become increasingly an issue, particularly in the areas backed by defences. The sections where the crest is topped only by the A379 would be able to rollback in response to sea level rise. A small section of cliffs at the northern end of this section would continue to erode as has occurred historically, with total erosion of between 2 and 10m predicted by 2025.	Sea level rise would be expected to cause narrowing and steepening of the beach where it is backed by defences. New defences, possibly including control structures and/or beach recharge, could be required in order to maintain current levels of protection in these areas and prevent flooding of the hinterland. The unprotected areas of beach, where only the road is present along its crest, could rollback causing partial loss of the road in the process. This could lead to a step change in the shoreline plan form and lead to increased exposure of the defended areas, particularly at Torcross. The small section of cliffs at the northern end of this section would be expected to continue to erode as historically, with total erosion by 2055 of 4 to 10m predicted depending on the occurrence of small scale cliff failure events during this period.	As sea levels rise, it would be expected that the areas of beach backed by defences would continue to narrow and steepen, and so new defences possibly including control structures and/or beach recharge could be required in order to maintain current levels of protection in these areas. Under a scenario of accelerated sea level rise, the tendency of unprotected sections of the beach would be to roll back to a position commensurate with the new sea level. This would be prevented along sections prevented by defences, resulting in accelerated beach narrowing and possible degradation of the barrier. There would therefore be an increased risk of breaching of the barrier beach itself during this period. Where sections are undefended this roll-back trend would continue, but this would put increased pressure on the adjacent defended sections all along this stretch, but particularly at the junction of undefended and defended sections. The area at Torcross Point would also become increasingly vulnerable during this period, both due to narrowing beaches and due to continuation of the south-north sediment drift. Changes along this shoreline would not impact on the adjacent sections of coast as there is little or

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
			no sediment exchange with the beaches to the south except during infrequent high energy wave events. The small section of cliffs at the northern end of this section would be expected to continue to erode as historically, with total erosion by 2105 of about 10m predicted depending on the occurrence of small scale cliff failure events during this period.
Limpet Rocks (Torcross) to Tinsey Head	Defences in the form of seawall and rock revetment are present along much of this section, providing protection against flooding and erosion.	Upgrade of the defences along this section could be required during this period in order to maintain current levels of protection.	Upgrade of the defences along this section could be required during this period in order to maintain current levels of protection.
	This section consists of an area of low-lying land backed by higher ground, fronted by a shingle barrier beach and bounded at its northern and southern ends by rock headlands. Sediment is largely confined to this section, with only infrequent transport of material to and from adjacent beaches during high energy wave events. The long term trend of the beach is one of erosion, with narrowing and steepening having occurred historically, a situation exacerbated by the presence of the defences that back the beach. There is no contemporary sediment supply to the beach and so coastal squeeze as a result of sea level rise is likely to become increasingly important towards 2025, resulting in further narrowing and steepening of the defended parts of the beach, whilst the unprotected northern	Sea level rise would be expected to cause further narrowing and steepening of the beach where it is backed by defences. New defences possibly including control structures and/or beach recharge could be required in order to maintain current levels of protection in these areas. The natural tendency for the beach ridge would be to roll back in response to sea level rise, and this could occur along the unprotected northern part of the beach. This could lead to a step change in the shoreline plan form and result in increased wave exposure of the defended southern part of this section. Erosion of the rock headlands that bound this section is expected to continue as has occurred historically, with total erosion of 10 to 12m predicted by 2055 depending on the occurrence	As sea levels rise, it would be expected that the areas of beach backed by defences would continue to narrow and steepen, and so new defences possibly including control structures and/or beach recharge could be required in order to maintain current levels of protection in these areas. Roll back of the beach ridge along the unprotected northern section would continue, in response to sea level rise and therefore the northern end of the defences could start to become a new 'headland', and an embayment could start to form between this and Limpet Rocks. This could affect the integrity of the barrier and could result in increased risk of breaching along this section, particularly at the start of the defences.

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	part could rollback onto the low-lying land behind. The rock headlands of Limpet Rocks and Tinsey Head that bound this section would be expected to erode slowly as has occurred historically, with total erosion of between 4 and 10m predicted by 2025 depending on the occurrence of small scale cliff failure events during this period. This erosion is more likely at Limpet Rocks than Tinsey Head.	of small scale cliff failure events during this period. This erosion is more likely at Limpet Rocks than Tinsey Head. These headlands would, however, remain prominent features.	To the south, in front of the defences, the beaches would be expected to continue to narrow and steepen and could disappear at the southern end of this stretch. The rock headlands that bound this section would be expected to continue to erode as historically, with total erosion by 2105 of between 10 and 25m predicted depending on the occurrence of small scale cliff failure events during this period. This erosion is more likely at Limpet Rocks than Tinsey Head.
Tinsey Head to Start Point	There are no defences present along most of this section, but there has been ad hoc rock placement at the back of Hallsands beach to protect a local development.	No defences apart from localised rock placement at Hallsands, which are assumed to remain as at present, i.e. no upgrade.	No defences apart from localised rock placement at Hallsands, which are assumed to remain as at present, i.e. no upgrade.
	The cliffs along this section consist of hard, resistant rock that has eroded very little over the long term. This is expected to continue to 2025, with negligible cliff recession predicted over this period. In places narrow beaches front the steep cliffs and these may continue to narrow during this period. At Hallsands the beach fronts a small valley, and this likely to remain in a similar form to today, although there could be steepening of the beach, which could start to undermine the rock defences here.	Negligible erosion of the hard rock cliffs that dominate this section is predicted between 2025 and 2055. Many of the narrow beaches that front the steep cliffs could become submerged under a scenario of accelerated sea level rise. At Hallsands the beach will attempt to roll landwards in response to sea level rise into the valley behind. The rock placement is unlikely to impact on this process. There could also be an increased risk of localised flooding	Negligible erosion of the hard rock cliffs that dominate this section is predicted between 2055 and 2105. At Hallsands there will continued migration of the beach in response to sea level rise, which will become increasing continued within the small valley. This would result in increased exposure and therefore erosion of the cliffs on either side of this pocket beach. There could be an increased risk of localised flooding.
Start Point to	There is a small section of defence at the back of Lannacombe Beach along this otherwise	Upgrade of the defences at the back of Lannacombe Beach could be required during this	Upgrade of the defences at the back of Lannacombe Beach could be required during this

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
Prawle Point	undefended section.	period in order to maintain current levels of protection.	period in order to maintain current levels of protection.
	The defences at the back of Lannacombe Beach, as well as the hard rock cliffs that make up the majority of this section, could result in some coastal squeeze occurring in this area as sea levels rise during this period. This section largely consists of hard, resistant rock that has eroded very little over the long term. This is expected to continue to 2025, with negligible cliff recession predicted over this period. Small scale cliff failures could occur as a result of geological factors and wave undercutting at the cliff toe, although these would be very localised and it is not possible to predict the location of such events. As such total erosion of 0 to 10m is predicted by 2025. There is no interaction between the small coves/ pocket beaches along this stretch.	There would continue to be negligible cliff recession along this section, although very localised small scale cliff failures could occur between 2025 and 2055. As such total erosion of 0 to 10m is predicted by 2055. Sea level rise could cause the narrowing of Lannacombe Beach and the other small pocket coves along this stretch.	There would continue to be negligible cliff recession along this section, although very localised small scale cliff failures could occur between 2055 and 2105. As such total erosion of 0 to 10m is predicted by 2105. As sea levels rise, there could be further submergence of remaining pocket beaches. Along the rest of the coast sea level rise will only mean that still water level sits higher up the cliff face and there is unlikely to be an acceleration in the rate of erosion.
Prawle Point to Bolt Head	Small lengths of defence are located at the back of a number of pocket beaches that indent this otherwise cliffed section.	Upgrade of the short lengths of defence along this section could be required during this period in order to maintain current levels of protection.	Upgrade of the short lengths of defence along this section could be required during this period in order to maintain current levels of protection.
	This section is dominated by hard rock cliffs that are indented with small pocket beaches. The resistant nature of the cliffs has historically resulted in very little cliff recession, although some areas are more erodible than others depending on local geological characteristics. In	The majority of the cliffs would be expected to experience only negligible erosion between 2025 and 2055. Faster rates of cliff recession within the slightly softer cliffs could occur, with a net recession of between 0 and 10m is predicted over this period.	Negligible erosion of the majority of the cliffs is expected to occur between 2055 and 2105. Faster rates of cliff recession within the slightly softer cliffs could occur, with a net recession of between 0 and 10m is predicted over this period. As sea levels rise, the small pocket beaches would

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	these localised areas of less resistant rock, erosion of 0 to 10m is predicted by 2025. The small pocket beaches fluctuate seasonally but have remained largely unchanged over the long term. These are supplied by erosion of the slightly more erodible cliffs within which they are located. There is little, if any, interaction with adjacent beaches. Coastal squeeze as a result of sea level rise is likely to become increasingly important towards 2025 if there is insufficient sediment supply to the pocket beaches from local cliff erosion. This is particularly the case for those pocket beaches, where defences prevent erosion of softer cliffs, which would otherwise have contributed beach sediment as they eroded.	Sea level rise could lead to the narrowing and possible submergence of the pocket beaches that indent the cliffs along this section, if there is insufficient supply of sediment from localised cliff erosion, or where beaches front resistant cliffs. The Kingsbridge Estuary system is largely natural and unconstrained, and it would be expected to undergo landward translation in response to rising sea levels. However, in parts of the estuary this may not be possible due to rapidly rising land. In these areas there it is likely that gradual loss of inter-tidal areas would occur.	be expected to narrow further and could disappear in places, where either resistant cliffs back the beaches or if there is insufficient supply of sediment from localised cliff erosion. The Kingsbridge Estuary system is largely natural and unconstrained, and it would be expected to undergo landward translation in response to rising sea levels. However, in parts of the estuary this may not be possible due to rapidly rising land. In these areas there it is likely that gradual loss of inter-tidal areas would occur.
Bolt Head to Bolt Tail	There are no defences present along this section.	No defences.	No defences.
	The cliffs along this section consist of hard, resistant rock that has eroded very little over the long term. This is expected to continue to 2025, with negligible cliff recession predicted over this period. As such total erosion of 0 to 10m is predicted by 2025 depending on the occurrence of small scale cliff failures.	Negligible erosion of the hard rock cliffs that dominate this section is predicted between 2025 and 2055. As such total erosion of 0 to 10m is predicted by 2055 depending on the occurrence of small scale cliff failures. Any small pocket beaches along this stretch are likely to become permanently submerged at all tidal states, due to sea level rise.	Negligible erosion of the hard rock cliffs that dominate this section is predicted between 2055 and 2105. As such total erosion of 0 to 10m is predicted by 2105 depending on the occurrence of small scale cliff failures.
Bolt Tail to Avon Estuary (East)	A small length of defence is located at the back of the beach at Thurlestone, protecting low-lying land from flooding.	Upgrade of the defence at Thurlestone Beach could be required during this period in order to maintain current levels of protection.	Upgrade of the defence at Thurlestone Beach could be required during this period in order to maintain current levels of protection.

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	**Medium Term (to 2055)**	**Long Term (to 2105)**
	The majority of this section consists of hard rock cliffs that have historically eroded very little over the long term, although there are localised areas that are slightly more erodible. This trend would continue to 2025, and a maximum erosion of between 0 and 10m is predicted in localised areas of softer cliffs over this period. Several pocket beaches indent this section, but there is little, if any, interaction between these. The largest of which is the beach at Thurlestone that fronts an area of low-lying land. Coastal squeeze as a result of sea level rise is likely to become increasingly important during this period, particularly where either defences exist, as at Thurlestone, or where beaches front resistant cliffs. At Thurlestone, this would result in an increased risk of flooding during storm events by 2025.	Cliff erosion would be limited to localised areas of slightly more erodible cliffs, with predicted erosion in these areas of 0 to 10m by 2055. Sea level rise could lead to the continued narrowing and possible submergence of the pocket beaches that front the cliffs along this section. At Thurlestone, this would result in an increased risk of flooding during storm events, and new defences could be required during this period in order to maintain current levels of protection.	Cliff erosion would be limited to localised areas of slightly more erodible cliffs, with total erosion in these areas predicted to be between 0 and 10m by 2105. Many of the pocket beaches that front the resistant cliffs will have disappeared by the end of this period, due to increases in sea level. At Thurlestone coastal squeeze would be caused by the defences holding the backshore position, but unless these defences are upgraded there would be an increased risk of flooding of the low-lying land behind during storm events.
Avon Estuary (East) to Challaborough (West)	There is a small length of defence located at the back of Challaborough Beach that protects low-lying land from flooding.	Upgrade of the defence at Challaborough Beach could be required during this period in order to maintain current levels of protection.	Upgrade of the defence at Challaborough Beach could be required during this period in order to maintain current levels of protection.
	This section contains extensive areas of sand at both the mouth of the Avon estuary and in the small beach that fronts the defences and low-lying land at Challaborough in the western part of this section. Challaborough Beach fluctuates seasonally but has been stable over the long term. This situation is	Sea level rise would continue to cause narrowing and steepening of Challaborough Beach, resulting in an increased risk of localised flooding in this area during storm events between 2025 and 2055, unless defences are upgraded. There could also be erosion, narrowing and possibly submergence of the beaches and	As sea levels rise, it would be expected that Challaborough Beach would narrow and possibly disappear between 2055 and 2105, resulting in an increased risk of localised flooding in this area during storm events, unless defences are upgraded. The beaches and tombolo around the mouth of

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	expected to continue to 2025, although coastal squeeze as a result of sea level rise could become increasingly important during this period, resulting in an increased risk of flooding during storm events by 2025. Sea level rise could also possibly result in some erosion and narrowing of the beaches around the mouth of the Avon estuary and the tombolo between the mainland and Burgh Island by 2025, features that have also historically been stable over the long term, although the channel at the mouth of the estuary has migrated from east to west over the past 100 years. The hard rock cliffs located along parts of this section have eroded very little over the long term, and this is expected to continue in the future, with negligible erosion predicted by 2025.	tombolo around the mouth of the Avon estuary in response to rising sea level. There is little or no link between the beaches therefore this would not impact on the adjacent Challaborough Beach. The hard rock cliffs would continue to erode only very slowly between 2025 and 2055, with negligible erosion predicted over this period. The dunes at Bantham Sand, which sit on top of a shore platform, would rollback in response to sea level rise, aided by net flood sediment transport that occurs over the sands. The Avon Estuary itself is largely natural and unconstrained, and would be expected to adjust to rising sea levels to maintain its current form.	the Avon estuary could also erode and narrow and possibly disappear in places in response to rising sea levels. The submergence of the tombolo during this period would leave Burgh Island permanently detached from the mainland. The hard rock cliffs would continue to erode only very slowly between 2055 and 2105, with negligible erosion predicted over this period. The Avon Estuary itself is largely natural and unconstrained, and would be expected to adjust to rising sea levels to maintain its current form.
Challaborough (West) to Wembury Point	There are no defences present along this section.	No defences.	No defences.
	The majority of this section consists of hard rock cliffs that have eroded very little over the long term, although there are localised areas that are slightly more erodible. This trend would continue to 2025, and total erosion of between 0 and 10m is predicted in localised areas over this period, whilst only the remainder erosion would be negligible. The cliffs along this section are indented with small pocket beaches that are supplied with sediment from local cliff erosion only, there is no	Cliff erosion would be limited to localised areas of slightly more erodible cliffs, with total erosion in these areas of between 0 and 10m predicted by 2055 depending on the occurrence of small scale cliff failures. Sea level rise could lead to the narrowing and possible submergence of the pocket beaches that indent the cliffs along this section, if there is insufficient supply of sediment from localised cliff erosion and where beaches front resistant cliffs. Where beaches are not present the still water	Cliff erosion would be limited to localised areas of slightly more erodible cliffs, with total erosion in these areas of 0 to 10m predicted by 2105 depending on the occurrence of small scale cliff failures. As sea levels rise, most of the small pocket beaches that indent the cliffs along this section would be expected to have disappeared, unless locally there is sufficient sediment supply from the cliffs.

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	interaction between adjacent beaches. These beaches have historically been stable over the long term, however coastal squeeze as a result of sea level rise is could become increasingly important during this period if there is insufficient sediment supply to the pocket beaches from local cliff erosion in the future. This stretch encompasses the estuaries Erme and Yealm. Both are ria type estuaries which are confined by steep cliffs. No change in the overall estuary forms are expected, although within the Erme there could be natural fluctuations in the position of the low water channel.	level will simply be higher up the cliff face. No change in the form of the Erme or Yealm is expected as they are natural and unconstrained by defences, allowing them to adjust to keep pace with rising sea levels.	No change in the form of the Erme or Yealm is expected as they are natural and unconstrained by defences, allowing them to adjust to keep pace with rising sea levels.
Wembury Point to Mount Batten Breakwater	The only defences present along this section occur at its western end in the form of the Mount Batten Breakwater, although its main effect is upon wave climate around the mouth of the Plym estuary. Part of this section is also affected by the sheltering effect of the Plymouth Breakwater within Plymouth Sound.	It is assumed that the Mount Batten and Plymouth Breakwaters would remain during this period and continue to affect wave climate within Plymouth Sound.	It is assumed that the Mount Batten and Plymouth Breakwaters would remain during this period and continue to affect wave climate within Plymouth Sound.
	The cliffs along this section consist of hard, resistant rock that has eroded very little over the long term. This is expected to continue to 2025, with negligible cliff recession predicted over this period. As such total erosion of 0 to 10m is predicted by 2025 depending on the occurrence of small scale cliff failures. This coast is geologically controlled and therefore	Negligible erosion of the hard rock cliffs that dominate this section is predicted between 2025 and 2055. As such total erosion of 0 to 10m is predicted by 2055 depending on the occurrence of small scale cliff failures. The small pocket beaches will gradually become drowned as sea level rise and shore platforms	Negligible erosion of the hard rock cliffs that dominate this section is predicted between 2055 and 2105. As such total erosion of 0 to 10m is predicted by 2105 depending on the occurrence of small scale cliff failures. Many of the small pocket beaches would have been lost in a scenario of accelerated sea level

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	would not be affected by any changes within Plymouth Sound, e.g. to the Breakwater.	become submerged. This coast is geologically controlled and therefore would not be affected by any changes within Plymouth Sound.	rise. This coast is geologically controlled and therefore would not be affected by any changes within Plymouth Sound.
Mount Batten Breakwater to Devil's Point	This section consists of a wide range of defences that protect the toe of the cliff from wave action, although a number of the defences form part of amenity features including a lido. Part of this section is also affected by the sheltering effect of the Plymouth Breakwater within Plymouth Sound.	Upgrade of the defences could be required during this period, although along Plymouth Hoe this would likely form part of any upgrade of the amenity features located along the toe of the cliffs in this area. It is assumed that the Plymouth Breakwater would remain during this period and continue to affect wave climate within Plymouth Sound.	Upgrade of the defences could be required during this period, although along Plymouth Hoe this would likely form part of any upgrade of the amenity features located along the toe of the cliffs in this area. It is assumed that the Plymouth Breakwater would remain during this period and continue to affect wave climate within Plymouth Sound.
	The cliff toe is almost entirely protected by defences and other structures along this section, and this has resulted in no cliff recession over the long term. Continued defence of this section by ongoing provision of amenity infrastructure would result in no cliff recession occurring by 2025, although even if undefended, the hard rock geology that forms this coastline would experience negligible, if any erosion. Increases in sea level and storminess as a result of climate change could cause increased flood risk to low-lying areas by 2025.	Continued defence of this section by ongoing provision of amenity infrastructure would result in no cliff recession occurring between 2025 and 2055, although even if undefended, the hard rock geology that forms this coastline would experience negligible erosion. Rising sea levels and increased storminess due to climate change would lead to an increased risk of flooding to low-lying land as a result of wave overtopping, requiring existing defences to be upgraded during this period to minimise this impact. The effect of rising sea levels on the Plymouth Estuary system would vary depending upon whether the estuary is natural or constrained. The Plym estuary that lies within this section	Continued defence of this section by ongoing provision of amenity infrastructure would result in no cliff recession occurring between 2055 and 2105, although even if undefended, the underlying hard rock geology would experience negligible erosion. Rising sea levels and increased storminess due to climate change would lead to an increased risk of flooding to low-lying land as a result of wave overtopping, requiring existing defences to be upgraded during this period to minimise this impact. The effect of rising sea levels on the Plymouth Estuary system would vary depending upon whether the estuary is natural or constrained. The Plym estuary that lies within this section

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
		would be likely to experience gradual loss of inter-tidal areas as they are restricted from adapting.	would be likely to experience gradual loss of inter-tidal areas as they are restricted from adapting.
Devil's Point to Mount Edgcumbe (Tamar Estuary)	Defences are largely confined to the eastern side of the estuary south of the Tamar bridge. These defences and other structures are associated with the development of the port and naval dockyard at Plymouth, which has also seen the estuary heavily modified in this area by dredging activity. The rest of the estuary is largely undefended although there are short isolated lengths of defence.	Upgrade of the defences and other structures is likely to be required during this period in order to maintain current levels of protection.	Upgrade of the defences and other structures is likely to be required during this period in order to maintain current levels of protection.
	Human intervention in the outer part of the Tamar estuary south of the Tamar bridge has heavily modified the estuary in this area. The defences along the eastern side of the estuary protect small areas of low-lying land between the estuary and higher ground to the east from flooding. The majority of the remaining estuary is largely natural, with extensive areas of intertidal mudflats constrained by steeply rising ground.	The effect of rising sea levels on the lower Tamar estuary would be likely to result in the gradual loss of inter-tidal areas as they are restricted from adapting by the ongoing presence of defences at Plymouth. The remaining undefended areas of the estuary in this section would be likely to maintain their current form as they adapt landwards at a rate that keeps pace with sea level rise.	The effect of rising sea levels on the lower Tamar estuary would be likely to result in the gradual loss of inter-tidal areas as they are restricted from adapting by the ongoing presence of defences at Plymouth. The remaining undefended areas of the estuary in this section would be likely to maintain their current form as they adapt landwards at a rate that keeps pace with sea level rise.
Mount Edgcumbe to Kingsand	A small section of defence is present along the cliff toe around Picklecombe Point, which protect Fort Picklecombe (which sits in front of the cliffs).	Upgrade of the defence around Picklecombe Point could be required during this period in order to maintain current levels of protection.	Upgrade of the defence around Picklecombe Point could be required during this period in order to maintain current levels of protection.
	The presence of defences around Picklecombe Point is unlikely to significantly affect cliff recession in this area by 2025, as the hard rock	The hard rock cliffs along this section would be expected to experience only negligible erosion between 2025 and 2055. As such total erosion of	The hard rock cliffs along this section would be expected to experience only negligible erosion between 2055 and 2105. As such total erosion of

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	cliffs along which they are located would be likely to experience only negligible erosion over this period in any case. The unprotected hard rock cliffs that form the rest of this section have also eroded very little over the long term, and negligible erosion of these cliffs is predicted by 2025. As such total erosion of 0 to 10m is predicted by 2025 depending on the occurrence of small scale cliff failures.	0 to 10m is predicted by 2055 depending on the occurrence of small scale cliff failures. The continued defence of Picklecombe Point would be unlikely to have a significant effect on cliff recession during this period, as they protect similarly hard rock cliffs that would also only experience negligible erosion if unprotected. There would also be no impact on the adjacent shoreline. If the defences were not upgraded there would be an increased risk of overtopping.	0 to 10m is predicted by 2105 depending on the occurrence of small scale cliff failures. The continued defence of Picklecombe Point would be unlikely to have a significant effect on cliff recession during this period, as they protect similarly hard rock cliffs that would also only experience negligible erosion if unprotected. There would also be no impact on the adjacent shoreline.
Kingsand/ Cawsand	Defences including seawalls are located at the back of the small pocket beaches located in front of Kingsand and Cawsand.	Upgrade of the defences along this section could be required during this period in order to maintain current levels of protection.	Upgrade of the defences along this section could be required during this period in order to maintain current levels of protection.
	The small pocket beaches at Cawsand and Kingsand have been stable over the long term, although they do fluctuate as a result of storm events. In the short term this trend is likely to continue although the beach width could start to reduce due to rising sea levels. Coastal squeeze as a result of sea level rise could become increasingly important during this period to 2025, due to the natural resistance of the cliffs. This could result in a greater risk of localised flooding at both Kingsand and Cawsand	Sea level rise could result in the small pocket beaches of Cawsand and Kingsand becoming narrower and steeper during this period, due to the resistance of the backing cliffs; this means there is a lack of sediment being input to the beaches (which are not fed by any other mechanism) and also prevents translation of the beach profile landwards in line with the rise in sea level. This will have implications for the small villages and to prevent localised flooding and overtopping the existing defences would need to be upgraded.	In the long term, the issue of narrowing beaches will continue under a scenario of accelerated sea level rise. This may mean that during this period the beaches of Cawsand and Kingsand disappear altogether or that a very narrow beach is present even at lowest tides. This will have implications for the small villages and to prevent localised flooding and overtopping the existing defences would need to be upgraded.
Cawsand to Rame Head	There are no defences present along this section.	No defences.	No defences.
	The cliffs along this section consist of hard, resistant rock that has eroded very little over the	Negligible erosion of the hard rock cliffs that dominate this section is predicted between 2025	Negligible erosion of the hard rock cliffs that dominate this section is predicted between 2055

Location	Predicted Change for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	long term. This is expected to continue to 2025, with negligible cliff recession predicted over this period. As such total erosion of 0 to 10m is predicted by 2025 depending on the occurrence of small scale cliff failures. The cliffs mainly plunge directly into the sea along this stretch.	and 2055. As such total erosion of 0 to 10m is predicted by 2055 depending on the occurrence of small scale cliff failures.	and 2105. As such total erosion of 0 to 10m is predicted by 2105 depending on the occurrence of small scale cliff failures.

C.5.4 WPM Data Interpretation

C.5.4.1 Introduction

The approach to data interpretation for the 'with present management' scenario is broadly the same as the approach described for the 'no activation intervention' scenario described in Section C.4.4). This included the use of a number of data sets in the predictions of future shoreline response and evolution under the scenario of 'with present management', as follows (these data were also used and reported in the Assessment of Shoreline and Estuary Dynamics, Section C.1 above):

- The cliff assessment database from Futurecoast, which includes information regarding likely failure mechanism, recession protection and frequency;
- Ordnance Survey historical maps, which date back to the 1880s.
- Other historical change data sets: e.g. at some locations cliff position data sets are available ;
- Futurecoast predictions of future shoreline change under an 'with present management practices' scenario: this assumed that all present management practices were to continue regardless of cost;
- Strategic Regional Coastal Monitoring programmes beach profile data: this data is only relevant for specific locations and restricted to specific time frames i.e. ten to fifteen years at most.
- Various studies and research papers.
- The National Coastal Erosion Risk Mapping research and development project (Halcrow, in progress) that used the Futurecoast data described above as a starting point, but which has been through a process of local validation with all coastal operating authorities to ensure the correct up-to-date information is being used as part of this project.
- The Futurecoast aerial CDs, Google Earth and other photographs were also used, together with any local knowledge of the area.

C.5.4.2 Consideration of Sea Level Rise

Section C.4.4.2 provides full details as to the how sea level rise has been considered throughout the SMP area depending upon the characteristics of the range of cliff types found along this coast.

C.5.4.3 Data Assessments (WPM)

Location	Data Assessment for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
Durlston Head to St Alban's Head	**Defended:** No defences present. **Undefended:** Very little erosion has occurred here in the past due to the resistant geology and this will continue to 2025 (Halcrow, 2002).	**Defended:** No defences present. **Undefended:** Very little erosion has occurred here in the past due to the resistant geology and this will continue to 2058 (Halcrow, 2002).	**Defended:** No defences present. **Undefended:** Very little erosion has occurred here in the past due to the resistant geology and this will continue to 2108 (Halcrow, 2002).
St Alban's Head to Worbarrow Tout	**Defended:** The small section of wall within Kimmeridge Bay would result in no change in shoreline position over this short length. **Undefended:** Lower limit of annual erosion will be in the region of 0.05-0.15m/yr for the area between Worbarrow Tout and Hobarrow Bay. These are also complex cliffs controlled by groundwater and so are also subject to infrequent small scale cliff failure events that occur every 1-10 years with a recession potential of less than 10m per event. This gives rise to total erosion of 2-20m predicted by 2025 (Halcrow, 2002; SCOPAC, 2004). Between Broad Bench and Kimmeridge Bay a similar pattern of annual erosion in the region of 0.2-0.4m/year that could be outweighed by infrequent landslide event. Total erosion of 5-20m in this area predicted by 2025 (SCOPAC, 2004). Complex cliffs also occur between St Alban's Head and Egmont Point, although here recession is as a result of large scale events of more than 50m that occur every 10-100 years	**Defended:** The small section of wall within Kimmeridge Bay would result in no change in shoreline position over this short length. **Undefended:** Lower limit of annual erosion will be in the region of 0.05-0.15m/yr for the area between Worbarrow Tout and Hobarrow Bay, although these complex cliffs could also experience a number of small scale landslide events, giving rise to total erosion of 5-50m predicted by 2055 (Halcrow, 2002; SCOPAC, 2004). Between Broad Bench and Kimmeridge Bay, erosion will be in the region of 0.2-0.4m/year. Although there could also be a number of landslide events during this period. Total erosion of 14-50m predicted by 2055 (SCOPAC, 2004). The complex cliffs between St Alban's Head and Egmont Point could experience a large landslide event during this period, and so recession of 0-50m is predicted by 2055 (Halcrow, 2002). Toe erosion within these complex cliffs is less	**Defended:** The small section of wall within Kimmeridge Bay would result in no change in shoreline position over this short length. **Undefended:** Lower limit of annual erosion will be in the region of 0.05-0.15m/yr for the area between Worbarrow Tout and Hobarrow Bay, although these complex cliffs could also experience a number of small scale landslide events, giving rise to total erosion of 10-100m predicted by 2105 (Halcrow, 2002; SCOPAC, 2004). Between Broad Bench and Kimmeridge Bay, erosion will be in the region of 0.2-0.4m/year. Although there could also be a number of landslide events during this period. Total erosion of 29-100m predicted by 2105 (SCOPAC, 2004). The complex cliffs between St Alban's Head and Egmont Point could experience a large landslide event during this period, and so recession of 0-50m is predicted by 2105 (Halcrow, 2002). Toe erosion within these complex cliffs is less

Location	Data Assessment for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	(Halcrow, 2002). Such an event could occur at anytime and so in this area total erosion of 0-50m predicted by 2025). The simple cliffs along Kimmeridge Ledges are likely to be affected by sea level rise, therefore use Bruun Rule estimate for upper limit of recession potential. However these cliffs have only eroded very slowly in the past and so recession of about 1m is predicted by 2025.	important and so sea level rise effects are outweighed by infrequent cliff failure events. The simple cliffs along Kimmeridge Ledges are likely to be affected by sea level rise, therefore use Bruun Rule estimate for upper limit of recession potential. However these cliffs have only eroded very slowly in the past and so recession of 2-4m is predicted by 2055.	important and so sea level rise effects are outweighed by infrequent cliff failure events. The simple cliffs along Kimmeridge Ledges are likely to be affected by sea level rise, therefore use Bruun Rule estimate for upper limit of recession potential. However these cliffs have only eroded very slowly in the past and so recession of 5-12m is predicted by 2105.
Worbarrow Tout to Lulworth Cove (East)	**Defended:** No defences present. **Undefended:** Annual erosion within Worbarrow Bay will vary. Simple cliffs in the western part of the bay are likely to be affected by sea level rise therefore use Bruun rule estimate as upper limit of recession, as historical recession rate incorporates the small frequent landslide events. Therefore annual erosion will be in the region of 0.08-0.12m/yr, giving rise to total erosion of 1-2m predicted by 2025 (SCOPAC, 2004). The eastern part consists of simple chalk cliffs that have a similar rate of recession as the clay ones in the western part of the bay, and presently consist of degraded chalk cliffs. Therefore the historic rate alone is likely to be most appropriate as the upper limit in this part of the bay therefore total erosion of 0-2m predicted by 2025 (SCOPAC, 2004). From Mupe Bay to Lulworth Cove (East), the	**Defended:** No defences present. **Undefended:** Annual erosion within Worbarrow Bay will vary. Simple cliffs in the western part of the bay are likely to be affected by sea level rise therefore use Bruun rule estimate as upper limit of recession, as historical recession rate incorporates the small frequent landslide events. Therefore total erosion of 5-6m predicted by 2055 (SCOPAC, 2004). The eastern part consists of simple chalk cliffs that have a similar rate of recession as the clay ones in the western part of the bay, and presently consist of degraded chalk cliffs. Therefore the historic rate alone of 0.08-0.12m/yr is likely to be most appropriate as the upper limit in this part of the bay therefore total erosion of 0-5m predicted by 2055 (SCOPAC, 2004). From Mupe Bay to Lulworth Cove (East),	**Defended:** No defences present. **Undefended:** Annual erosion within Worbarrow Bay will vary. Simple cliffs in the western part of the bay are likely to be affected by sea level rise therefore use Bruun rule estimate as upper limit of recession, as historical recession rate incorporates the small frequent landslide events. Therefore total erosion of 10-17m predicted by 2105 (SCOPAC, 2004). The eastern part consists of simple chalk cliffs that have a similar rate of recession as the clay ones in the western part of the bay, and presently consist of degraded chalk cliffs. Therefore the historic rate alone of 0.08-0.12m/yr is likely to be most appropriate as the upper limit in this part of the bay therefore total erosion of 0-10m predicted by 2105 (SCOPAC, 2004). From Mupe Bay to Lulworth Cove (East),

Location	Data Assessment for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	annual erosion will be negligible (SCOPAC, 2004).	there has been negligible recession historically, although landslides could occur in softer rocks as per adjacent erosion of Worbarrow Bay. These are simple cliffs and likely to be affected by sea level rise, therefore use Bruun rule estimate total erosion of 0-1m predicted by 2055.	there has been negligible recession historically, although landslides could occur in softer rocks as per adjacent erosion of Worbarrow Bay. These are simple cliffs and likely to be affected by sea level rise, therefore use Bruun rule estimate total erosion of 0-8m predicted by 2105.
Lulworth Cove	**Defended:** The small section of defences within Lulworth Cove would result in no change in shoreline position of the defended section. **Undefended:** Annual erosion will be in the region of 0.12m/yr, giving rise to a total erosion of 0-2m predicted by 2025 (Halcrow, 2002). The frequency of cliff failures is 1-10 years, with a recession potential of less than 10m per event (Halcrow, 2002). Not considered likely that recession potential would be reached due to sheltered nature of cove. Therefore use historical rate for future projections.	**Defended:** The small section of defences within Lulworth Cove would result in no change in shoreline position of the defended section. **Undefended:** Annual erosion will be in the region of 0.12m/yr, giving rise to a total erosion of 0-6m predicted by 2055 (Halcrow, 2002). The frequency of cliff failures is 1-10 years, with a recession potential of less than 10m per event (Halcrow, 2002). Not considered likely that recession potential would be reached due to sheltered nature of cove. Therefore use historical rate for future projections.	**Defended:** The small section of defences within Lulworth Cove would result in no change in shoreline position of the defended section. **Undefended:** Annual erosion will be in the region of 0.12m/yr, giving rise to a total erosion of 0-12m predicted by 2105 (Halcrow, 2002). The frequency of cliff failures is 1-10 years, with a recession potential of less than 10m per event (Halcrow, 2002). Not considered likely that recession potential would be reached due to sheltered nature of cove. Therefore use historical rate for future projections.
Lulworth Cove (West) to White Nothe	**Defended:** No defences present. **Undefended:** Lower limit of annual erosion will be in the region of 0.06-0.22m/yr between White Nothe and Bats Head. These are also complex cliffs controlled by groundwater and so toe erosion is less important and therefore sea level rise effects are outweighed by infrequent cliff failure events that occur along this length, giving rise to total erosion of 2-	**Defended:** No defences present. **Undefended:** Lower limit of annual erosion will be in the region of 0.06-0.22m/yr between White Nothe and Bats Head. These are also complex cliffs controlled by groundwater and so toe erosion is less important and therefore sea level rise effects are outweighed by infrequent cliff failure events that occur along this length, giving rise to total erosion of 7-	**Defended:** No defences present. **Undefended:** Lower limit of annual erosion will be in the region of 0.06-0.22m/yr between White Nothe and Bats Head. These are also complex cliffs controlled by groundwater and so toe erosion is less important and therefore sea level rise effects are outweighed by infrequent cliff failure events that occur along this length, giving rise to total erosion of 14-

Location	Data Assessment for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	10m predicted by 2025 (Halcrow, 2002; SCOPAC, 2004). Between Bats Head and Lulworth Cove (West), there are hard rock cliffs with localised cliff failure events that cause increases in recession. Use mean of historical rate for future predictions as unlikely to be affected by sea level rise, therefore annual erosion in the region of 0.2-0.46m/yr. Total erosion of 0-6m predicted by 2025 (SCOPAC, 2004). The frequency of landslides is along most of this section is 1-10 years, with a recession potential of less than 10m. The exception being towards White Nothe, where a similar recession potential is likely, but at a frequency of 10-100 years (Halcrow, 2002).	10m predicted by 2055 (Halcrow, 2002; SCOPAC, 2004). Between Bats Head and Lulworth Cove (West), there are hard rock cliffs with localised cliff failure events that cause increases in recession. Use mean of historical rate for future predictions as unlikely to be affected by sea level rise, therefore annual erosion in the region of 0.2-0.46m/yr. Total erosion of 0-16m predicted by 2055 (SCOPAC, 2004). The frequency of landslides is along most of this section is 1-10 years, with a recession potential of less than 10m. The exception being towards White Nothe, where a similar recession potential is likely, but at a frequency of 10-100 years (Halcrow, 2002).	20m predicted by 2105 (Halcrow, 2002; SCOPAC, 2004). Between Bats Head and Lulworth Cove (West), there are hard rock cliffs with localised cliff failure events that cause increases in recession. Use mean of historical rate for future predictions as unlikely to be affected by sea level rise, therefore annual erosion in the region of 0.2-0.46m/yr. Total erosion of 0-32m predicted by 2105 (SCOPAC, 2004). The frequency of landslides is along most of this section is 1-10 years, with a recession potential of less than 10m. The exception being towards White Nothe, where a similar recession potential is likely, but at a frequency of 10-100 years (Halcrow, 2002).
White Nothe to Redcliff Point	**Defended:** The rock groyne and revetment within Ringstead Bay would continue to hold beach locally and reduce the exposure of the cliff toe to marine action, thus reducing the rate of erosion which is primarily controlled by groundwater. Coastal squeeze anticipated. **Undefended:** Cliff failures events with a recession potential of more than 50m occur every 250 years or more at White Nothe (King Rock). No recession in this area is predicted by 2025. The simple cliffs in Ringstead Bay are likely to be affected by sea level rise, therefore use	**Defended:** The rock groyne and revetment within Ringstead Bay would continue to hold beach locally and reduce the exposure of the cliff toe to marine action, thus reducing the rate of erosion which is primarily controlled by groundwater. Coastal squeeze anticipated. **Undefended:** Cliff failures events with a recession potential of more than 50m occur every 250 years or more at White Nothe (King Rock). No recession in this area is predicted by 2055. The simple cliffs in Ringstead Bay are likely to be affected by sea level rise, therefore use	**Defended:** The rock groyne and revetment within Ringstead Bay would continue to hold beach locally and reduce the exposure of the cliff toe to marine action, thus reducing the rate of erosion which is primarily controlled by groundwater. Coastal squeeze anticipated. **Undefended:** Cliff failures events with a recession potential of more than 50m occur every 250 years or more at White Nothe (King Rock). No recession in this area is predicted by 2105. The simple cliffs in Ringstead Bay are likely to be affected by sea level rise, therefore use

Location	Data Assessment for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	Bruun Rule estimate for upper limit of recession potential. However, state of the beach is an important factor, as currently this is being managed and would reduce toe erosion. Lower limit is based on historic rate of annual erosion in the region of 0.5m/yr. Total erosion in this area of about 9m predicted by 2025 (Halcrow, 2002; SCOPAC, 2004). From Osmington to Redcliff Point are complex cliffs controlled by groundwater. Toe erosion is less important in this area and so sea level rise effects are outweighed by infrequent medium scale cliff failure events that occur every 10-100 years. Total erosion of 9-50m predicted by 2025 (Halcrow, 2002; SCOPAC, 2004).	Bruun Rule estimate for upper limit of recession potential. However, state of the beach is an important factor, as currently this is being managed and would reduce toe erosion. Lower limit is based on historic rate of annual erosion in the region of 0.5m/yr. Total erosion in this area of 24-27m predicted by 2055 (Halcrow, 2002; SCOPAC, 2004). From Osmington to Redcliff Point are complex cliffs controlled by groundwater. Toe erosion is less important in this area and so sea level rise effects are outweighed by infrequent medium scale cliff failure events that occur every 10-100 years. Total erosion of 24-50m predicted by 2055 (Halcrow, 2002; SCOPAC, 2004).	Bruun Rule estimate for upper limit of recession potential. However, state of the beach is an important factor, as currently this is being managed and would reduce toe erosion. Lower limit is based on historic rate of annual erosion in the region of 0.5m/yr. Total erosion in this area of 49-67m predicted by 2105 (Halcrow, 2002; SCOPAC, 2004). From Osmington to Redcliff Point are complex cliffs controlled by groundwater. Toe erosion is less important in this area and so sea level rise effects are outweighed by infrequent medium scale cliff failure events that occur every 10-100 years. Total erosion of 49-100m predicted by 2105 (Halcrow, 2002; SCOPAC, 2004).
Redcliff Point to Preston Beach (Rock Groyne)	**Defended:** No change in shoreline position due to continued defence. Coastal squeeze anticipated. **Undefended:** Lower limit of annual erosion of Furzy Cliff is in the region of 0.75m/yr (Weymouth & Portland Borough Council, 2002), whilst at Redcliff, the lower limit of annual erosion is in the region of 0.62m/yr (Mouchel, 1998). These are both complex cliffs controlled by groundwater. Toe erosion is therefore less important and so sea level rise effects are outweighed by infrequent medium scale cliff failure events. Total erosion of Furzy	**Defended:** No change in shoreline position due to continued defence. Coastal squeeze anticipated. **Undefended:** Lower limit of annual erosion of Furzy Cliff is in the region of 0.75m/yr (Weymouth & Portland Borough Council, 2002), whilst at Redcliff, the lower limit of annual erosion is in the region of 0.62m/yr (Mouchel, 1998). These are both complex cliffs controlled by groundwater. Toe erosion is therefore less important and so sea level rise effects are outweighed by infrequent medium scale cliff failure events. Total erosion of Furzy	**Defended:** No change in shoreline position due to continued defence. Coastal squeeze anticipated. **Undefended:** Lower limit of annual erosion of Furzy Cliff is in the region of 0.75m/yr (Weymouth & Portland Borough Council, 2002), whilst at Redcliff, the lower limit of annual erosion is in the region of 0.62m/yr (Mouchel, 1998). These are both complex cliffs controlled by groundwater. Toe erosion is therefore less important and so sea level rise effects are outweighed by infrequent medium scale cliff failure events. Total erosion of Furzy

Location	Data Assessment for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	Cliff by 2025 is 13-50m whilst at Redcliff it is 11-50m (Halcrow, 2002). The frequency of cliff failures between Redcliff Point and Furzy Cliff is 10-100 years with a recession potential of 10-50m (Halcrow, 2002). Transport of material could occur from Preston Beach towards Bowleaze Cove with no beach recycling could lead to increased beach levels in front of Furzy Cliffs.	Cliff by 2025 is 35-50m whilst at Redcliff it is 29-50m (Halcrow, 2002). The frequency of cliff failures between Redcliff Point and Furzy Cliff is 10-100 years with a recession potential of 10-50m (Halcrow, 2002). Transport of material could occur from Preston Beach towards Bowleaze Cove with no beach recycling could lead to increased beach levels in front of Furzy Cliffs.	Cliff by 2025 is 73-100m whilst at Redcliff it is 60-100m (Halcrow, 2002). The frequency of cliff failures between Redcliff Point and Furzy Cliff is 10-100 years with a recession potential of 10-50m (Halcrow, 2002).
Preston Beach (Rock Groyne) to Weymouth Harbour (Stone Pier)	**Defended:** No change in shoreline position due to continued defence. Coastal squeeze anticipated in the northern part of this section, although accumulation of sand sediment in the southern part of the bay will continue (Halcrow, 2002; Channel Coastal Observatory, 2006). **Undefended:** Section is completely defended.	**Defended:** No change in shoreline position due to continued defence. Coastal squeeze anticipated in the northern part of this section, although accumulation of sand sediment in the southern part of the bay will continue if supply is maintained (Halcrow, 2002; Channel Coastal Observatory, 2006). **Undefended:** Section is completely defended.	**Defended:** No change in shoreline position due to continued defence. Coastal squeeze anticipated in the northern part of this section, although accumulation of sand sediment in the southern part of the bay will continue if supply is maintained (Halcrow, 2002; Channel Coastal Observatory, 2006). **Undefended:** Section is completely defended.
Weymouth Harbour (Stone Pier) to Portland Harbour (North Breakwater)	**Defended:** No change in shoreline position due to continued defence. Coastal squeeze anticipated, along with continued land sliding due to groundwater conditions. **Undefended:** Section is completely defended, though if it were not, a mean annual rate of recession of 0.5m/yr possible (Weymouth and Portland Borough Council, 2002). If the defences were not present, the frequency of cliff failures along most of this section is predicted to be 10-100 years, with a	**Defended:** No change in shoreline position due to continued defence. Coastal squeeze anticipated, along with continued land sliding due to groundwater conditions. **Undefended:** Section is completely defended, though if it were not, a mean annual rate of recession of 0.5m/yr possible (Weymouth and Portland Borough Council, 2002). If the defences were not present, the frequency of cliff failures along most of this section is predicted to be 10-100 years, with a	**Defended:** No change in shoreline position due to continued defence. Coastal squeeze anticipated, along with continued land sliding due to groundwater conditions. **Undefended:** Section is completely defended, though if it were not, a mean annual rate of recession of 0.5m/yr possible (Weymouth and Portland Borough Council, 2002). If the defences were not present, the frequency of cliff failures along most of this section is predicted to be 10-100 years, with a

Location	Data Assessment for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	recession potential of 10-50m. The frequency of events would increase to 1-10 years towards Newton's Cove, although the recession potential would be the same (Halcrow, 2002).	recession potential of 10-50m. The frequency of events would increase to 1-10 years towards Newton's Cove, although the recession potential would be the same (Halcrow, 2002).	recession potential of 10-50m. The frequency of events would increase to 1-10 years towards Newton's Cove, although the recession potential would be the same (Halcrow, 2002).
Portland Harbour (North Breakwater) to Small Mouth	**Defended:** A range of structures and ad-hoc defences are present along this section. These serve to reduce the exposure of the cliff toe to wave action, and thus reduce the rate of recession, which is primarily controlled by groundwater (Halcrow, 2008). The effect of wave action at the cliff toe is also limited by the presence of the Portland Harbour Breakwaters (Halcrow, 2008). **Undefended:** Recession along this section is highly dependent upon the local geology, however, erosion at a mean annual rate of in the region of 0.1-0.5/m/yr is possible along most parts (Halcrow, 2008). The frequency of events along this section varies between 1-10 years and 10-100 years, although in both cases, the recession potential is less than 10m per event (Halcrow, 2008). These are however complex cliffs controlled by groundwater and toe erosion is therefore less important and so sea level rise effects are outweighed by infrequent small scale cliff failure events. Total erosion of 5-10m predicted by 2025, inclusive of episodic landslide events (Halcrow,	**Defended:** A range of structures and ad-hoc defences are present along this section. These serve to reduce the exposure of the cliff toe to wave action, and thus reduce the rate of recession, which is primarily controlled by groundwater (Halcrow, 2008). The effect of wave action at the cliff toe is also limited by the presence of the Portland Harbour Breakwaters (Halcrow, 2008). **Undefended:** Recession along this section is highly dependent upon the local geology, however, erosion at a mean annual rate of in the region of 0.1-0.5/m/yr is possible along most parts (Halcrow, 2008). The frequency of events along this section varies between 1-10 years and 10-100 years, although in both cases, the recession potential is less than 10m per event (Halcrow, 2008). These are however complex cliffs controlled by groundwater and toe erosion is therefore less important and so sea level rise effects are outweighed by infrequent small scale cliff failure events. Total erosion of 14-25m predicted by 2055, inclusive of episodic landslide events (Halcrow,	**Defended:** A range of structures and ad-hoc defences are present along this section. These serve to reduce the exposure of the cliff toe to wave action, and thus reduce the rate of recession, which is primarily controlled by groundwater (Halcrow, 2008). The effect of wave action at the cliff toe is also limited by the presence of the Portland Harbour Breakwaters (Halcrow, 2008). **Undefended:** Recession along this section is highly dependent upon the local geology, however, erosion at a mean annual rate of in the region of 0.1-0.5/m/yr is possible along most parts (Halcrow, 2008). The frequency of events along this section varies between 1-10 years and 10-100 years, although in both cases, the recession potential is less than 10m per event (Halcrow, 2008). These are however complex cliffs controlled by groundwater and toe erosion is therefore less important and so sea level rise effects are outweighed by infrequent small scale cliff failure events. Total erosion of 29-50m predicted by 2105, inclusive of episodic landslide events (Halcrow,

Location	Data Assessment for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	2008 and Halcrow, 2002).	2008 and Halcrow, 2002).	2008 and Halcrow, 2002).
Small Mouth to Osprey Quay (Portland Harbour)	**Defended:** There are some areas of rock revetment at either end of this section, along with other structures associated with flood protection at Portland and the entrance to The Fleet. The presence of the Portland Harbour Breakwaters is also a significant control on this section. **Undefended:** Whilst not having defences along the shoreline, the central part of this section, which is occupied by the shingle barrier of Ham Beach, has been relatively stable with no observable change over the past century since the construction of the Portland Harbour Breakwaters (Halcrow, 2002).	**Defended:** There are some areas of rock revetment at either end of this section, along with other structures associated with flood protection at Portland and the entrance to The Fleet. The presence of the Portland Harbour Breakwaters is also a significant control on this section. **Undefended:** Whilst not having defences along the shoreline, the central part of this section, which is occupied by the shingle barrier of Ham Beach, has been relatively stable with no observable change over the past century since the construction of the Portland Harbour Breakwaters (Halcrow, 2002).	**Defended:** There are some areas of rock revetment at either end of this section, along with other structures associated with flood protection at Portland and the entrance to The Fleet. The presence of the Portland Harbour Breakwaters is also a significant control on this section. **Undefended:** Whilst not having defences along the shoreline, the central part of this section, which is occupied by the shingle barrier of Ham Beach, has been relatively stable with no observable change over the past century since the construction of the Portland Harbour Breakwaters (Halcrow, 2002).
Osprey Quay (Portland Harbour) to Grove Point	**Defended:** This section is entirely defended with a range of structures including rock revetment, quay walls and breakwaters, including the Portland Harbour Breakwaters for some of its length. As a result, there has been negligible recession of the backing cliffs along this section over the past century. **Undefended:** Section is completely defended. However, if it were not, it is predicted that cliff failures would occur with a frequency of more than 250 years, with a recession potential of	**Defended:** This section is entirely defended with a range of structures including rock revetment, quay walls and breakwaters, including the Portland Harbour Breakwaters for some of its length. As a result, there has been negligible recession of the backing cliffs along this section over the past century. **Undefended:** Section is completely defended. However, if it were not, it is predicted that cliff failures would occur with a frequency of more than 250 years, with a recession potential of	**Defended:** This section is entirely defended with a range of structures including rock revetment, quay walls and breakwaters, including the Portland Harbour Breakwaters for some of its length. As a result, there has been negligible recession of the backing cliffs along this section over the past century. **Undefended:** Section is completely defended. However, if it were not, it is predicted that cliff failures would occur with a frequency of more than 250 years, with a recession potential of

Location	Data Assessment for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	10-50m per event (Halcrow, 2002).	10-50m per event (Halcrow, 2002).	10-50m per event (Halcrow, 2002).
Grove Point to West Weare	**Defended:** No defences present. **Undefended:** Lower limit of annual erosion of the north-west cliffs at West Weare in the region of 0.11m/yr. These are complex cliffs, where cliff recession is driven by small scale, infrequent rock falls, creating large debris fans, which are then gradually eroded by wave action. Therefore sea level rise does not appear to be dominant force in the rate of cliff top recession. Therefore total erosion of about 2-10m predicted by 2025 (Halcrow, 2002). The other cliffs along this section that make up the southern part of the Isle of Portland are highly resistant and have changed very little over the past century (Halcrow, 2002). The frequency of cliff failure events along this entire section is 100-250 years, with a recession potential of less than 10m per event (Halcrow, 2002).	**Defended:** No defences present. **Undefended:** Lower limit of annual erosion of the north-west cliffs at West Weare in the region of 0.11m/yr. These are complex cliffs, where cliff recession is driven by small scale, infrequent rock falls, creating large debris fans, which are then gradually eroded by wave action. Therefore sea level rise does not appear to be dominant force in the rate of cliff top recession. Therefore total erosion of about 5-10m predicted by 2055 (Halcrow, 2002). The other cliffs along this section that make up the southern part of the Isle of Portland are highly resistant and have changed very little over the past century (Halcrow, 2002). The frequency of cliff failure events along this entire section is 100-250 years, with a recession potential of less than 10m per event (Halcrow, 2002).	**Defended:** No defences present. **Undefended:** Lower limit of annual erosion of the north-west cliffs at West Weare in the region of 0.11m/yr. These are complex cliffs, where cliff recession is driven by small scale, infrequent rock falls, creating large debris fans, which are then gradually eroded by wave action. Therefore sea level rise does not appear to be dominant force in the rate of cliff top recession. Therefore total erosion of about 10-11m predicted by 2105 (Halcrow, 2002). The other cliffs along this section that make up the southern part of the Isle of Portland are highly resistant and have changed very little over the past century (Halcrow, 2002). The frequency of cliff failure events along this entire section is 100-250 years, with a recession potential of less than 10m per event (Halcrow, 2002).
Chiswell to Chesil Beach (Northern end of Osprey Quay)	**Defended:** Most of this section is defended by a range of structures, including sea walls, gabions and revetments. Coastal squeeze anticipated as Chesil Beach is prevented from rolling back. **Undefended:** This length is undefended on its seaward face, but is backed by storm	**Defended:** Most of this section is defended by a range of structures, including sea walls, gabions and revetments. Coastal squeeze anticipated as Chesil Beach is prevented from rolling back. **Undefended:** This length is undefended on its seaward face, but is backed by storm	**Defended:** Most of this section is defended by a range of structures, including sea walls, gabions and revetments. Coastal squeeze anticipated as Chesil Beach is prevented from rolling back. **Undefended:** This length is undefended on its seaward face, but is backed by storm

Location	Data Assessment for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	interceptor drains along its landward length. Annual recession of Chesil Beach in the region 0.06-0.12m/yr. Total recession of 1-2m by 2025 predicted (SCOPAC, 2004).	interceptor drains along its landward length. Annual recession of Chesil Beach in the region 0.06-0.12m/yr. Total recession of 2-4m by 2055 predicted (SCOPAC, 2004).	interceptor drains along its landward length. Annual recession of Chesil Beach in the region 0.06-0.12m/yr. Total recession of 3-6m by 2105 predicted (SCOPAC, 2004).
Chesil Beach (Northern end of Osprey Quay) and The Fleet	**Defended:** No defences present. **Undefended:** Annual recession of Chesil Beach in the region 0.06-0.12m/yr. Total recession of 1-2m by 2025 predicted (SCOPAC, 2004). The slopes behind The Fleet are simple (relict) cliffs, which are protected from direct wave action by Chesil Beach, therefore there would be no affect of sea level rise and failure will be due to the action of groundwater alone, resulting in infrequent small scale landslide events with a frequency greater than 250 years and a recession potential of less than 10m per event (Halcrow, 2002). Total erosion of 0-10m predicted by 2025 along these cliffs.	**Defended:** No defences present. **Undefended:** Annual recession of Chesil Beach in the region 0.06-0.12m/yr. Total recession of 2-4m by 2055 predicted (SCOPAC, 2004). The slopes behind The Fleet are simple (relict) cliffs, which are protected from direct wave action by Chesil Beach, therefore there would be no affect of sea level rise and failure will be due to the action of groundwater alone, resulting in infrequent small scale landslide events with a frequency greater than 250 years and a recession potential of less than 10m per event (Halcrow, 2002). Total erosion of 0-10m predicted by 2055 along these cliffs.	**Defended:** No defences present. **Undefended:** Annual recession of Chesil Beach in the region 0.06-0.12m/yr. Total recession of 3-6m by 2105 predicted (SCOPAC, 2004). The slopes behind The Fleet are simple (relict) cliffs, which are protected from direct wave action by Chesil Beach, therefore there would be no affect of sea level rise and failure will be due to the action of groundwater alone, resulting in infrequent small scale landslide events with a frequency greater than 250 years and a recession potential of less than 10m per event (Halcrow, 2002). Total erosion of 0-10m predicted by 2105 along these cliffs.
Abbotsbury to Cogden Beach	**Defended:** No defences present. **Undefended:** There has been negligible movement of this section over the past century (Halcrow, 2002).	**Defended:** No defences present. **Undefended:** There has been negligible movement of this section over the past century (Halcrow, 2002).	**Defended:** No defences present. **Undefended:** There has been negligible movement of this section over the past century (Halcrow, 2002).
Cogden Beach to Burton Cliff (West)	**Defended:** No defences present. **Undefended:** The lower limit of annual erosion of the cliffs along this section in the region of 0.14m/yr (Halcrow, 2002). The simple inter-bedded sandstone cliffs	**Defended:** No defences present. **Undefended:** The lower limit of annual erosion of the cliffs along this section in the region of 0.14m/yr (Halcrow, 2002). The simple inter-bedded sandstone cliffs	**Defended:** No defences present. **Undefended:** The lower limit of annual erosion of the cliffs along this section in the region of 0.14m/yr (Halcrow, 2002). The simple inter-bedded sandstone cliffs

Location	Data Assessment for 'With Present Management'		
	Short Term (to 2025)	**Medium Term (to 2055)**	**Long Term (to 2105)**
	recede through a combination of gradual erosion and infrequent small scale cliff falls. Future rate is likely to be affected by sea level rise therefore use Bruun Rule for future predictions. There could be a feedback mechanism through input of sand to the beaches, which may slow erosion for a period, but is unlikely to be sufficient to stop erosion under accelerated sea level rise. The simple low level clay cliff at the eastern end recedes through a combination of gradual erosion and mudslide events. Future recession of these cliffs is likely to be affected by sea level rise therefore use Bruun Rule for future predictions. Sediment released from the cliff is unlikely to be retained on the beaches. The frequency of cliff failures along this section is 1-10 years, with a recession potential of less than 10m per event (Halcrow, 2002). Therefore total erosion of about 2-3m predicted by 2025 in both the sandstone and clay cliffs.	recede through a combination of gradual erosion and infrequent small scale cliff falls. Future rate is likely to be affected by sea level rise therefore use Bruun Rule for future predictions. There could be a feedback mechanism through input of sand to the beaches, which may slow erosion for a period, but is unlikely to be sufficient to stop erosion under accelerated sea level rise. Total erosion of these cliffs of about 7-10m predicted by 2055. The simple low level clay cliff at the eastern end recedes through a combination of gradual erosion and mudslide events. Future recession of these cliffs is likely to be affected by sea level rise therefore use Bruun Rule for future predictions. Sediment released from the cliff is unlikely to be retained on the beaches. Total erosion of these cliffs of about 7-13m predicted by 2055.	recede through a combination of gradual erosion and infrequent small scale cliff falls. Future rate is likely to be affected by sea level rise therefore use Bruun Rule for future predictions. There could be a feedback mechanism through input of sand to the beaches, which may slow erosion for a period, but is unlikely to be sufficient to stop erosion under accelerated sea level rise. Total erosion of these cliffs of about 14-35m predicted by 2105. The simple low level clay cliff at the eastern end recedes through a combination of gradual erosion and mudslide events. Future recession of these cliffs is likely to be affected by sea level rise therefore use Bruun Rule for future predictions. Sediment released from the cliff is unlikely to be retained on the beaches. Total erosion of these cliffs of about 14-53m predicted by 2105.
Freshwater Beach	**Defended:** The beach has no hard defences, but is actively managed by beach recycling and re-profiling. Beach levels fluctuate, with accretion having occurred in recent years (Jacobs Babtie, 2006). Potential for rollback of the beach onto the low-lying land behind (Halcrow, 2002).	**Defended:** The beach has no hard defences, but is actively managed by beach recycling and re-profiling. Beach levels fluctuate, with accretion having occurred in recent years (Jacobs Babtie, 2006). Potential for rollback of the beach onto the low-lying land behind (Halcrow, 2002).	**Defended:** The beach has no hard defences, but is actively managed by beach recycling and re-profiling. Beach levels fluctuate, with accretion having occurred in recent years (Jacobs Babtie, 2006). Potential for rollback of the beach onto the low-lying land behind (Halcrow, 2002).

Location	Data Assessment for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	Undefended: This section is completely defended.	**Undefended:** This section is completely defended.	**Undefended:** This section is completely defended.
East Cliff (West Bay)	**Defended:** No defences present. **Undefended:** The lower limit of annual erosion of the cliffs along this section in the region of 0.14m/yr (Halcrow, 2002). The simple inter-bedded sandstone cliffs recede through a combination of gradual erosion and infrequent small scale cliff falls. Future rate is likely to be affected by sea level rise therefore use Bruun Rule for future predictions. There could be a feedback mechanism through input of sand to the beaches, which may slow erosion for a period, but is unlikely to be sufficient to stop erosion under accelerated sea level rise. The frequency of cliff failures along this section is 1-10 years, with a recession potential of less than 10m per event (Halcrow, 2002). Total of erosion of about 2-3m predicted by 2025.	**Defended:** No defences present. **Undefended:** The lower limit of annual erosion of the cliffs along this section in the region of 0.14m/yr (Halcrow, 2002). The simple inter-bedded sandstone cliffs recede through a combination of gradual erosion and infrequent small scale cliff falls. Future rate is likely to be affected by sea level rise therefore use Bruun Rule for future predictions. There could be a feedback mechanism through input of sand to the beaches, which may slow erosion for a period, but is unlikely to be sufficient to stop erosion under accelerated sea level rise. Total erosion of these cliffs of about 7-10m predicted by 2055. The frequency of cliff failures along this section is 1-10 years, with a recession potential of less than 10m per event (Halcrow, 2002).	**Defended:** No defences present. **Undefended:** The lower limit of annual erosion of the cliffs along this section in the region of 0.14m/yr (Halcrow, 2002). The simple inter-bedded sandstone cliffs recede through a combination of gradual erosion and infrequent small scale cliff falls. Future rate is likely to be affected by sea level rise therefore use Bruun Rule for future predictions. There could be a feedback mechanism through input of sand to the beaches, which may slow erosion for a period, but is unlikely to be sufficient to stop erosion under accelerated sea level rise. Total erosion of these cliffs of about 14-35m predicted by 2105. The frequency of cliff failures along this section is 1-10 years, with a recession potential of less than 10m per event (Halcrow, 2002).
West Bay (East Beach to eastern pier)	**Defended:** There are no actual structures on the beach face, however the beach is actively managed by recycling and re-profiling, whilst the eastern pier of West Bay Harbour entrance also affects shoreline evolution. Beach levels vary in response to prevailing conditions, with MHW position having	**Defended:** There are no actual structures on the beach face, however the beach is actively managed by recycling and re-profiling, whilst the eastern pier of West Bay Harbour entrance also affects shoreline evolution. Beach levels vary in response to prevailing conditions, with MHW position having	**Defended:** There are no actual structures on the beach face, however the beach is actively managed by recycling and re-profiling, whilst the eastern pier of West Bay Harbour entrance also affects shoreline evolution. Beach levels vary in response to prevailing conditions, with MHW position having

Location	Data Assessment for 'With Present Management'		
	Short Term (to 2025)	**Medium Term (to 2055)**	**Long Term (to 2105)**
	previously fluctuated within a range of 60m (HR Wallingford, 1997), although the management activities have resulted in very little net change (Halcrow, 2002). Potential for rollback of the beach onto the low-lying land behind (Halcrow, 2002). **Undefended:** This section is completely defended.	previously fluctuated within a range of 60m (HR Wallingford, 1997), although the management activities have resulted in very little net change (Halcrow, 2002). Potential for rollback of the beach onto the low-lying land behind (Halcrow, 2002). **Undefended:** This section is completely defended.	previously fluctuated within a range of 60m (HR Wallingford, 1997), although the management activities have resulted in very little net change (Halcrow, 2002). Potential for rollback of the beach onto the low-lying land behind (Halcrow, 2002). **Undefended:** This section is completely defended.
West Bay (West Beach from eastern pier) to West Cliff (East)	**Defended:** The east and west piers at the entrance to West Bay Harbour influence littoral drift, as do a number of rock groynes. There is also a sea wall the back the beach. Beach levels fluctuate, with draw-down during storms exacerbated by scour at the sea wall. However, active beach management using recycling and re-profiling means that there is very little net change (Halcrow, 2002). Coastal squeeze anticipated. **Undefended:** This section is completely defended.	**Defended:** The east and west piers at the entrance to West Bay Harbour influence littoral drift, as do a number of rock groynes. There is also a sea wall the back the beach. Beach levels fluctuate, with draw-down during storms exacerbated by scour at the sea wall. However, active beach management using recycling and re-profiling means that there is very little net change (Halcrow, 2002). Coastal squeeze anticipated. **Undefended:** This section is completely defended.	**Defended:** The east and west piers at the entrance to West Bay Harbour influence littoral drift, as do a number of rock groynes. There is also a sea wall the back the beach. Beach levels fluctuate, with draw-down during storms exacerbated by scour at the sea wall. However, active beach management using recycling and re-profiling means that there is very little net change (Halcrow, 2002). Coastal squeeze anticipated. **Undefended:** This section is completely defended.
West Cliff (East) to Thorncombe Beacon	**Defended:** The eastern part of West Cliff is defended by a sea wall and promenade along its toe. This has reduced the rate of erosion along this part by preventing wave action at the toe (SCOPAC, 2004). **Undefended:** Annual erosion of the undefended part of West Cliff in the region of	**Defended:** The eastern part of West Cliff is defended by a sea wall and promenade along its toe. This has reduced the rate of erosion along this part by preventing wave action at the toe (SCOPAC, 2004). **Undefended:** Annual erosion of the undefended part of West Cliff in the region of	**Defended:** The eastern part of West Cliff is defended by a sea wall and promenade along its toe. This has reduced the rate of erosion along this part by preventing wave action at the toe (SCOPAC, 2004). **Undefended:** Annual erosion of the undefended part of West Cliff in the region of

Location	Data Assessment for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	0.37m/yr. These are complex cliffs which tend to recede due to landslide events controlled by groundwater. Toe erosion is therefore less important and so sea level rise effects are outweighed by infrequent large scale cliff failure events. Total erosion of these cliffs of about 6-50m predicted by 2025 (SCOPAC, 2004 and Halcrow, 2002). The cliffs towards Eype and Thorncombe Beacon experience annual erosion in the region of 0.05-0.5m/yr. These are also complex cliffs which tend to recede due to both gradual erosion and large scale landslide events controlled by groundwater. As for West Cliff, sea level rise effects are outweighed by infrequent large scale cliff failure events. Total erosion in this area of 5-20m predicted by 2025 (SCOPAC, 2004 and Halcrow, 2002). The frequency of landslides along this section is 1-10 years, with a recession potential of 10-50m at West Cliff, but less than 10m at Thorncombe Beacon (Halcrow, 2002).	0.37m/yr. These are complex cliffs which tend to recede due to landslide events controlled by groundwater. Toe erosion is therefore less important and so sea level rise effects are outweighed by infrequent large scale cliff failure events. Total erosion of these cliffs of about 17-125m predicted by 2055 (SCOPAC, 2004 and Halcrow, 2002). The cliffs towards Eype and Thorncombe Beacon experience annual erosion in the region of 0.05-0.5m/yr. These are also complex cliffs which tend to recede due to both gradual erosion and large scale landslide events controlled by groundwater. As for West Cliff, sea level rise effects are outweighed by infrequent large scale cliff failure events. Total erosion in this area of 13-50m predicted by 2055 (SCOPAC, 2004 and Halcrow, 2002). The frequency of landslides along this section is 1-10 years, with a recession potential of 10-50m at West Cliff, but less than 10m at Thorncombe Beacon (Halcrow, 2002).	0.37m/yr. These are complex cliffs which tend to recede due to landslide events controlled by groundwater. Toe erosion is therefore less important and so sea level rise effects are outweighed by infrequent large scale cliff failure events. Total erosion of these cliffs of about 36-250m predicted by 2105 (SCOPAC, 2004 and Halcrow, 2002). The cliffs towards Eype and Thorncombe Beacon experience annual erosion in the region of 0.05-0.5m/yr. These are also complex cliffs which tend to recede due to both gradual erosion and large scale landslide events controlled by groundwater. As for West Cliff, sea level rise effects are outweighed by infrequent large scale cliff failure events. Total erosion in this area of 27-100m predicted by 2105 (SCOPAC, 2004 and Halcrow, 2002). The frequency of landslides along this section is 1-10 years, with a recession potential of 10-50m at West Cliff, but less than 10m at Thorncombe Beacon (Halcrow, 2002).
Thorncombe Beacon to Seatown (East)	**Defended:** No defences present. **Undefended:** Lower limit of annual cliff erosion in the region of 0.7m/yr. These are complex cliffs which tend to recede due to both gradual erosion and large scale landslide events controlled by groundwater. Toe erosion is therefore less important and so sea level rise	**Defended:** No defences present. **Undefended:** Lower limit of annual cliff erosion in the region of 0.7m/yr. These are complex cliffs which tend to recede due to both gradual erosion and large scale landslide events controlled by groundwater. Toe erosion is therefore less important and so sea level rise	**Defended:** No defences present. **Undefended:** Lower limit of annual cliff erosion in the region of 0.7m/yr. These are complex cliffs which tend to recede due to both gradual erosion and large scale landslide events controlled by groundwater. Toe erosion is therefore less important and so sea level rise

Location	Data Assessment for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	effects are outweighed by infrequent large scale cliff failure events. This gives rise to total erosion of 12-20m predicted by 2025 (Halcrow, 2007b and Halcrow, 2002). The frequency of landslides along this section is 1-10 years, with a recession potential of less than 10m (Halcrow, 2002).	effects are outweighed by infrequent large scale cliff failure events. This gives rise to total erosion of 33-50m predicted by 2055 (Halcrow, 2007b and Halcrow, 2002). The frequency of landslides along this section is 1-10 years, with a recession potential of less than 10m (Halcrow, 2002).	effects are outweighed by infrequent large scale cliff failure events. This gives rise to total erosion of 68-100m predicted by 2105 (Halcrow, 2007b and Halcrow, 2002). The frequency of landslides along this section is 1-10 years, with a recession potential of less than 10m (Halcrow, 2002).
Seatown	**Defended:** Rock armour revetment along the toe of part of the cliff fronting the western part of Seatown. Despite this, annual cliff erosion in the region of 0.33m/yr could still occur within the complex cliffs which tend to recede due to both gradual erosion and large scale landslide events controlled by groundwater. Toe erosion is therefore less important and so sea level rise effects are outweighed by infrequent large scale cliff failure events. This gives rise to total erosion of 6-20m predicted by 2025 (Halcrow, 2007b; Halcrow, 2002). The remaining part of this section is low-lying land susceptible that is protected by a sea wall, fronted by shingle beach which has been significantly depleted by historical shingle mining (SCOPAC, 2004). **Undefended:** This section is completely defended.	**Defended:** Rock armour revetment along the toe of part of the cliff fronting the western part of Seatown. Despite this, annual cliff erosion in the region of 0.33m/yr could still occur within the complex cliffs which tend to recede due to both gradual erosion and large scale landslide events controlled by groundwater. Toe erosion is therefore less important and so sea level rise effects are outweighed by infrequent large scale cliff failure events. This gives rise to total erosion of 16-50m predicted by 2055 (Halcrow, 2007b; Halcrow, 2002). The remaining part of this section is low-lying land susceptible that is protected by a sea wall, fronted by shingle beach which has been significantly depleted by historical shingle mining (SCOPAC, 2004). **Undefended:** This section is completely defended.	**Defended:** Rock armour revetment along the toe of part of the cliff fronting the western part of Seatown. Despite this, annual cliff erosion in the region of 0.33m/yr could still occur within the complex cliffs which tend to recede due to both gradual erosion and large scale landslide events controlled by groundwater. Toe erosion is therefore less important and so sea level rise effects are outweighed by infrequent large scale cliff failure events. This gives rise to total erosion of 32-100m predicted by 2105 (Halcrow, 2007b; Halcrow, 2002). The remaining part of this section is low-lying land susceptible that is protected by a sea wall, fronted by shingle beach which has been significantly depleted by historical shingle mining (SCOPAC, 2004). **Undefended:** This section is completely defended.
Seatown (West) to Golden Cap	**Defended:** No defences present. **Undefended:** Lower limit of annual cliff erosion	**Defended:** No defences present. **Undefended:** Lower limit of annual cliff erosion	**Defended:** No defences present. **Undefended:** Lower limit of annual cliff erosion

Location	Data Assessment for 'With Present Management'		
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	in the region of 0.7m/yr. These are complex cliffs which tend to recede due to both gradual erosion and large scale landslide events controlled by groundwater. Toe erosion is therefore less important and so sea level rise effects are outweighed by infrequent large scale cliff failure events. This gives rise to total erosion of 12-20m predicted by 2025 (Halcrow, 2007b and Halcrow, 2002). The frequency of landslides along this section is 1-10 years, with a recession potential of less than 10m (Halcrow, 2002).	in the region of 0.7m/yr. These are complex cliffs which tend to recede due to both gradual erosion and large scale landslide events controlled by groundwater. Toe erosion is therefore less important and so sea level rise effects are outweighed by infrequent large scale cliff failure events. This gives rise to total erosion of 33-50m predicted by 2055 (Halcrow, 2007b and Halcrow, 2002). The frequency of landslides along this section is 1-10 years, with a recession potential of less than 10m (Halcrow, 2002).	in the region of 0.7m/yr. These are complex cliffs which tend to recede due to both gradual erosion and large scale landslide events controlled by groundwater. Toe erosion is therefore less important and so sea level rise effects are outweighed by infrequent large scale cliff failure events. This gives rise to total erosion of 68-100m predicted by 2105 (Halcrow, 2007b and Halcrow, 2002). The frequency of landslides along this section is 1-10 years, with a recession potential of less than 10m (Halcrow, 2002).
Golden Cap to Charmouth (East)	**Defended:** No defences present. **Undefended:** Lower limits of annual cliff erosion along this section based upon historical rates. At Broom Hill this is in the region of 0.99m/yr, whilst at Stonebarrow it is 0.39m/yr and at Golden Cap, annual cliff erosion in the region of 0.05-0.3m/yr (SCOPAC, 2004). These are all complex cliffs, which tend to recede due to both gradual erosion and medium to large scale landslide events controlled by groundwater. Toe erosion is therefore less important and so sea level rise effects are outweighed by infrequent cliff failure events along this section. The frequency of landslide events at along this section is 10-100 years (Halcrow, 2002) ,	**Defended:** No defences present. **Undefended:** Lower limits of annual cliff erosion along this section based upon historical rates. At Broom Hill this is in the region of 0.99m/yr, whilst at Stonebarrow it is 0.39m/yr and at Golden Cap, annual cliff erosion in the region of 0.05-0.3m/yr (SCOPAC, 2004). These are all complex cliffs, which tend to recede due to both gradual erosion and medium to large scale landslide events controlled by groundwater. Toe erosion is therefore less important and so sea level rise effects are outweighed by infrequent cliff failure events along this section. The frequency of landslide events at along this section is 10-100 years (Halcrow, 2002) ,	**Defended:** No defences present. **Undefended:** Lower limits of annual cliff erosion along this section based upon historical rates. At Broom Hill this is in the region of 0.99m/yr, whilst at Stonebarrow it is 0.39m/yr and at Golden Cap, annual cliff erosion in the region of 0.05-0.3m/yr (SCOPAC, 2004). These are all complex cliffs, which tend to recede due to both gradual erosion and medium to large scale landslide events controlled by groundwater. Toe erosion is therefore less important and so sea level rise effects are outweighed by infrequent cliff failure events along this section. The frequency of landslide events at along this section is 10-100 years (Halcrow, 2002) ,

<table>
<tr><th rowspan="2">Location</th><th colspan="3">Data Assessment for 'With Present Management'</th></tr>
<tr><th>Short Term (to 2025)</th><th>Medium Term (to 2055)</th><th>Long Term (to 2105)</th></tr>
<tr><td></td><td>although at Stonebarrow, it is up to 100-150 years (SCOPAC, 2004). The recession potential at Golden Cap is 10-50m per event, whilst at Stonebarrow it is greater than 50m per event (Halcrow, 2002).

At Stonebarrow there is also a large landslide complex seaward of the cliff top, which will affect the rate of actual cliff top recession.

Total erosion predicted along this section by 2025 therefore varies from 3-50m at Golden Cap, 17-50m at Broom Hill, and 7-50m at Stonebarrow (SCOPAC, 2004 and Halcrow, 2002).</td><td>although at Stonebarrow, it is up to 100-150 years (SCOPAC, 2004). The recession potential at Golden Cap is 10-50m per event, whilst at Stonebarrow it is greater than 50m per event (Halcrow, 2002).

At Stonebarrow there is also a large landslide complex seaward of the cliff top, which will affect the rate of actual cliff top recession.

Total erosion predicted along this section by 2055 therefore varies from 8-50m at Golden Cap, 47-50m at Broom Hill, and 18-50m at Stonebarrow (SCOPAC, 2004 and Halcrow, 2002).</td><td>although at Stonebarrow, it is up to 100-150 years (SCOPAC, 2004). The recession potential at Golden Cap is 10-50m per event, whilst at Stonebarrow it is greater than 50m per event (Halcrow, 2002).

At Stonebarrow there is also a large landslide complex seaward of the cliff top, which will affect the rate of actual cliff top recession.

Total erosion predicted along this section by 2105 therefore varies from 17-50m at Golden Cap, 50-100m at Broom Hill, and 38-50m at Stonebarrow (SCOPAC, 2004 and Halcrow, 2002).</td></tr>
<tr><td>Charmouth (East) to East Cliff (Lyme Regis)</td><td>Defended: Defences protect the low-lying land at Charmouth at the back of a sandy beach. Coastal squeeze anticipated here.

Undefended: Major landslide complexes with varying annual rates of recession. Black Ven East and Central, annual cliff erosion in the region of 0.2-0.6m/yr (Halcrow, 2007a).

Annual cliff erosion at Black Ven West in the region of 0.6m/yr (Halcrow, 2007a). This lower estimate of recession is based upon the more recent rate of recession observed, although depending upon the period looked at, there are potentially large distortions depending on the occurrence of failure events. Use of this rate is in broad agreement with the Futurecoast assessment of recession potential</td><td>Defended: Defences protect the low-lying land at Charmouth at the back of a sandy beach. Coastal squeeze anticipated here.

Undefended: Major landslide complexes with varying annual rates of recession. Black Ven East and Central, annual cliff erosion in the region of 0.2-0.6m/yr (Halcrow, 2007a).

Annual cliff erosion at Black Ven West in the region of 0.6m/yr (Halcrow, 2007a). This lower estimate of recession is based upon the more recent rate of recession observed, although depending upon the period looked at, there are potentially large distortions depending on the occurrence of failure events. Use of this rate is in broad agreement with the Futurecoast assessment of recession potential</td><td>Defended: Defences protect the low-lying land at Charmouth at the back of a sandy beach. Coastal squeeze anticipated here.

Undefended: Major landslide complexes with varying annual rates of recession. Black Ven East and Central, annual cliff erosion in the region of 0.2-0.6m/yr (Halcrow, 2007a).

Annual cliff erosion at Black Ven West in the region of 0.6m/yr (Halcrow, 2007a). This lower estimate of recession is based upon the more recent rate of recession observed, although depending upon the period looked at, there are potentially large distortions depending on the occurrence of failure events. Use of this rate is in broad agreement with the Futurecoast assessment of recession potential</td></tr>
</table>

Location	Data Assessment for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	and frequency. At The Spittles, annual cliff recession in the region of 0.52m/yr. These cliffs are all complex cliffs, which tend to recede due to landslide events controlled by groundwater. Toe erosion is therefore less important and so sea level rise effects are outweighed by infrequent large scale cliff failure events. The frequency of landslide events is 10-100 years, with a recession potential of more than 50m per event (Halcrow, 2002). Total erosion of 10-50m is predicted by 2025 along this section (Halcrow, 2007a and Halcrow, 2002).	and frequency. At The Spittles, annual cliff recession in the region of 0.52m/yr. These cliffs are all complex cliffs, which tend to recede due to landslide events controlled by groundwater. Toe erosion is therefore less important and so sea level rise effects are outweighed by infrequent large scale cliff failure events. The frequency of landslide events is 10-100 years, with a recession potential of more than 50m per event (Halcrow, 2002). Total erosion is predicted to vary along this section by 2055, with 19-50m predicted for Black Ven East and Central) and 28-50m at Black Ven West. At The Spittles, 24-50m of erosion is predicted by 2055 (Halcrow, 2007a and Halcrow, 2002).	and frequency. At The Spittles, annual cliff recession in the region of 0.52m/yr. These cliffs are all complex cliffs, which tend to recede due to landslide events controlled by groundwater. Toe erosion is therefore less important and so sea level rise effects are outweighed by infrequent large scale cliff failure events. The frequency of landslide events is 10-100 years, with a recession potential of more than 50m per event (Halcrow, 2002). Total erosion is predicted to vary along this section by 2105, with 40-50m predicted for Black Ven East and Central) and 50-60m at Black Ven West. At The Spittles, about 50m of erosion is predicted by 2105 (Halcrow, 2007a and Halcrow, 2002).
East Cliff (Lyme Regis) to Broad Ledge (Lyme Regis)	**Defended:** A sea wall extends along the toe of East and Church Cliffs at Lyme Regis and has prevented any significant landslide activity in this area. It is estimated that prior to construction of the sea wall, recession at an annual rate of 0.45-0.8m/yr (East Cliff) or even 1.3m/yr (Church Cliff) occurred (SCOPAC, 2004), with a landslide frequency of 10-100 years and a recession potential of more than 50m per event (Halcrow, 2002). **Undefended:** This section is completely	**Defended:** A sea wall extends along the toe of East and Church Cliffs at Lyme Regis and has prevented any significant landslide activity in this area. It is estimated that prior to construction of the sea wall, recession at an annual rate of 0.45-0.8m/yr (East Cliff) or even 1.3m/yr (Church Cliff) occurred (SCOPAC, 2004), with a landslide frequency of 10-100 years and a recession potential of more than 50m per event (Halcrow, 2002). **Undefended:** This section is completely	**Defended:** A sea wall extends along the toe of East and Church Cliffs at Lyme Regis and has prevented any significant landslide activity in this area. It is estimated that prior to construction of the sea wall, recession at an annual rate of 0.45-0.8m/yr (East Cliff) or even 1.3m/yr (Church Cliff) occurred (SCOPAC, 2004), with a landslide frequency of 10-100 years and a recession potential of more than 50m per event (Halcrow, 2002). **Undefended:** This section is completely

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	defended.	defended.	defended.
Broad Ledge (Lyme Regis) to The Cobb (Lyme Regis)	**Defended:** The presence of defences along the cliff toe prevents cliff erosion and also littoral drift of sediment. **Undefended:** This section is completely defended.	**Defended:** The presence of defences along the cliff toe prevents cliff erosion and also littoral drift of sediment. **Undefended:** This section is completely defended.	**Defended:** The presence of defences along the cliff toe prevents cliff erosion and also littoral drift of sediment. **Undefended:** This section is completely defended.
The Cobb (Lyme Regis) to Seven Rock Point	**Defended:** Sea wall along part of cliff toe at Lyme Regis prevents cliff erosion in this area. Some accretion of Monmouth Beach immediately adjacent The Cobb, but overall long term trend of erosion along Monmouth Beach. **Undefended:** This section comprises complex cliffs which tend to recede due to landslide events controlled by groundwater. Toe erosion is therefore less important for continued erosion of cliff base, with historic rates of recession of cliff base presented in SCOPAC (2004), but historic rates of cliff top recession are not available. The frequency of landslide events is 250-1000+ years, with a recession potential of 10-50m per event (Halcrow, 2002). No cliff top recession is predicted to occur by 2025.	**Defended:** Sea wall along part of cliff toe at Lyme Regis prevents cliff erosion in this area. Some accretion of Monmouth Beach immediately adjacent The Cobb, but overall long term trend of erosion along Monmouth Beach. **Undefended:** This section comprises complex cliffs which tend to recede due to landslide events controlled by groundwater. Toe erosion is therefore less important for continued erosion of cliff base, with historic rates of recession of cliff base presented in SCOPAC (2004), but historic rates of cliff top recession are not available. The frequency of landslide events is 250-1000+ years, with a recession potential of 10-50m per event (Halcrow, 2002). No cliff top recession is predicted to occur by 2055.	**Defended:** Sea wall along part of cliff toe at Lyme Regis prevents cliff erosion in this area. Some accretion of Monmouth Beach immediately adjacent The Cobb, but overall long term trend of erosion along Monmouth Beach. **Undefended:** This section comprises complex cliffs which tend to recede due to landslide events controlled by groundwater. Toe erosion is therefore less important for continued erosion of cliff base, with historic rates of recession of cliff base presented in SCOPAC (2004), but historic rates of cliff top recession are not available. The frequency of landslide events is 250-1000+ years, with a recession potential of 10-50m per event (Halcrow, 2002). No cliff top recession is predicted to occur by 2105.
Seven Rock Point to Haven Cliff (West)	**Defended:** No defences present. **Undefended:** Along this section the cliffs are all	**Defended:** No defences present. **Undefended:** Along this section the cliffs are all	**Defended:** No defences present. **Undefended:** Along this section the cliffs are all

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	complex cliffs, which tend to recede due to landslide events controlled by groundwater. Towards the eastern end of this section (Pinhay and Dowland Cliffs) the frequency of landslide events is 250-1000+ years, with a recession potential of more than 50m per event. Toe erosion in this area is important for continued erosion of the cliff base. Historic rates of recession of the cliff base area presented in SCOPAC (2004), but historic rates of cliff top recession are not available. No cliff top recession is predicted in this area by 2025. Towards the western end of this section (Haven Cliffs), the lower limit of annual cliff erosion in this area is in the region of 0.2m/yr (SCOPAC, 2004). The frequency of landslide events is 10-100 years with a recession potential of less than 10m per event (Halcrow, 2002). Toe erosion is less important and so sea level rise effects are outweighed by infrequent cliff failure events. Total erosion in this area is predicted to be 3-10m by 2025.	complex cliffs, which tend to recede due to landslide events controlled by groundwater. Towards the eastern end of this section (Pinhay and Dowland Cliffs) the frequency of landslide events is 250-1000+ years, with a recession potential of more than 50m per event. Toe erosion in this area is important for continued erosion of the cliff base. Historic rates of recession of the cliff base area presented in SCOPAC (2004), but historic rates of cliff top recession are not available. No cliff top recession is predicted in this area by 2055. Towards the western end of this section (Haven Cliffs), the lower limit of annual cliff erosion in this area is in the region of 0.2m/yr (SCOPAC, 2004). The frequency of landslide events is 10-100 years with a recession potential of less than 10m per event (Halcrow, 2002). Toe erosion is less important and so sea level rise effects are outweighed by infrequent cliff failure events. Total erosion in this area is predicted to be 9-10m by 2055.	complex cliffs, which tend to recede due to landslide events controlled by groundwater. Towards the eastern end of this section (Pinhay and Dowland Cliffs) the frequency of landslide events is 250-1000+ years, with a recession potential of more than 50m per event. Toe erosion in this area is important for continued erosion of the cliff base. Historic rates of recession of the cliff base area presented in SCOPAC (2004), but historic rates of cliff top recession are not available. No cliff top recession is predicted in this area by 2105. Towards the western end of this section (Haven Cliffs), the lower limit of annual cliff erosion in this area is in the region of 0.2m/yr (SCOPAC, 2004). The frequency of landslide events is 10-100 years with a recession potential of less than 10m per event (Halcrow, 2002). Toe erosion is less important and so sea level rise effects are outweighed by infrequent cliff failure events. Total erosion in this area is predicted to be 10-20m by 2105.
Haven Cliff (West) to Seaton Hole	**Defended:** Sediment transport from west to east maintains spit across Axe estuary mouth. Beach is stable and accreting in recent years, though levels fluctuate seasonally. Defences along the cliff toe from Seaton to Seaton Hole, along with recent natural beach	**Defended:** Sediment transport from west to east maintains spit across Axe estuary mouth. Beach is stable and accreting in recent years, though levels fluctuate seasonally. Defences along the cliff toe from Seaton to Seaton Hole, along with recent natural beach	**Defended:** Sediment transport from west to east maintains spit across Axe estuary mouth. Beach is stable and accreting in recent years, though levels fluctuate seasonally. Defences along the cliff toe from Seaton to Seaton Hole, along with recent natural beach

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	accumulation, has reduced rate of cliff recession to the region of 0.2m/yr, giving rise to total erosion of 3-5m predicted by 2025 (SCOPAC, 2004). Prior to defences, annual cliff erosion occurred in the region of 0.5-1m/yr at Seaton (Posford Duvivier, 1996), and up to 1.5m/yr at Seaton Hole (Posford Duvivier, 1997). Should the defence not be present, landslide frequency would be between 1-10 and 10-100 years, with a recession potential of less than 10m per event (Halcrow, 2002). **Undefended:** This section is completely defended.	accumulation, has reduced rate of cliff recession to the region of 0.2m/yr, giving rise to total erosion of 5-10m predicted by 2055 (SCOPAC, 2004). Prior to defences, annual cliff erosion occurred in the region of 0.5-1m/yr at Seaton (Posford Duvivier, 1996), and up to 1.5m/yr at Seaton Hole (Posford Duvivier, 1997). Should the defence not be present, landslide frequency would be between 1-10 and 10-100 years, with a recession potential of less than 10m per event (Halcrow, 2002). **Undefended:** This section is completely defended.	accumulation, has reduced rate of cliff recession to the region of 0.2m/yr, giving rise to total erosion of 10-15m predicted by 2105 (SCOPAC, 2004). Prior to defences, annual cliff erosion occurred in the region of 0.5-1m/yr at Seaton (Posford Duvivier, 1996), and up to 1.5m/yr at Seaton Hole (Posford Duvivier, 1997). Should the defence not be present, landslide frequency would be between 1-10 and 10-100 years, with a recession potential of less than 10m per event (Halcrow, 2002). **Undefended:** This section is completely defended.
Seaton Hole to Beer Head	**Defended:** No defences present along most of this section, except for a short length of defence at Beer which is unlikely to have much effect upon erosion rates as it is backed by resistant chalk cliffs. **Undefended:** Chalk cliffs largely resistant to erosion with little change over past century. Failure by infrequent cliff falls, with a frequency of 10-100 years and a recession potential of 10-50m per event (Halcrow, 2002). Total erosion of 0-50m predicted by 2025.	**Defended:** No defences present along most of this section, except for a short length of defence at Beer which is unlikely to have much effect upon erosion rates as it is backed by resistant chalk cliffs. **Undefended:** Chalk cliffs largely resistant to erosion with little change over past century. Failure by infrequent cliff falls, with a frequency of 10-100 years and a recession potential of 10-50m per event (Halcrow, 2002). Total erosion of 0-50m predicted by 2055.	**Defended:** No defences present along most of this section, except for a short length of defence at Beer which is unlikely to have much effect upon erosion rates as it is backed by resistant chalk cliffs. **Undefended:** Chalk cliffs largely resistant to erosion with little change over past century. Failure by infrequent cliff falls, with a frequency of 10-100 years and a recession potential of 10-50m per event (Halcrow, 2002). Total erosion of 0-50m predicted by 2105.
Beer Head to Salcombe Hill (West)	**Defended:** No defences present along the majority of this section, except for some very	**Defended:** No defences present along the majority of this section, except for some very	**Defended:** No defences present along the majority of this section, except for some very

Location	Data Assessment for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	localised rock placement at Branscombe. **Undefended:** Beach erosion has occurred at the western end (Salcombe Hill) of this section, whilst a slight long term trend of accretion occurs towards Beer Head. The frequency of landslide events increases from east to west along this section, with events every 250-1000+ at Hooken Cliff, increasing to 100-250 years at Branscombe Cliff, and 10-100 years at Dunscombe Cliff and Salcombe Hill. The recession potential of landslide events along this section is typically less than 10m per event, except at Hooken Cliff, where it is more than 50m per event (Halcrow, 2002). Lower limit of annual cliff erosion towards Beer Head in the region of 0.06-0.3m/yr. (Halcrow, 2002; SCOPAC, 2004). These are composite cliffs consisting of an undercliff formation and an upper chalk formation. Although erosion of the exposed cliff face would occur, cliff top recession would result from a large scale event which would be due to groundwater rather than wave action at the toe. Total erosion in this area is predicted to be 3-10m by 2025. At Salcombe Hill the lower limit of annual erosion is in the region of 1.2-1.7m/yr (Royal Haskoning, 2003), although longer term rate is	localised rock placement at Branscombe. **Undefended:** Beach erosion has occurred at the western end (Salcombe Hill) of this section, whilst a slight long term trend of accretion occurs towards Beer Head. The frequency of landslide events increases from east to west along this section, with events every 250-1000+ at Hooken Cliff, increasing to 100-250 years at Branscombe Cliff, and 10-100 years at Dunscombe Cliff and Salcombe Hill. The recession potential of landslide events along this section is typically less than 10m per event, except at Hooken Cliff, where it is more than 50m per event (Halcrow, 2002). Lower limit of annual cliff erosion towards Beer Head in the region of 0.06-0.3m/yr. (Halcrow, 2002; SCOPAC, 2004). These are composite cliffs consisting of an undercliff formation and an upper chalk formation. Although erosion of the exposed cliff face would occur, cliff top recession would result from a large scale event which would be due to groundwater rather than wave action at the toe. Total erosion in this area is predicted to be 8-10m by 2055. At Salcombe Hill the lower limit of annual erosion is in the region of 1.2-1.7m/yr (Royal Haskoning, 2003), although longer term rate is	localised rock placement at Branscombe. **Undefended:** Beach erosion has occurred at the western end (Salcombe Hill) of this section, whilst a slight long term trend of accretion occurs towards Beer Head. The frequency of landslide events increases from east to west along this section, with events every 250-1000+ at Hooken Cliff, increasing to 100-250 years at Branscombe Cliff, and 10-100 years at Dunscombe Cliff and Salcombe Hill. The recession potential of landslide events along this section is typically less than 10m per event, except at Hooken Cliff, where it is more than 50m per event (Halcrow, 2002). Lower limit of annual cliff erosion towards Beer Head in the region of 0.06-0.3m/yr. (Halcrow, 2002; SCOPAC, 2004). These are composite cliffs consisting of an undercliff formation and an upper chalk formation. Although erosion of the exposed cliff face would occur, cliff top recession would result from a large scale event which would be due to groundwater rather than wave action at the toe. Total erosion in this area is predicted to be 10-17m by 2105. At Salcombe Hill the lower limit of annual erosion is in the region of 1.2-1.7m/yr (Royal Haskoning, 2003), although longer term rate is

Location	Data Assessment for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	0.3m/yr (SCOPAC, 2004). These are simple cliffs, which tend to recede through gradual erosion and very small scale slides. These are likely to be affected by sea level rise therefore use Bruun Rule prediction. The cliffs do not appear to contribute much to the beach budget. Longer term historic rate of 0.3m/yr used here as higher rates based on more recent data likely distorted by recent events. Total erosion in this area is predicted to be 5-6m by 2025.	0.3m/yr (SCOPAC, 2004). These are simple cliffs, which tend to recede through gradual erosion and very small scale slides. These are likely to be affected by sea level rise therefore use Bruun Rule prediction. The cliffs do not appear to contribute much to the beach budget. Longer term historic rate of 0.3m/yr used here as higher rates based on more recent data likely distorted by recent events. Total erosion in this area is predicted to be 14-18m by 2055.	0.3m/yr (SCOPAC, 2004). These are simple cliffs, which tend to recede through gradual erosion and very small scale slides. These are likely to be affected by sea level rise therefore use Bruun Rule prediction. The cliffs do not appear to contribute much to the beach budget. Longer term historic rate of 0.3m/yr used here as higher rates based on more recent data likely distorted by recent events. Total erosion in this area is predicted to be 29-53m by 2105.
Sidmouth	**Defended:** The beach here is subject to active beach management, including the use of offshore breakwaters, which has kept the beach relatively stable over the long term all be it with a slight trend of erosion. This is likely associated with the frequent large fluctuations in beach volume that occur, with not all material being returned after initial erosion. The sea wall along this section protects low-lying land. **Undefended:** This section is completely defended.	**Defended:** The beach here is subject to active beach management, including the use of offshore breakwaters, which has kept the beach relatively stable over the long term all be it with a slight trend of erosion. This is likely associated with the frequent large fluctuations in beach volume that occur, with not all material being returned after initial erosion. The sea wall along this section protects low-lying land. **Undefended:** This section is completely defended.	**Defended:** The beach here is subject to active beach management, including the use of offshore breakwaters, which has kept the beach relatively stable over the long term all be it with a slight trend of erosion. This is likely associated with the frequent large fluctuations in beach volume that occur, with not all material being returned after initial erosion. The sea wall along this section protects low-lying land. **Undefended:** This section is completely defended.
Chit Rocks to Big Picket Rock	**Defended:** No defences present. **Undefended:** Lower limit of annual cliff erosion in the region of 0.2m/yr. These are simple cliffs which tend to recede through gradual erosion and very small scale slides. These are likely to	**Defended:** No defences present. **Undefended:** Lower limit of annual cliff erosion in the region of 0.2m/yr. These are simple cliffs which tend to recede through gradual erosion and very small scale slides. These are likely to	**Defended:** No defences present. **Undefended:** Lower limit of annual cliff erosion in the region of 0.2m/yr. These are simple cliffs which tend to recede through gradual erosion and very small scale slides. These are likely to

Location	Data Assessment for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	be affected by sea level rise therefore use Bruun Rule prediction. Total erosion of 3-5m predicted by 2025 (SCOPAC, 2004). The frequency of landslide events is 10-100 years, with a recession potential of less than 10m per event (Halcrow, 2002). The cliffs do not appear to contribute much to the beach budget.	be affected by sea level rise therefore use Bruun Rule prediction. Total erosion of 9-11m predicted by 2025 (SCOPAC, 2004). The frequency of landslide events is 10-100 years, with a recession potential of less than 10m per event (Halcrow, 2002).	be affected by sea level rise therefore use Bruun Rule prediction. Total erosion of 19-29m predicted by 2025 (SCOPAC, 2004). The frequency of landslide events is 10-100 years, with a recession potential of less than 10m per event (Halcrow, 2002).
Big Picket Rock to Otterton Ledge	**Defended:** No defences present. **Undefended:** Lower limit of annual cliff erosion in the region of 0.2m/yr. These are simple cliffs which tend to recede through gradual erosion and very small scale slides. These are likely to be affected by sea level rise therefore use Bruun Rule prediction. Total erosion of 3-5m predicted by 2025 (SCOPAC, 2004). The frequency of landslide events is 1-10 years, with a recession potential of less than 10m per event (Halcrow, 2002).	**Defended:** No defences present. **Undefended:** Lower limit of annual cliff erosion in the region of 0.2m/yr. These are simple cliffs which tend to recede through gradual erosion and very small scale slides. These are likely to be affected by sea level rise therefore use Bruun Rule prediction. Total erosion of 9-13m predicted by 2055 (SCOPAC, 2004). The frequency of landslide events is 1-10 years, with a recession potential of less than 10m per event (Halcrow, 2002).	**Defended:** No defences present. **Undefended:** Lower limit of annual cliff erosion in the region of 0.2m/yr. These are simple cliffs which tend to recede through gradual erosion and very small scale slides. These are likely to be affected by sea level rise therefore use Bruun Rule prediction. Total erosion of 19-38m predicted by 2105 (SCOPAC, 2004). The frequency of landslide events is 1-10 years, with a recession potential of less than 10m per event (Halcrow, 2002).
Otterton Ledge to Budleigh Salterton (West)	**Defended:** Sea wall and gabions along part of the cliff prevent cliff toe erosion locally. Gabions also 'anchor' the landward end of the shingle spit that extends across the Otter estuary. Coastal squeeze possible in front of sea wall. The beach fronting Budleigh Salterton, including the shingle spit, experiences seasonal fluctuations but has been stable long term due	**Defended:** Sea wall and gabions along part of the cliff prevent cliff toe erosion locally. Gabions also 'anchor' the landward end of the shingle spit that extends across the Otter estuary. Coastal squeeze possible in front of sea wall. The beach fronting Budleigh Salterton, including the shingle spit, experiences seasonal fluctuations but has been stable long term due	**Defended:** Sea wall and gabions along part of the cliff prevent cliff toe erosion locally. Gabions also 'anchor' the landward end of the shingle spit that extends across the Otter estuary. Coastal squeeze possible in front of sea wall. The beach fronting Budleigh Salterton, including the shingle spit, experiences seasonal fluctuations but has been stable long term due

Location	Data Assessment for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	to continued sediment supply from the west. If the cliffs were not protected, landslide events would occur with a frequency of 10-100 years or even 100-250 years, with a recession potential of less than 10m per event (Halcrow, 2002). **Undefended:** The shingle spit across the Otter estuary is mostly undefended, and subject to infrequent temporary breaching during times of high river discharge every 20-30 years (Halcrow, 2002).	to continued sediment supply from the west. If the cliffs were not protected, landslide events would occur with a frequency of 10-100 years or even 100-250 years, with a recession potential of less than 10m per event (Halcrow, 2002). **Undefended:** The shingle spit across the Otter estuary is mostly undefended, and subject to infrequent temporary breaching during times of high river discharge every 20-30 years (Halcrow, 2002).	to continued sediment supply from the west. If the cliffs were not protected, landslide events would occur with a frequency of 10-100 years or even 100-250 years, with a recession potential of less than 10m per event (Halcrow, 2002). **Undefended:** The shingle spit across the Otter estuary is mostly undefended, and subject to infrequent temporary breaching during times of high river discharge every 20-30 years (Halcrow, 2002).
Budleigh Salterton (West) to Straight Point	**Defended:** No defences present. **Undefended:** Lower limit of annual cliff erosion in the region of 0.4m/yr (SCOPAC, 2004). These are simple cliffs which tend to recede through gradual erosion and very small scale slides. These are likely to be affected by sea level rise therefore use Bruun Rule prediction. Total erosion of about 7m predicted by 2025. The frequency of landslide events is typically 1-10 years, except at Straight Point where it is 100-250 years, with a recession potential of less than 10m per event (Halcrow, 2002). At Straight Point total erosion of 0-10m is predicted (Halcrow, 2002).	**Defended:** No defences present. **Undefended:** Lower limit of annual cliff erosion in the region of 0.4m/yr (SCOPAC, 2004). These are simple cliffs which tend to recede through gradual erosion and very small scale slides. These are likely to be affected by sea level rise therefore use Bruun Rule prediction. Total erosion of about 20m predicted by 2055. The frequency of landslide events is typically 1-10 years, except at Straight Point where it is 100-250 years, with a recession potential of less than 10m per event (Halcrow, 2002). At Straight Point total erosion of 0-10m is predicted (Halcrow, 2002).	**Defended:** No defences present. **Undefended:** Lower limit of annual cliff erosion in the region of 0.4m/yr (SCOPAC, 2004). These are simple cliffs which tend to recede through gradual erosion and very small scale slides. These are likely to be affected by sea level rise therefore use Bruun Rule prediction. Total erosion of 39-53m predicted by 2105. The frequency of landslide events is typically 1-10 years, except at Straight Point where it is 100-250 years, with a recession potential of less than 10m per event (Halcrow, 2002). At Straight Point total erosion of 0-10m is predicted (Halcrow, 2002).
Straight Point to Orcombe Rocks	**Defended:** No defence present. **Undefended:** Annual cliff erosion at the back of	**Defended:** No defence present. **Undefended:** Annual cliff erosion at the back of	**Defended:** No defence present. **Undefended:** Annual cliff erosion at the back of

Location	Data Assessment for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	Sandy Bay in the region of 0.4m/yr gives rise to total erosion of 6-8m predicted by 2025. At Orcombe Rocks, annual erosion is in the region of 0.5-0.6m/yr (SCOPAC, 2004). These are all simple cliffs which tend to recede through gradual erosion and small scale slides and cliff falls. These are likely to be affected by sea level rise, therefore use Bruun Rule prediction. Total erosion of 3-5m is predicted by 2025. The frequency of landslide events is 10-100 years, with a recession potential of less than 10m per event (Halcrow, 2002).	Sandy Bay in the region of 0.4m/yr gives rise to total erosion of 10-15m predicted by 2055. At Orcombe Rocks, annual erosion is in the region of 0.5-0.6m/yr (SCOPAC, 2004). These are all simple cliffs which tend to recede through gradual erosion and small scale slides and cliff falls. These are likely to be affected by sea level rise, therefore use Bruun Rule prediction. Total erosion of 9-14m is predicted by 2055. The frequency of landslide events is 10-100 years, with a recession potential of less than 10m per event (Halcrow, 2002).	Sandy Bay in the region of 0.4m/yr gives rise to total erosion of 15-25m predicted by 2105. At Orcombe Rocks, annual erosion is in the region of 0.5-0.6m/yr (SCOPAC, 2004). These are all simple cliffs which tend to recede through gradual erosion and small scale slides and cliff falls. These are likely to be affected by sea level rise, therefore use Bruun Rule prediction. Total erosion of 19-46m is predicted by 2105. The frequency of landslide events is 10-100 years, with a recession potential of less than 10m per event (Halcrow, 2002).
Orcombe Rocks to Exmouth Point	**Defended:** Exmouth frontage is lined by sea wall along the base of the cliffs that prevents cliff toe erosion. If left undefended, the cliffs would retreat as a result of landslide events with a frequency of 10-100 years and a recession potential of less than 10m per event (Halcrow, 2002). The sea wall also extends in front of low-lying land at Exmouth towards the mouth of the Exe estuary. Beach levels fluctuate but have a recent trend of erosion (Halcrow, 2007c). Coastal squeeze likely. **Undefended:** This section is completely defended.	**Defended:** Exmouth frontage is lined by sea wall along the base of the cliffs that prevents cliff toe erosion. If left undefended, the cliffs would retreat as a result of landslide events with a frequency of 10-100 years and a recession potential of less than 10m per event (Halcrow, 2002). The sea wall also extends in front of low-lying land at Exmouth towards the mouth of the Exe estuary. Beach levels fluctuate but have a recent trend of erosion (Halcrow, 2007c). Coastal squeeze likely. **Undefended:** This section is completely defended.	**Defended:** Exmouth frontage is lined by sea wall along the base of the cliffs that prevents cliff toe erosion. If left undefended, the cliffs would retreat as a result of landslide events with a frequency of 10-100 years and a recession potential of less than 10m per event (Halcrow, 2002). The sea wall also extends in front of low-lying land at Exmouth towards the mouth of the Exe estuary. Beach levels fluctuate but have a recent trend of erosion (Halcrow, 2007c). Coastal squeeze likely. **Undefended:** This section is completely defended.

Location	Data Assessment for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
Exe Estuary	**Defended:** Within the Exe Estuary there are a range of defences that provide flood protection, including the railway line that runs along both the east and west sides of the estuary as well as both earth and armoured embankments. The presence of these defences serve to restrict the ability of the estuary to respond naturally, although it has been constrained for so long by human activity that it has adapted to this situation and is in a state of sedimentary equilibrium. A number of these defences could fail towards the end of this period (residual lives 10-15 years) and would need to be updated. **Undefended:** This section is completely defended.	**Defended:** There would be continued defence against flooding provided throughout the estuary, although the remaining defences within the Exe Estuary would be at risk of failing during this period and so would need to be updated. The effect of sea level rise could result in the loss of some areas of inter-tidal mudflats as the estuary seeks to maintain its sedimentary equilibrium without being able to migrate laterally, unless the rate of sedimentation is able to keep pace with rising sea levels. **Undefended:** This section is completely defended.	**Defended:** Continued flood protection provided by a range of defences. The effect of sea level rise could result in the loss of some areas of inter-tidal mudflats as the estuary seeks to maintain its sedimentary equilibrium without being able to migrate laterally, unless the rate of sedimentation is able to keep pace with rising sea levels. **Undefended:** This section is completely defended.
Dawlish Warren to Langstone Rock	**Defended:** The landward end of Dawlish Warren spit is also defended, effectively anchoring this end of the spit. The breakwater at Langstone Rock prevents material reaching the spit by longshore transport, although long term evolution is strongly related to complex nearshore sediment transport processes, **Undefended:** The distal end of Dawlish Warren spit is presently accreting, although it has fluctuated greatly in the past with long term evolution strongly related to complex nearshore sediment transport processes (Halcrow, 2007c).	**Defended:** The landward end of Dawlish Warren spit is also defended, effectively anchoring this end of the spit. The breakwater at Langstone Rock prevents material reaching the spit by longshore transport, although long term evolution is strongly related to complex nearshore sediment transport processes, **Undefended:** The distal end of Dawlish Warren spit is presently accreting, although it has fluctuated greatly in the past with long term evolution strongly related to complex nearshore sediment transport processes (Halcrow, 2007c).	**Defended:** The landward end of Dawlish Warren spit is also defended, effectively anchoring this end of the spit. The breakwater at Langstone Rock prevents material reaching the spit by longshore transport, although long term evolution is strongly related to complex nearshore sediment transport processes, **Undefended:** The distal end of Dawlish Warren spit is presently accreting, although it has fluctuated greatly in the past with long term evolution strongly related to complex nearshore sediment transport processes (Halcrow, 2007c).

Location	Data Assessment for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	Historically the distal end has been shown to experience periodic rapid erosion in response to south-easterly storm events although it is not possible to predict if such an event would occur during this period (Fox *et al*, 2008).	Historically the distal end has been shown to experience periodic rapid erosion in response to south-easterly storm events although it is not possible to predict if such an event would occur during this period (Fox *et al*, 2008).	Historically the distal end has been shown to experience periodic rapid erosion in response to south-easterly storm events although it is not possible to predict if such an event would occur during this period (Fox *et al*, 2008).
Langstone Rock to Coryton Cove	**Defended:** The cliffs along this section are prevented from eroding by the sea wall that protects the railway line. The beach that fronts the sea wall is defended with groynes, and has gradually narrowed over the long term. On going narrowing and coastal squeeze very probable. **Undefended:** This section is completely defended.	**Defended:** The cliffs along this section are prevented from eroding by the sea wall that protects the railway line. The beach that fronts the sea wall is defended with groynes, and has gradually narrowed over the long term. On going narrowing and coastal squeeze very probable. **Undefended:** This section is completely defended.	**Defended:** The cliffs along this section are prevented from eroding by the sea wall that protects the railway line. The beach that fronts the sea wall is defended with groynes, and has gradually narrowed over the long term. On going narrowing and coastal squeeze very probable. **Undefended:** This section is completely defended.
Coryton Cove to Holcombe	**Defended:** Short lengths of sea wall at the back of small pocket beaches protect the railway line. These pocket beaches are relatively stable over the long term. Coastal squeeze likely. **Undefended:** Lower limit of annual cliff erosion in the region of 0.1m/yr. These are simple cliffs which recede through gradual erosion and small scale cliff falls. They are likely to be affected by sea level rise therefore use Bruun Rule prediction. Total erosion of about 1m predicted by 2025. The frequency of landslide events is 10-100 years with a recession potential of less than 10m per event (Halcrow, 2002).	**Defended:** Short lengths of sea wall at the back of small pocket beaches protect the railway line. These pocket beaches are relatively stable over the long term. Coastal squeeze likely. **Undefended:** Lower limit of annual cliff erosion in the region of 0.1m/yr. These are simple cliffs which recede through gradual erosion and small scale cliff falls. They are likely to be affected by sea level rise therefore use Bruun Rule prediction. Total erosion of 2-6m predicted by 2055. The frequency of landslide events is 10-100 years with a recession potential of less than 10m per event (Halcrow, 2002).	**Defended:** Short lengths of sea wall at the back of small pocket beaches protect the railway line. These pocket beaches are relatively stable over the long term. Coastal squeeze likely. **Undefended:** Lower limit of annual cliff erosion in the region of 0.1m/yr. These are simple cliffs which recede through gradual erosion and small scale cliff falls. They are likely to be affected by sea level rise therefore use Bruun Rule prediction. Total erosion of 5-29m predicted by 2105. The frequency of landslide events is 10-100 years with a recession potential of less than 10m per event (Halcrow, 2002).

Location	Data Assessment for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
Holcombe to Sprey Point	**Defended:** The cliffs along this section are prevented from significant erosion by the sea wall that protects the railway line, although infrequent landslides occur due to elevate groundwater. These are with a frequency of 10-100 years and a recession potential of less than 10m per event (Halcrow, 2002). The beach that fronts the sea wall has gradually narrowed over the long term. On going narrowing and coastal squeeze very probable. **Undefended:** This section is completely defended.	**Defended:** The cliffs along this section are prevented from significant erosion by the sea wall that protects the railway line, although infrequent landslides occur due to elevate groundwater. These are with a frequency of 10-100 years and a recession potential of less than 10m per event (Halcrow, 2002). The beach that fronts the sea wall has gradually narrowed over the long term. On going narrowing and coastal squeeze very probable. **Undefended:** This section is completely defended.	**Defended:** The cliffs along this section are prevented from significant erosion by the sea wall that protects the railway line, although infrequent landslides occur due to elevate groundwater. These are with a frequency of 10-100 years and a recession potential of less than 10m per event (Halcrow, 2002). The beach that fronts the sea wall has gradually narrowed over the long term. On going narrowing and coastal squeeze very probable. **Undefended:** This section is completely defended.
Sprey Point to Teignmouth Pier	**Defended:** The majority of the cliffs along this section are prevented from significant erosion by the sea wall that protects the railway line, although infrequent landslides occur due to elevate groundwater. If the defences were not present, then landslide events with a frequency of 10-100 years and a recession potential of less than 10m per event would be likely to occur (Halcrow, 2002). The beach that fronts the sea wall in the northern part of this section has gradually narrowed over the long term, whilst the beach towards the mouth of the Teign estuary fluctuates as part of the cyclic sediment transport processes that occur in this area. On going narrowing and coastal squeeze very probable over this period.	**Defended:** The majority of the cliffs along this section are prevented from significant erosion by the sea wall that protects the railway line, although infrequent landslides occur due to elevate groundwater. If the defences were not present, then landslide events with a frequency of 10-100 years and a recession potential of less than 10m per event would be likely to occur (Halcrow, 2002). The beach that fronts the sea wall in the northern part of this section has gradually narrowed over the long term, whilst the beach towards the mouth of the Teign estuary fluctuates as part of the cyclic sediment transport processes that occur in this area. On going narrowing and coastal squeeze very probable over this period.	**Defended:** The majority of the cliffs along this section are prevented from significant erosion by the sea wall that protects the railway line, although infrequent landslides occur due to elevate groundwater. If the defences were not present, then landslide events with a frequency of 10-100 years and a recession potential of less than 10m per event would be likely to occur (Halcrow, 2002). The beach that fronts the sea wall in the northern part of this section has gradually narrowed over the long term, whilst the beach towards the mouth of the Teign estuary fluctuates as part of the cyclic sediment transport processes that occur in this area. On going narrowing and coastal squeeze very probable over this period.

<table>
<tr><th rowspan="2">Location</th><th colspan="3">Data Assessment for 'With Present Management'</th></tr>
<tr><th>Short Term (to 2025)</th><th>Medium Term (to 2055)</th><th>Long Term (to 2105)</th></tr>
<tr><td></td><td>Undefended: This section is completely defended.</td><td>Undefended: This section is completely defended.</td><td>Undefended: This section is completely defended.</td></tr>
<tr><td>Teign Estuary</td><td>Defended: The beach towards the mouth of the Teign estuary fluctuates as part of the cyclic sediment transport processes that occur in this area. On going narrowing and coastal squeeze very probable over this period.

The beach at Shaldon on the south side of the entrance to the Teign estuary has been stable over the past decade (ABPmer, 2007).

Within the Teign estuary the northern side is completely defended by structures associated with both the railway line and the port.

These serve to prevent flooding of low lying areas of land, although these areas are restricted by the steeply rising side of the estuary valley on the landward side of the defences. The defences also serve to restrict the lateral movement of the estuary.

Undefended: Parts of the southern side of the Teign estuary west of Shaldon are undefended and so function naturally, although the sides of the estuary valley here rise steeply and so the lack of defences does not present a significant flood risk as areas of low lying land are limited.</td><td>Defended: The beach towards the mouth of the Teign estuary fluctuates as part of the cyclic sediment transport processes that occur in this area. On going narrowing and coastal squeeze very probable over this period.

The beach at Shaldon on the south side of the entrance to the Teign estuary has been stable over the past decade (ABPmer, 2007).

Within the Teign estuary the northern side is completely defended by structures associated with both the railway line and the port.

The continued presence of these defences would serve to both prevent flooding of low lying areas of land, and restrict the lateral movement of the estuary.

Undefended: Parts of the southern side of the Teign estuary west of Shaldon are undefended and so function naturally, although the sides of the estuary valley here rise steeply and so the lack of defences does not present a significant flood risk as areas of low lying land are limited.</td><td>Defended: The beach towards the mouth of the Teign estuary fluctuates as part of the cyclic sediment transport processes that occur in this area. On going narrowing and coastal squeeze very probable over this period.

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<tr><td>Shaldon (The Ness) to Petit Tor Point</td><td>Defended: Short sections of defences at Watcombe, Babbacombe and Maidencombe are at the back of small pocket beaches and</td><td>Defended: Short sections of defences at Watcombe, Babbacombe and Maidencombe are at the back of small pocket beaches and</td><td>Defended: Short sections of defences at Watcombe, Babbacombe and Maidencombe are at the back of small pocket beaches and</td></tr>
</table>

Location	Data Assessment for 'With Present Management'		
	Short Term (to 2025)	**Medium Term (to 2055)**	**Long Term (to 2105)**
	prevent erosion of the cliff toe locally. **Undefended:** There has been little historical erosion along this section over the past century (Halcrow, 2002) , with annual erosion less than 0.2m/yr occurring (SCOPAC, 2004). These are simple cliffs, which tend to recede through gradual erosion and small scale slides and cliff falls. These are likely to be affected by sea level rise therefore use Bruun Rule prediction. The frequency of landslide events is between 10-100 and 100-250 years, with a recession potential of less than 10m per event between Shaldon and Maidencombe, but 10-50m from Maidencombe to Petit Tor Point (Halcrow, 2002). Total erosion of about 2m predicted by 2025 along this entire section.	prevent erosion of the cliff toe locally. **Undefended:** There has been little historical erosion along this section over the past century (Halcrow, 2002) , with annual erosion less than 0.2m/yr occurring (SCOPAC, 2004). These are simple cliffs, which tend to recede through gradual erosion and small scale slides and cliff falls. These are likely to be affected by sea level rise therefore use Bruun Rule prediction. The frequency of landslide events is between 10-100 and 100-250 years, with a recession potential of less than 10m per event between Shaldon and Maidencombe, but 10-50m from Maidencombe to Petit Tor Point (Halcrow, 2002). Total erosion of 5-7m predicted by 2055 along this entire section.	prevent erosion of the cliff toe locally. **Undefended:** There has been little historical erosion along this section over the past century (Halcrow, 2002) , with annual erosion less than 0.2m/yr occurring (SCOPAC, 2004). These are simple cliffs, which tend to recede through gradual erosion and small scale slides and cliff falls. These are likely to be affected by sea level rise therefore use Bruun Rule prediction. The frequency of landslide events is between 10-100 and 100-250 years, with a recession potential of less than 10m per event between Shaldon and Maidencombe, but 10-50m from Maidencombe to Petit Tor Point (Halcrow, 2002). Total erosion of 10-24m predicted by 2105 along this entire section.
Petit Tor Point to Hope's Nose	**Defended:** Defences present along parts of Oddicombe and Anstey's Cove located at the back of beaches that show a long term trend of erosion. These also prevent erosion of the cliff toe locally and so reduce input of sediment to local beaches. Coastal squeeze possible in future. **Undefended:** Annual erosion in the region of 0.07-0.23m/yr occurs along this section, although the nature of the cliff recession varies.	**Defended:** Defences present along parts of Oddicombe and Anstey's Cove located at the back of beaches that show a long term trend of erosion. These also prevent erosion of the cliff toe locally and so reduce input of sediment to local beaches. Coastal squeeze possible in future. **Undefended:** Annual erosion in the region of 0.07-0.23m/yr occurs along this section, although the nature of the cliff recession varies.	**Defended:** Defences present along parts of Oddicombe and Anstey's Cove located at the back of beaches that show a long term trend of erosion. These also prevent erosion of the cliff toe locally and so reduce input of sediment to local beaches. Coastal squeeze possible in future. **Undefended:** Annual erosion in the region of 0.07-0.23m/yr occurs along this section, although the nature of the cliff recession varies.

Location	Data Assessment for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	The cliffs at Oddicombe Bay and from Anstey's Cove to Hope's Nose are complex cliffs controlled by groundwater. Toe erosion is less important in these areas and so sea level rise effects are outweighed by infrequent medium scale cliff failure events. Total erosion of 3-10m predicted by 2025 in these areas. The cliffs at Walls Hill are simple cliffs which would tend to recede through gradual erosion and infrequent, small scale cliff failure events. As such these cliffs are likely to be affected by sea level rise, therefore use Bruun Rule prediction. Total erosion of about 3m is predicted by 2025. The frequency of landslide events is between 10-100 and 100-250 years, with a recession potential of less than 10m per event (Halcrow, 2002).	The cliffs at Oddicombe Bay and from Anstey's Cove to Hope's Nose are complex cliffs controlled by groundwater. Toe erosion is less important in these areas and so sea level rise effects are outweighed by infrequent medium scale cliff failure events. Total erosion of 7-10m predicted by 2055 in these areas. The cliffs at Walls Hill are simple cliffs which would tend to recede through gradual erosion and infrequent, small scale cliff failure events. As such these cliffs are likely to be affected by sea level rise, therefore use Bruun Rule prediction. Total erosion of 7-9m is predicted by 2055. The frequency of landslide events is between 10-100 and 100-250 years, with a recession potential of less than 10m per event (Halcrow, 2002).	The cliffs at Oddicombe Bay and from Anstey's Cove to Hope's Nose are complex cliffs controlled by groundwater. Toe erosion is less important in these areas and so sea level rise effects are outweighed by infrequent medium scale cliff failure events. Total erosion of 10-15m predicted by 2105 in these areas. The cliffs at Walls Hill are simple cliffs which would tend to recede through gradual erosion and infrequent, small scale cliff failure events. As such these cliffs are likely to be affected by sea level rise, therefore use Bruun Rule prediction. Total erosion of 15-25m is predicted by 2025. The frequency of landslide events is between 10-100 and 100-250 years, with a recession potential of less than 10m per event (Halcrow, 2002).
Hope's Nose to Livermead Head	**Defended:** Very little cliff recession due to presence of defences along the base of cliffs. The beaches fronting defences have been stable over the medium to long term. Coastal squeeze possible in the future. **Undefended:** These are composite cliffs which tend to recede through a range of mechanisms but are relatively resistant to change. Lower limit of annual erosion in the region of 0.27m/yr in the localised area at London Bridge	**Defended:** Very little cliff recession due to presence of defences along the base of cliffs. The beaches fronting defences have been stable over the medium to long term. Coastal squeeze possible in the future. **Undefended:** These are composite cliffs which tend to recede through a range of mechanisms but are relatively resistant to change. Lower limit of annual erosion in the region of 0.27m/yr in the localised area at London Bridge	**Defended:** Very little cliff recession due to presence of defences along the base of cliffs. The beaches fronting defences have been stable over the medium to long term. Coastal squeeze possible in the future. **Undefended:** These are composite cliffs which tend to recede through a range of mechanisms but are relatively resistant to change. Lower limit of annual erosion in the region of 0.27m/yr in the localised area at London Bridge

Location	Data Assessment for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	(Halcrow, 2002) , whilst the remainder of this section has experienced slower recession over the past century, with annual erosion of about 0.05m/yr. The frequency of landslide events is between 10-100 and 100-250 years, with a recession potential of less than 10m per event throughout this section (Halcrow, 2002). Total erosion along most of this section of 1-10m predicted by 2025. This rises to 5-10m predicted in the localised area around London Bridge.	(Halcrow, 2002) , whilst the remainder of this section has experienced slower recession over the past century, with annual erosion of about 0.05m/yr. The frequency of landslide events is between 10-100 and 100-250 years, with a recession potential of less than 10m per event throughout this section (Halcrow, 2002). Total erosion along most of this section of 1-10m predicted by 2025. This rises to 5-10m predicted in the localised area around London Bridge.	(Halcrow, 2002) , whilst the remainder of this section has experienced slower recession over the past century, with annual erosion of about 0.05m/yr. The frequency of landslide events is between 10-100 and 100-250 years, with a recession potential of less than 10m per event throughout this section (Halcrow, 2002). Total erosion along most of this section of 5-10m predicted by 2105. This rises to 10-26m predicted in the localised area around London Bridge.
Livermead Head to Roundham Head	**Defended:** Most of the section is defended, with beaches fronting the defences having been highly stable over the long term (Halcrow, 2002). Coastal squeeze possible in the future in response to sea level rise. **Undefended:** Short sections of undefended rock headlands experience varying amounts of annual recession, with a maximum around Hollicombe Head in the region of 0-0.15m/yr (SCOPAC, 2004). These consist of simple cliffs that have experienced localised recession around Hollicombe Head headland although adjacent headlands have not retreated as much in the past. These could be affected in the future by sea level rise. Total erosion of 0-1m predicted by 2025 in around Hollicombe Head. Other headlands	**Defended:** Most of the section is defended, with beaches fronting the defences having been highly stable over the long term (Halcrow, 2002). Coastal squeeze possible in the future in response to sea level rise. **Undefended:** Short sections of undefended rock headlands experience varying amounts of annual recession, with a maximum around Hollicombe Head in the region of 0-0.15m/yr (SCOPAC, 2004). These consist of simple cliffs that have experienced localised recession around Hollicombe Head headland although adjacent headlands have not retreated as much in the past. These could be affected in the future by sea level rise. Total erosion of 0-4m predicted by 2055 in around Hollicombe Head. Other headlands	**Defended:** Most of the section is defended, with beaches fronting the defences having been highly stable over the long term (Halcrow, 2002). Coastal squeeze possible in the future in response to sea level rise. **Undefended:** Short sections of undefended rock headlands experience varying amounts of annual recession, with a maximum around Hollicombe Head in the region of 0-0.15m/yr (SCOPAC, 2004). These consist of simple cliffs that have experienced localised recession around Hollicombe Head headland although adjacent headlands have not retreated as much in the past. These could be affected in the future by sea level rise. Total erosion of 0-8m predicted by 2105 in around Hollicombe Head. Other headlands

Location	Data Assessment for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	have experienced negligible recession over the past 100 years and this would continue during this period.	have experienced negligible recession over the past 100 years and this would continue during this period.	have experienced negligible recession over the past 100 years and this would continue during this period.
Goodrington Sands to Broadsands	**Defended:** Sea wall located at the back of Broadsands Beach prevents erosion of cliff to and so restrict sediment supply to local beach. Wall at the back of Goodrington Sands fronts low-lying land. Both beaches have been stable over the long term. Coastal squeeze possible in the future in response to sea level rise. **Undefended:** The cliffs along this section that are undefended have eroded very little over the long term. This is likely to continue in the future.	**Defended:** Sea wall located at the back of Broadsands Beach prevents erosion of cliff to and so restrict sediment supply to local beach. Wall at the back of Goodrington Sands fronts low-lying land. Both beaches have been stable over the long term. Coastal squeeze possible in the future in response to sea level rise. **Undefended:** The cliffs along this section that are undefended have eroded very little over the long term. This is likely to continue in the future.	**Defended:** Sea wall located at the back of Broadsands Beach prevents erosion of cliff to and so restrict sediment supply to local beach. Wall at the back of Goodrington Sands fronts low-lying land. Both beaches have been stable over the long term. Coastal squeeze possible in the future in response to sea level rise. **Undefended:** The cliffs along this section that are undefended have eroded very little over the long term. This is likely to continue in the future.
Broadsands to Churston Cove (East)	**Defended:** No defences present, although likely affect by Brixham Harbour breakwater. **Undefended:** The cliffs along this section have eroded very little over the long term. This is likely to continue in the future. The pocket beaches along this section are stable, and have been slowly accreting over the long term.	**Defended:** No defences present, although likely affect by Brixham Harbour breakwater. **Undefended:** The cliffs along this section have eroded very little over the long term. This is likely to continue in the future. The pocket beaches along this section are stable, and have been slowly accreting over the long term.	**Defended:** No defences present, although likely affect by Brixham Harbour breakwater. **Undefended:** The cliffs along this section have eroded very little over the long term. This is likely to continue in the future. The pocket beaches along this section are stable, and have been slowly accreting over the long term.
Churston Cove (East) to Berry Head	**Defended:** Defences around Brixham prevent marine action at the base of the cliffs, although these are, in any case, very resistant to erosion. **Undefended:** The cliffs along this section have eroded very little over the long term. This is	**Defended:** Defences around Brixham prevent marine action at the base of the cliffs, although these are, in any case, very resistant to erosion. **Undefended:** The cliffs along this section have eroded very little over the long term. This is	**Defended:** Defences around Brixham prevent marine action at the base of the cliffs, although these are, in any case, very resistant to erosion. **Undefended:** The cliffs along this section have eroded very little over the long term. This is

Location	Data Assessment for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	likely to continue in the future.	likely to continue in the future.	likely to continue in the future.
Berry Head to Sharkham Point	**Defended:** No defences present. **Undefended:** This section consists of simple cliffs that erode as a result of marine action at the cliff toe and so are likely to be affected by sea level rise, therefore sue Bruun Rule prediction for upper limit. Lower limit of annual erosion in the region of 0 to 0.15m/yr, giving rise to total erosion of 1-2m predicted by 2025 along most of this section, up to about 3m in St Mary's Bay where there has historically been more recession (Halcrow, 2002; SCOPAC, 2004). The frequency of landslides is 10-100 years, with a recession potential of less than 10m per event (Halcrow, 2002).	**Defended:** No defences present. **Undefended:** This section consists of simple cliffs that erode as a result of marine action at the cliff toe and so are likely to be affected by sea level rise, therefore sue Bruun Rule prediction for upper limit. Lower limit of annual erosion in the region of 0 to 0.15m/yr, giving rise to total erosion of 4-7m predicted by 2055 along most of this section, rising to 7-10m in St Mary's Bay where there has historically been more recession (Halcrow, 2002; SCOPAC, 2004). The frequency of landslides is 10-100 years, with a recession potential of less than 10m per event (Halcrow, 2002).	**Defended:** No defences present. **Undefended:** This section consists of simple cliffs that erode as a result of marine action at the cliff toe and so are likely to be affected by sea level rise, therefore sue Bruun Rule prediction for upper limit. Lower limit of annual erosion in the region of 0 to 0.15m/yr, giving rise to total erosion of 8-28m predicted by 2055 along most of this section, rising to 15-35m in St Mary's Bay where there has historically been more recession (Halcrow, 2002; SCOPAC, 2004). The frequency of landslides is 10-100 years, with a recession potential of less than 10m per event (Halcrow, 2002).
Sharkham Point to Blackstone Point	**Defended:** No defences present. **Undefended:** Lower limit of annual erosion in the region of 0.05m/yr. This section is comprised of composite cliffs which are generally very resistant to erosion, but with the occasional pockets of slightly softer rocks. In general, sea level rise is unlikely to affect the rate of erosion. The frequency of landslides is 10-100 years, with a recession potential of less than 10m per event (Halcrow, 2002). Total erosion is predicted to be 1-10m by	**Defended:** No defences present. **Undefended:** Lower limit of annual erosion in the region of 0.05m/yr. This section is comprised of composite cliffs which are generally very resistant to erosion, but with the occasional pockets of slightly softer rocks. In general, sea level rise is unlikely to affect the rate of erosion. The frequency of landslides is 10-100 years, with a recession potential of less than 10m per event (Halcrow, 2002). Total erosion is predicted to be 2-10m by	**Defended:** No defences present. **Undefended:** Lower limit of annual erosion in the region of 0.05m/yr. This section is comprised of composite cliffs which are generally very resistant to erosion, but with the occasional pockets of slightly softer rocks. In general, sea level rise is unlikely to affect the rate of erosion. The frequency of landslides is 10-100 years, with a recession potential of less than 10m per event (Halcrow, 2002). Total erosion is predicted to be 5-10m by

Location	Data Assessment for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	2025.	2055.	2105.
Blackstone Point to Stoke Fleming	**Defended:** No defences present. **Undefended:** Lower limit of annual erosion in the region of 0.18-0.3m/yr (Halcrow, 2002; SCOPAC, 2004). This section is comprised of composite cliffs which are generally very resistant to erosion, but with the occasional pockets of slightly softer rocks. In general, sea level rise is unlikely to affect the rate of erosion. The frequency of landslides is 10-100 years, with a recession potential of less than 10m per event (Halcrow, 2002). Total erosion is predicted to be 2-10m by 2025.	**Defended:** No defences present. **Undefended:** Lower limit of annual erosion in the region of 0.18-0.3m/yr (Halcrow, 2002; SCOPAC, 2004). This section is comprised of composite cliffs which are generally very resistant to erosion, but with the occasional pockets of slightly softer rocks. In general, sea level rise is unlikely to affect the rate of erosion. The frequency of landslides is 10-100 years, with a recession potential of less than 10m per event (Halcrow, 2002). Total erosion is predicted to be 4-10m by 2055.	**Defended:** No defences present. **Undefended:** Lower limit of annual erosion in the region of 0.18-0.3m/yr (Halcrow, 2002; SCOPAC, 2004). This section is comprised of composite cliffs which are generally very resistant to erosion, but with the occasional pockets of slightly softer rocks. In general, sea level rise is unlikely to affect the rate of erosion. The frequency of landslides is 10-100 years, with a recession potential of less than 10m per event (Halcrow, 2002). Total erosion is predicted to be 9-10m by 2105.
Stoke Fleming to Strete	**Defended:** Defences at Blackpool Sands located at the back of the beach, which has slowly narrowed and eroded over the long term. Coastal squeeze possible in the future in response to sea level rise. **Undefended:** Lower limit of annual erosion in the region of 0.3m/yr (SCOPAC, 2004). This section is comprised of composite cliffs which are generally very resistant to erosion, but with the occasional pockets of slightly softer rocks. In general, sea level rise is unlikely to affect the rate of erosion. The frequency of landslides is 10-100 years,	**Defended:** Defences at Blackpool Sands located at the back of the beach, which has slowly narrowed and eroded over the long term. Coastal squeeze possible in the future in response to sea level rise. **Undefended:** Lower limit of annual erosion in the region of 0.3m/yr (SCOPAC, 2004). This section is comprised of composite cliffs which are generally very resistant to erosion, but with the occasional pockets of slightly softer rocks. In general, sea level rise is unlikely to affect the rate of erosion. The frequency of landslides is 10-100 years,	**Defended:** Defences at Blackpool Sands located at the back of the beach, which has slowly narrowed and eroded over the long term. Coastal squeeze possible in the future in response to sea level rise. **Undefended:** Lower limit of annual erosion in the region of 0.3m/yr (SCOPAC, 2004). This section is comprised of composite cliffs which are generally very resistant to erosion, but with the occasional pockets of slightly softer rocks. In general, sea level rise is unlikely to affect the rate of erosion. The frequency of landslides is 10-100 years,

Location	Data Assessment for 'With Present Management'		
	Short Term (to 2025)	**Medium Term (to 2055)**	**Long Term (to 2105)**
	with a recession potential of less than 10m per event (Halcrow, 2002). Total erosion is predicted to be 2-10m by 2025.	with a recession potential of less than 10m per event (Halcrow, 2002). Total erosion is predicted to be 4-10m by 2055.	with a recession potential of less than 10m per event (Halcrow, 2002). Total erosion is predicted to be 9-10m by 2105.
Strete to Limpet Rocks (Torcross)	**Defended:** The shingle barrier beach is defended by a range of structures, and the crest has the A379 coast road along its length. Beach levels fluctuate significantly in response to storm conditions (Scott Wilson, 2006). Long term trends are for accretion at the northern end of the beach and erosion at the southern end. Coastal squeeze possible in response to sea level rise in defended areas around Torcross, whilst the section with only the road would rollback (Halcrow, 2002). **Undefended:** Short section of cliffs from Strete Gate to Strete at the north end of this section is undefended. Lower limit of annual erosion in the region of 0.3m/yr (SCOPAC, 2004). This section is comprised of composite cliffs which are generally very resistant to erosion, but with the occasional pockets of slightly softer rocks. In general, sea level rise is unlikely to affect the rate of erosion. The frequency of landslides is 10-100 years, with a recession potential of less than 10m per event (Halcrow, 2002).	**Defended:** The shingle barrier beach is defended by a range of structures, and the crest has the A379 coast road along its length. Beach levels fluctuate significantly in response to storm conditions (Scott Wilson, 2006). Long term trends are for accretion at the northern end of the beach and erosion at the southern end. Coastal squeeze possible in response to sea level rise in defended areas around Torcross, whilst the section with only the road would rollback (Halcrow, 2002). **Undefended:** Short section of cliffs from Strete Gate to Strete at the north end of this section is undefended. Lower limit of annual erosion in the region of 0.3m/yr (SCOPAC, 2004). This section is comprised of composite cliffs which are generally very resistant to erosion, but with the occasional pockets of slightly softer rocks. In general, sea level rise is unlikely to affect the rate of erosion. The frequency of landslides is 10-100 years, with a recession potential of less than 10m per event (Halcrow, 2002).	**Defended:** The shingle barrier beach is defended by a range of structures, and the crest has the A379 coast road along its length. Beach levels fluctuate significantly in response to storm conditions (Scott Wilson, 2006). Long term trends are for accretion at the northern end of the beach and erosion at the southern end. Coastal squeeze possible in response to sea level rise in defended areas around Torcross, whilst the section with only the road would rollback (Halcrow, 2002) , leading to possibility of breaching during this period (Scott Wilson, 2006). **Undefended:** Short section of cliffs from Strete Gate to Strete at the north end of this section is undefended. Lower limit of annual erosion in the region of 0.3m/yr (SCOPAC, 2004). This section is comprised of composite cliffs which are generally very resistant to erosion, but with the occasional pockets of slightly softer rocks. In general, sea level rise is unlikely to affect the rate of erosion. The frequency of landslides is 10-100 years,

Location	Data Assessment for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	Total erosion is predicted to be 2-10m by 2025.	Total erosion is predicted to be 4-10m by 2055.	with a recession potential of less than 10m per event (Halcrow, 2002). Total erosion is predicted to be 9-10m by 2105.
Limpet Rocks (Torcross) to Tinsey Head	**Defended:** Defences located at the back of the beach along part of this section at Beesands prevent rollback of the beach locally onto low-lying land behind. Beach levels along this section fluctuate in response to storm events, but long term trend is for narrowing and steepening of the beach, particularly in front of the defences (Halcrow, 2002). Coastal squeeze probable in response to sea level rise. **Undefended:** Lower limit of annual erosion of the cliffed headlands at either end of this section in the region of 0.2-0.3m/yr (SCOPAC, 2004). These are comprised of simple cliffs which are generally relatively resistant to erosion, but very localised small scale rock falls may occur. The frequency of landslides is 10-100 years, with a recession potential of less than 10m per event (Halcrow, 2002). Total erosion in these areas of 4-10m predicted by 2025. The undefended beach north of Beesands	**Defended:** Defences located at the back of the beach along part of this section at Beesands prevent rollback of the beach locally onto low-lying land behind. Beach levels along this section fluctuate in response to storm events, but long term trend is for narrowing and steepening of the beach, particularly in front of the defences (Halcrow, 2002). Coastal squeeze probable in response to sea level rise. **Undefended:** Lower limit of annual erosion of the cliffed headlands at either end of this section in the region of 0.2-0.3m/yr (SCOPAC, 2004). These are comprised of simple cliffs which are generally relatively resistant to erosion, but very localised small scale rock falls may occur. The frequency of landslides is 10-100 years, with a recession potential of less than 10m per event (Halcrow, 2002). Total erosion in these areas of 10-12m predicted by 2055. The undefended beach north of Beesands	**Defended:** Defences located at the back of the beach along part of this section at Beesands prevent rollback of the beach locally onto low-lying land behind. Beach levels along this section fluctuate in response to storm events, but long term trend is for narrowing and steepening of the beach, particularly in front of the defences (Halcrow, 2002). Coastal squeeze probable in response to sea level rise. **Undefended:** Lower limit of annual erosion of the cliffed headlands at either end of this section in the region of 0.2-0.3m/yr (SCOPAC, 2004). These are comprised of simple cliffs which are generally relatively resistant to erosion, but very localised small scale rock falls may occur. The frequency of landslides is 10-100 years, with a recession potential of less than 10m per event (Halcrow, 2002). Total erosion in these areas of 10-24m predicted by 2105. The undefended beach north of Beesands

Location	Data Assessment for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	could rollback onto low-lying land behind.	could rollback onto low-lying land behind.	could rollback onto low-lying land behind.
Tinsey Head to Start Point	**Defended:** No defences present. **Undefended:** The cliffs along this section have eroded very little over the long term (Halcrow, 2002). This is likely to continue in the future.	**Defended:** No defences present. **Undefended:** The cliffs along this section have eroded very little over the long term (Halcrow, 2002). This is likely to continue in the future.	**Defended:** No defences present. **Undefended:** The cliffs along this section have eroded very little over the long term (Halcrow, 2002). This is likely to continue in the future.
Start Point to Prawle Point	**Defended:** Small section of defence at the back of Lannacombe Beach which has been stable over the long term but fluctuates seasonally. Coastal squeeze possible in response to sea level rise. **Undefended:** The cliffs along this section have eroded very little over the long term (Halcrow, 2002). This is likely to continue in the future, although infrequent landslide events with a frequency of 10-100 years and a recession potential of less than 10m per event can occur (Halcrow, 2002). Total erosion of 0-10m predicted along this section by 2025.	**Defended:** Small section of defence at the back of Lannacombe Beach which has been stable over the long term but fluctuates seasonally. Coastal squeeze possible in response to sea level rise. **Undefended:** The cliffs along this section have eroded very little over the long term (Halcrow, 2002). This is likely to continue in the future, although infrequent landslide events with a frequency of 10-100 years and a recession potential of less than 10m per event can occur (Halcrow, 2002). Total erosion of 0-10m predicted along this section by 2055.	**Defended:** Small section of defence at the back of Lannacombe Beach which has been stable over the long term but fluctuates seasonally. Coastal squeeze possible in response to sea level rise. **Undefended:** The cliffs along this section have eroded very little over the long term (Halcrow, 2002). This is likely to continue in the future, although infrequent landslide events with a frequency of 10-100 years and a recession potential of less than 10m per event can occur (Halcrow, 2002). Total erosion of 0-10m predicted along this section by 2105.
Prawle Point to Bolt Head	**Defended:** Small sections of defence at the back of pocket beaches near Salcombe. These beaches have been stable over the long term but fluctuate seasonally. Coastal squeeze possible in response to sea level rise. **Undefended:** The cliffs along this section have eroded very little over the long term (Halcrow, 2002) , with localised annual rates of	**Defended:** Small sections of defence at the back of pocket beaches near Salcombe. These beaches have been stable over the long term but fluctuate seasonally. Coastal squeeze possible in response to sea level rise. **Undefended:** The cliffs along this section have eroded very little over the long term (Halcrow, 2002) , with localised annual rates of	**Defended:** Small sections of defence at the back of pocket beaches near Salcombe. These beaches have been stable over the long term but fluctuate seasonally. Coastal squeeze possible in response to sea level rise. **Undefended:** The cliffs along this section have eroded very little over the long term (Halcrow, 2002) , with localised annual rates of

Location	Data Assessment for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	erosion in the region of 0.1m/yr, giving rise to total erosion of 1-2m predicted by 2025 (Halcrow, 2002). This is likely to continue in the future, although infrequent landslide events with a frequency of 10-100 years and a recession potential of less than 10m per event can occur (Halcrow, 2002). Total erosion of 0-10m predicted along this section by 2025. Small pocket beaches that indent undefended cliffs have been stable over the long term but fluctuate seasonally.	erosion in the region of 0.1m/yr, giving rise to total erosion of 2-4m predicted by 2055 (Halcrow, 2002). This is likely to continue in the future, although infrequent landslide events with a frequency of 10-100 years and a recession potential of less than 10m per event can occur (Halcrow, 2002). Total erosion of 0-10m predicted along this section by 2055. Small pocket beaches that indent undefended cliffs have been stable over the long term but fluctuate seasonally.	erosion in the region of 0.1m/yr, giving rise to total erosion of 4-6m predicted by 2105 (Halcrow, 2002). This is likely to continue in the future, although infrequent landslide events with a frequency of 10-100 years and a recession potential of less than 10m per event can occur (Halcrow, 2002). Total erosion of 0-10m predicted along this section by 2105. Small pocket beaches that indent undefended cliffs have been stable over the long term but fluctuate seasonally.
Bolt Head to Bolt Tail	**Defended:** No defences present. **Undefended:** The cliffs along this section have eroded very little over the long term (Halcrow, 2002) , with localised annual rates of erosion in the region of 0.1m/yr, giving rise to total erosion of 1-2m predicted by 2025 (Halcrow, 2002). This is likely to continue in the future, although infrequent landslide events with a frequency of 10-100 years and a recession potential of less than 10m per event can occur (Halcrow, 2002). Total erosion of 0-10m predicted along this section by 2025.	**Defended:** No defences present. **Undefended:** The cliffs along this section have eroded very little over the long term (Halcrow, 2002) , with localised annual rates of erosion in the region of 0.1m/yr, giving rise to total erosion of 2-4m predicted by 2055 (Halcrow, 2002). This is likely to continue in the future, although infrequent landslide events with a frequency of 10-100 years and a recession potential of less than 10m per event can occur (Halcrow, 2002). Total erosion of 0-10m predicted along this section by 2055.	**Defended:** No defences present. **Undefended:** The cliffs along this section have eroded very little over the long term (Halcrow, 2002) , with localised annual rates of erosion in the region of 0.1m/yr, giving rise to total erosion of 4-6m predicted by 2105 (Halcrow, 2002). This is likely to continue in the future, although infrequent landslide events with a frequency of 10-100 years and a recession potential of less than 10m per event can occur (Halcrow, 2002). Total erosion of 0-10m predicted along this section by 2105.
Bolt Tail to Avon Estuary	**Defended:** Small section of defence at the back of Thurlestone Beach that protects low-lying	**Defended:** Small section of defence at the back of Thurlestone Beach that protects low-lying	**Defended:** Small section of defence at the back of Thurlestone Beach that protects low-lying

Location	Data Assessment for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
(East)	land, has been stable over the long term but fluctuates seasonally. Coastal squeeze possible in response to sea level rise, along with increased risk of flooding during storm events (Halcrow, 2002). **Undefended:** The cliffs along this section have eroded very little over the long term (Halcrow, 2002) , with localised annual rates of erosion in the region of 0.1m/yr (Halcrow, 2002). This is likely to continue in the future, although infrequent landslide events with a frequency of 10-100 years and a recession potential of less than 10m per event can occur (Halcrow, 2002). Total erosion of 0-10m predicted by 2025.	land, has been stable over the long term but fluctuates seasonally. Coastal squeeze possible in response to sea level rise, along with increased risk of flooding during storm events (Halcrow, 2002). **Undefended:** The cliffs along this section have eroded very little over the long term (Halcrow, 2002) , with localised annual rates of erosion in the region of 0.1m/yr (Halcrow, 2002). This is likely to continue in the future, although infrequent landslide events with a frequency of 10-100 years and a recession potential of less than 10m per event can occur (Halcrow, 2002). Total erosion of 0-10m predicted by 2055.	land, has been stable over the long term but fluctuates seasonally. Coastal squeeze possible in response to sea level rise, along with increased risk of flooding during storm events (Halcrow, 2002). **Undefended:** The cliffs along this section have eroded very little over the long term (Halcrow, 2002) , with localised annual rates of erosion in the region of 0.1m/yr (Halcrow, 2002). This is likely to continue in the future, although infrequent landslide events with a frequency of 10-100 years and a recession potential of less than 10m per event can occur (Halcrow, 2002). Total erosion of 0-10m predicted by 2105.
Avon Estuary (East) to Challaborough (West)	**Defended:** Small section of defence at the back of Challaborough Beach that protects low-lying land, has been stable over the long term but fluctuates seasonally. Coastal squeeze possible in response to sea level rise, along with increased risk of flooding during storm events (Halcrow, 2002). The beaches and tombolo at Bigbury have also been stable over the long term. Possible erosion and narrowing of tombolo and beaches in response to sea level rise. **Undefended:** The cliffs along this section have	**Defended:** Small section of defence at the back of Challaborough Beach that protects low-lying land, has been stable over the long term but fluctuates seasonally. Coastal squeeze possible in response to sea level rise, along with increased risk of flooding during storm events (Halcrow, 2002). The beaches and tombolo at Bigbury have also been stable over the long term. Possible erosion and narrowing of tombolo and beaches in response to sea level rise. **Undefended:** The cliffs along this section have	**Defended:** Small section of defence at the back of Challaborough Beach that protects low-lying land, has been stable over the long term but fluctuates seasonally. Coastal squeeze possible in response to sea level rise, along with increased risk of flooding during storm events (Halcrow, 2002). The beaches and tombolo at Bigbury have also been stable over the long term. Possible erosion and narrowing of tombolo and beaches in response to sea level rise. **Undefended:** The cliffs along this section have

Location	Data Assessment for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	eroded very little over the long term and this is likely to continue in the future (Halcrow, 2002).	eroded very little over the long term and this is likely to continue in the future (Halcrow, 2002).	eroded very little over the long term and this is likely to continue in the future (Halcrow, 2002).
Challaborough (West) to Wembury Point	**Defended:** No defences present. **Undefended:** The small pocket beaches that indent the cliffs along this section have been stable over the long term. The cliffs along this section have also eroded very little over the long term over the long term (Halcrow, 2002) , with localised annual rates of erosion in the region of 0.1m/yr (Halcrow, 2002). This is likely to continue in the future, although infrequent landslide events with a frequency of 10-100 years and a recession potential of less than 10m per event can occur (Halcrow, 2002). Total erosion of 0-10m predicted by 2025.	**Defended:** No defences present. **Undefended:** The small pocket beaches that indent the cliffs along this section have been stable over the long term. The cliffs along this section have also eroded very little over the long term over the long term (Halcrow, 2002) , with localised annual rates of erosion in the region of 0.1m/yr (Halcrow, 2002). This is likely to continue in the future, although infrequent landslide events with a frequency of 10-100 years and a recession potential of less than 10m per event can occur (Halcrow, 2002). Total erosion of 0-10m predicted by 2055.	**Defended:** No defences present. **Undefended:** The small pocket beaches that indent the cliffs along this section have been stable over the long term. The cliffs along this section have also eroded very little over the long term over the long term (Halcrow, 2002) , with localised annual rates of erosion in the region of 0.1m/yr (Halcrow, 2002). This is likely to continue in the future, although infrequent landslide events with a frequency of 10-100 years and a recession potential of less than 10m per event can occur (Halcrow, 2002). Total erosion of 0-10m predicted by 2105.
Wembury Point to Mount Batten Breakwater	**Defended:** No defences present along the shoreline prior to reaching Mount Batten Breakwater, although part of this section is affected by the presence of the Plymouth Breakwater. **Undefended:** The cliffs along this section have eroded very little over the long term and This is likely to continue in the future, although infrequent landslide events with a frequency of 10-100 years and a recession potential of less	**Defended:** No defences present along the shoreline prior to reaching Mount Batten Breakwater, although part of this section is affected by the presence of the Plymouth Breakwater. **Undefended:** The cliffs along this section have eroded very little over the long term and This is likely to continue in the future, although infrequent landslide events with a frequency of 10-100 years and a recession potential of less	**Defended:** No defences present along the shoreline prior to reaching Mount Batten Breakwater, although part of this section is affected by the presence of the Plymouth Breakwater. **Undefended:** The cliffs along this section have eroded very little over the long term and This is likely to continue in the future, although infrequent landslide events with a frequency of 10-100 years and a recession potential of less

Location	Data Assessment for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	than 10m per event can occur (Halcrow, 2002). Total erosion of 0-10m predicted by 2025.	than 10m per event can occur (Halcrow, 2002). Total erosion of 0-10m predicted by 2055.	than 10m per event can occur (Halcrow, 2002). Total erosion of 0-10m predicted by 2105.
Mount Batten Breakwater to Devil's Point	**Defended:** Defences prevent erosion at cliff toe, although it is unlikely that erosion at any significant rate would occur due to the resistance of underlying geology. **Undefended:** This section is completely defended.	**Defended:** Defences prevent erosion at cliff toe, although it is unlikely that erosion at any significant rate would occur due to the resistance of underlying geology. **Undefended:** This section is completely defended.	**Defended:** Defences prevent erosion at cliff toe, although it is unlikely that erosion at any significant rate would occur due to the resistance of underlying geology. **Undefended:** This section is completely defended.
Devil's Point to Mount Edgcumbe (Tamar Estuary)	**Defended:** South of the Tamar bridge, the estuary is heavily modified by dredging activity associated with the development of the port and naval dockyard on the eastern shore. The defences and other structures associated with these developments serve to constrain the estuary in this area, as well as providing flood protection to the small areas of low lying land between the estuary and higher ground to the east. **Undefended:** Tamar estuary is largely undefended north of the Tamar bridge and so the estuary functions naturally in its upper part. Areas of intertidal flats are present in the upper part of the Tamar and its tributaries, although flood plains are limited in size by steeply rising valley sides through which they	**Defended:** South of the Tamar bridge, the estuary is heavily modified by dredging activity associated with the development of the port and naval dockyard on the eastern shore. The ongoing presence of defences and other structures will continue serve to constrain the estuary in this area, as well as providing flood protection to the small areas of low lying land between the estuary and higher ground to the east. **Undefended:** Tamar estuary is largely undefended north of the Tamar bridge and so the estuary functions naturally in its upper part. Areas of intertidal flats are present in the upper part of the Tamar and its tributaries, although flood plains are limited in size by steeply rising valley sides through which they flow, resulting in limited opportunity for lateral	**Defended:** South of the Tamar bridge, the estuary is heavily modified by dredging activity associated with the development of the port and naval dockyard on the eastern shore. The ongoing presence of defences and other structures will continue serve to constrain the estuary in this area, as well as providing flood protection to the small areas of low lying land between the estuary and higher ground to the east. **Undefended:** Tamar estuary is largely undefended north of the Tamar bridge and so the estuary functions naturally in its upper part. Areas of intertidal flats are present in the upper part of the Tamar and its tributaries, although flood plains are limited in size by steeply rising valley sides through which they flow, resulting in limited opportunity for lateral

Location	Data Assessment for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	flow. South of the Tamar bridge, the estuary is heavily modified by dredging activity associated with the port and naval dockyard on the eastern shore. However the western side of the estuary is largely undefended. As with the upper Tamar, there are large areas of intertidal flats, particularly at St John's Lake. This side of the estuary in its lower reaches are also flanked by steeply rising land.	migration of the estuary in response to sea level rise. South of the Tamar bridge, the estuary is heavily modified by dredging activity associated with the port and naval dockyard on the eastern shore. However the western side of the estuary is largely undefended. As with the upper Tamar, there are large areas of intertidal flats, particularly at St John's Lake. This side of the estuary in its lower reaches are also flanked by steeply rising land resulting in limited opportunity for lateral migration of the estuary in response to sea level rise.	migration of the estuary in response to sea level rise. South of the Tamar bridge, the estuary is heavily modified by dredging activity associated with the port and naval dockyard on the eastern shore. However the western side of the estuary is largely undefended. As with the upper Tamar, there are large areas of intertidal flats, particularly at St John's Lake. This side of the estuary in its lower reaches are also flanked by steeply rising land resulting in limited opportunity for lateral migration of the estuary in response to sea level rise.
Mount Edgcumbe to Kingsand	**Defended:** Defences prevent erosion at cliff toe around Picklecombe Point, although it is unlikely that erosion at any significant rate would occur due to the resistance of underlying geology. **Undefended:** The cliffs along this section have eroded very little over the long term and This is likely to continue in the future, although infrequent landslide events with a frequency of 10-100 years and a recession potential of less than 10m per event can occur (Halcrow, 2002). Total erosion of 0-10m predicted by 2025.	**Defended:** Defences prevent erosion at cliff toe around Picklecombe Point, although it is unlikely that erosion at any significant rate would occur due to the resistance of underlying geology. **Undefended:** The cliffs along this section have eroded very little over the long term and This is likely to continue in the future, although infrequent landslide events with a frequency of 10-100 years and a recession potential of less than 10m per event can occur (Halcrow, 2002). Total erosion of 0-10m predicted by 2055.	**Defended:** Defences prevent erosion at cliff toe around Picklecombe Point, although it is unlikely that erosion at any significant rate would occur due to the resistance of underlying geology. **Undefended:** The cliffs along this section have eroded very little over the long term and This is likely to continue in the future, although infrequent landslide events with a frequency of 10-100 years and a recession potential of less than 10m per event can occur (Halcrow, 2002). Total erosion of 0-10m predicted by 2105.
Kingsand/Cawsand	**Defended:** Defences located at the back of pocket beaches which have been stable over the long term. Coastal squeeze possible in	**Defended:** Defences located at the back of pocket beaches which have been stable over the long term. Coastal squeeze possible in	**Defended:** Defences located at the back of pocket beaches which have been stable over the long term. Coastal squeeze possible in

Location	Data Assessment for 'With Present Management'		
	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
	response to sea level rise. **Undefended:** This section is completely defended.	response to sea level rise. **Undefended:** This section is completely defended.	response to sea level rise. **Undefended:** This section is completely defended.
Cawsand to Rame Head	**Defended:** No defences present. **Undefended:** The cliffs along this section have eroded very little over the long term and This is likely to continue in the future, although infrequent landslide events with a frequency of 1-10 years and a recession potential of less than 10m per event can occur (Halcrow, 2002). Total erosion of 0-10m predicted by 2025.	**Defended:** No defences present. **Undefended:** The cliffs along this section have eroded very little over the long term and This is likely to continue in the future, although infrequent landslide events with a frequency of 1-10 years and a recession potential of less than 10m per event can occur (Halcrow, 2002). Total erosion of 0-10m predicted by 2055.	**Defended:** No defences present. **Undefended:** The cliffs along this section have eroded very little over the long term and This is likely to continue in the future, although infrequent landslide events with a frequency of 1-10 years and a recession potential of less than 10m per event can occur (Halcrow, 2002). Total erosion of 0-10m predicted by 2105.

C.6 References

C.6.1 Relating to Sections C.1, C.4 and C.5

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Annex C.1 – Summary of Estuary and Coast Direct Interaction

C.1.1 Introduction

This appendix to the Baseline Process Understanding report provides a summary of the interactions between the estuaries along the SMP2 shoreline and coastal processes.

C.1.2 Assessment

The estuaries reviewed in completion of this task where those identified in the Durlston Head to Rame Head SMP2 Scoping Report (June 2007). The identification of issues was primarily based upon a review of information contained in Futurecoast (Halcrow, 2002), however a number of smaller features are not discussed in Futurecoast and as such assessment has been based upon a review of Futurecoast aerial photography and OS mapping. Where available, a number of other studies have been use to supplement the information from Futurecoast. Table 1 provides a summary of the interaction between estuary and open coast processes.

Table 1 Summary of Estuary-Coast Interactions

River/Lagoon	Tidal Limit OS Co-Ordinates		Interaction with Coastal Processes
	Easting	Northing	
Lynher	238330	61340	Feeds in to the Tamar and is part of the larger 'Plymouth Estuary' system that has little impact on coastal processes with little sediment exchange between the estuary system and the sea. *(Halcrow, 2002)*
Tamar	243694	71134	Part of the larger 'Plymouth Estuary' system that has little impact on coastal processes with little sediment exchange between the estuary system and the sea. *(Halcrow, 2002)*
Plym	251753	57094	Feeds in to the Tamar and is part of the larger 'Plymouth Estuary' system that has little impact on coastal processes with little sediment exchange between the estuary system and the sea. *(Halcrow, 2002)*
Tavy	247441	65038	Feeds in to the Tamar and is part of the larger 'Plymouth Estuary' system that has little impact on coastal processes with little sediment exchange between the estuary system and the sea. *(Halcrow, 2002)*
Tamerton Lake	246545	60925	Feeds in to the Tamar and is part of the larger 'Plymouth Estuary' system that has little impact on coastal processes with little sediment exchange between the estuary system and the sea (*Halcrow, 2002*).
Tiddy	234780	59500	Feeds in to the Lynher that in turn feeds into the Tamar and is therefore part of the larger 'Plymouth Estuary' system that has little impact on coastal processes with little sediment exchange between the estuary system and the sea (*Halcrow, 2002*).
Yealm	256663	50956	Some sand flats at the mouth but generally low river flows with very little suspended sediment. Entrance exposed to south-westerly waves, though is

River/Lagoon	Tidal Limit OS Co-Ordinates		Interaction with Coastal Processes
	Easting	Northing	
			partially sheltered by Great Mew Stone (*Halcrow, 2002*).
Erme	263070	51596	Sandy at the mouth which is very exposed to south-westerly waves (*Halcrow, 2002*).
Avon (Devon)	270071	47240	Sand deposits at the mouth and includes some short sections of sand dunes. Mouth is sheltered from south-westerly waves by Burgh Island, which has led to the development of a tombolo in the lee of the island (*Halcrow, 2002*).
Kingsbridge Estuary	273551	44009	Sand accumulation in bays at the mouth. There is also a sand bar seaward of the mouth. Most sediment input is fluvial, with very little from sea (*Halcrow, 2002*).
Bowcombe Creek (Kingsbridge Estuary)	274848	44109	Creek feeds into the Kingsbridge Estuary therefore see notes above for 'Kingsbridge Estuary'.
Frogmore Creek (Kingsbridge Estuary)	277517	42613	Creek feeds into the Kingsbridge Estuary therefore see notes above for 'Kingsbridge Estuary'.
Southpool Creek (Kingsbridge Estuary)	277439	40100	Creek feeds into the Kingsbridge Estuary therefore see notes above for 'Kingsbridge Estuary'.
Waterhead Creek (Kingsbridge Estuary)	276988	38850	Creek feeds into the Kingsbridge Estuary therefore see notes above for 'Kingsbridge Estuary'.
Collapit Creek (Kingsbridge Estuary)	272807	42198	Creek feeds into the Kingsbridge Estuary therefore see notes above for 'Kingsbridge Estuary'.
Blanksmill Creek (Kingsbridge Estuary)	272672	40982	Creek feeds into the Kingsbridge Estuary therefore see notes above for 'Kingsbridge Estuary'.
Batson Creek (Kingsbridge Estuary)	273518	39712	Creek feeds into the Kingsbridge Estuary therefore see notes above for 'Kingsbridge Estuary'.
Slapton Ley	281876	44067	Lagoon feature with no direct interaction with the sea due to being enclosed by a shingle barrier beach (*Halcrow, 2002*). There is seepage from Slapton Ley through the barrier towards seaward due to the shingle barrier causing the water level in the lagoon to be maintained at an artificially high level above mean sea level thus establishing an hydraulic gradient (*SCOPAC Sediment Transport Study 2004*). Whilst there is no present direct interaction, should Slapton

River/Lagoon	Tidal Limit OS Co-Ordinates		Interaction with Coastal Processes
	Easting	Northing	
			Sands barrier breach in the future, then this will change this situation significantly.
Dart	280079	61257	Very low sediment input to the coast despite relatively high discharge. No spit at mouth, rather entrance is flanked by high rocky cliffs *(Halcrow, 2002)*. The high, resistant rock headlands that form the mouth of the estuary create a stable form that, together with a relative absence of coarse sediment around the mouth, exclude any interaction between the estuarine and littoral sediment environments (*SCOPAC Sediment Transport Study, 2004*).
Bow Creek	281222	56553	Feed into the Dart therefore see notes above for 'Dart'.
Teign	293404	90152	Spit extends across the mouth from the north has been fixed by development of Teignmouth, causing the channel to be diverted to the south and constricting flow through the mouth. Very mobile ebb tidal delta seaward of the mouth is in a cyclic sediment transport relationship with sand bars and beach to the north of the mouth (up to Sprey Point (*SCOPAC Sediment Transport Study, 2004*)), which also causes beach levels in front of Teignmouth to fluctuate as material moves around this system (*Halcrow, 2002*).
Exe	293404	90152	Historically there were double spits at mouth of estuary that oscillated in growth, however at present only one is still mobile (Dawlish Warren) whilst the other has been fixed by development of Exmouth, thus making it a single spit estuary. Flood and ebb tidal deltas landward/seaward of these spits, form part of a complex sediment transport system (*Exe Estuary Coastal Management Study, Coastal Evolution Study (Draft), 2007*). Ebb tidal delta (Pole Sands) has a significant impact upon the coastal processes of a wide area and is also a store for large quantities of sediment (*Halcrow, 2002*).
Otter	307569	83916	Spit extends across the mouth from the west causing the mouth to be diverted to the east where it is 'squeezed' against sandstone cliffs and rock platform (Otterton Ledge) (*Halcrow, 2002*). Wave driven longshore transport moves shingle material into the river channel and this is then transported, by a combination of river and tidal currents, a short distance offshore to form an ebb tidal delta that has accumulated against Otterton Ledge. Wave action then moves shingle from the delta back onshore to the beach west of the entrance to the Otter, thus establishing a cyclic sediment transport pathway (*SCOPAC Sediment Transport Study, 2004*).

River/Lagoon	Tidal Limit OS Co-Ordinates		Interaction with Coastal Processes
	Easting	Northing	
Sid	312909	87305	Largely trained along east side of Sidmouth, flowing out through an outfall. As a result has no significant impact on coastal processes (*Halcrow, 2002*).
Branscombe Stream	320746	88173	Not included explicitly in Futurecoast (Halcrow, 2002), so analysis here is based upon review of *Futurecoast Aerial Photos (Halcrow, 2002)* and OS maps. This shows mouth is enclosed by shingle beach and so it is unlikely to have a significant effect on coastal processes. The permanent eastward deflection and damning of Branscombe Stream is due to net littoral drift eastwards (*SCOPAC Sediment Transport Study, 2004*).
Axe	325894	92268	Shingle spit extends across mouth from the west causing the mouth to be diverted to the east. At low water tide doesn't enter the estuary (it is 'cut off' by shingle beach/spit. At high river flows erosion and breach of the spit can occur forming a temporary inlet until it is closed by the re-forming of the spit by longshore drift. River inputs a small amount of gravel to the system (*Halcrow, 2002*). Most material enters channel from seaward (driven by wave action) and this is then flushed offshore by river and tidal flow with material then moved back onshore by wave action (*SCOPAC Sediment Transport Study, 2004*).
Lim	334264	92071	Not included explicitly in Futurecoast (Halcrow, 2002), so analysis here is based upon review of *Futurecoast Aerial Photos (Halcrow, 2002)* and OS maps. This shows no obvious discharge of impacts and therefore it is not likely to have a significant influence on coastal processes.
Char	336635	93111	No significant impact on shoreline processes. A 20-30 year event can produce sufficient discharge to cause the river to erode a channel through the beach forming a temporary debris fan on the foreshore that is then pushed back by wave action to re-form the beach (*Halcrow, 2002*). The gravel beach restricts discharge, such that during summer months the river is usually "ponded" upto 300m inland. In this case percolation through the beach occurs (*SCOPAC Sediment Transport Study, 2004*).
Winniford (Seatown)	342051	91793	Not included explicitly in Futurecoast (Halcrow, 2002), so analysis here is based upon review of *Futurecoast Aerial Photos (Halcrow, 2002)* and OS maps. This shows a small stream discharging of shingle beach but no

River/Lagoon	Tidal Limit OS Co-Ordinates		Interaction with Coastal Processes
	Easting	Northing	
			significant impact upon coastal processes.
Eype	344782	90978	Not included explicitly in Futurecoast (Halcrow, 2002), so analysis here is based upon review of *Futurecoast Aerial Photos (Halcrow, 2002)* and OS maps. This shows no significant impact upon coastal processes.
Brit	346239	90494	Estuary has a very high flow volume causing a plume at almost all river flows and this in turn possibly causes local modification to littoral transport from one side of the harbour to the other (*Halcrow, 2002*). Sluices control discharge into West Bay Harbour from the river (*SCOPAC Sediment Transport Study, 2004*). The harbour entrance structures inhibit longshore transport processes and the estuary as a whole is likely to be dynamically important to adjacent beaches (*Halcrow, 2002*). Transport of shingle across the mouth occurs, as evidenced by periodic shingle accumulation in the harbour, and so the harbour entrance structures are not a complete barrier to longshore transport (*SCOPAC Sediment Transport Study, 2004*).
Bride	347813	89484	Not included explicitly in Futurecoast (Halcrow, 2002), so analysis here is based upon review of *Futurecoast Aerial Photos (Halcrow, 2002)* and OS maps. This shows a river discharging through a shingle ridge and over a shingle foreshore. From Halcrow's experience from developing a beach management plan for this beach it is known that the Environment Agency manage the entrance to control flood risk – this involves both closing and clearing the entrance of shingle to prevent tidal inundation or allow fluvial drainage as necessary.
Burton Mere	350957	87875	Not included explicitly in Futurecoast (Halcrow, 2002), so analysis here is based upon review of *Futurecoast Aerial Photos (Halcrow, 2002)* and OS maps. This shows an area of enclosed marsh land behind Chesil Beach. It has no obvious interaction with the coastal processes.
The Fleet	360456	82307	A number of small streams drain into the western end of the Fleet, providing freshwater input. The only direct interaction with the open sea is a small tidal inlet at Ferrybridge towards the Portland end of the Fleet (*Halcrow, 2002*). There is at present no significant interaction on coastal processes, though at the Wyke Narrows the tidal flow is constrained and so high currents occur through this channel, which in turn stops the beach rolling back into the channel.

River/Lagoon	Tidal Limit OS Co-Ordinates		Interaction with Coastal Processes
	Easting	Northing	
			Intrusion of saltwater through Chesil Beach into the Fleet also occurs through both gradual seepage and (less frequent) 'bursts' (forming 'cans' on the Fleet side of Chesil Beach (*Malcolm Bray Lecture 21/11/07 and associated slides*). Whilst at present there are no direct interactions, The Fleet itself was formed as a result of enclosure by Chesil Beach (as a result of coastal processes), and should this breach in the future, then once again there will be more significant direct interactions with coastal processes (*Halcrow, 2002*).
Wey	367730	79236	A series of sluice gates divide the mouth from the freshwater Radipole Lake upstream and also control the discharge rate (except at times of high river flows when they are opened to reduce flood risk upstream). As a result there is little fluvial sediment input to the coast. Some sediment enters the mouth from the sea and is deposited (*Halcrow, 2002*).

Based upon the information summarised in Table 1, it is apparent that of the estuaries identified in the Scoping Report of June 2007, the estuaries that have a significant direct interaction with the sea are:

- **Brit Estuary (West Bay)** – inhibits longshore transport and discharge may affect sediment transport across the mouth;
- **Axe Estuary** – coastal processes have formed a spit across the mouth, though this can be breached during high river flow events;
- **Otter Estuary** – coastal processes have formed a spit across the mouth.
- **Exe Estuary** – complex sediment transport system involving double spits at the mouth and flood and ebb tidal deltas, the latter having an influence on coastal processes over a wide area;
- **Teign Estuary** – spit across the mouth as well as a very mobile ebb tidal delta, both of which form parts of a cyclic sediment transport system.

Given the size of both the Tamar and Dart estuaries, it is perhaps surprising that they are not included within the above list of estuaries that have a significant interaction with coastal processes. The reason for this is that, despite their size, neither contributes a large amount of sediment to the sea because of the hard, resistant geology through which their rivers flow.

Annex C.2 – No Active Intervention Flood and Erosion Risk Maps