Coastal Morphology Report

Essex (part sub-cell 8 Harwich to Canvey Island)

RP044/E/2015
March 2015

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Anglian Coastal Monitoring Programme

Coastal Trends Analysis

East Cliffs, The Naze, Essex

Essex

East Anglia Coastal Group (EACG) part Sub-cell 8: Harwich to Canvey Island

March 2015

Contents

List of Abbreviations

ACMP – Anglian Coastal Monitoring Programme

EA – Environment Agency

FCP – Foreshore Change Parameter

MHWS – Mean High Water Spring

MHWN – Mean High Water Neap

MLWN – Mean Low Water Neap

MLWS – Mean Low Water Spring

MSL – Mean Sea Level

SMP – Shoreline Management Plan

SMG – Shoreline Monitoring Group

Glossary

Accretion	Accumulation of sediment on a beach by the action of natural forces or human intervention
Bathymetry	Topographic relief of the seabed
Chainage	Distance along a topographic survey transect line (measured in metres)
Chart Datum	Level to which all soundings on a marine navigational chart are based
Erosion	Loss of material from a beach by the action of natural forces or the result of man-made artificial structures interfering with coastal processes
Foreshore	Intertidal region between the highest and lowest tide level
Foreshore rotation	Foreshore steepening or flattening resulting in the convergence or divergence of high and low water marks
Longshore drift	Movement of sediment along the shoreline
Ordnance Datum	Mean sea level (derived from 6 years of observation at Newlyn, Cornwall) used as a datum for calculating the absolute height of land on official British maps.
Recharge	Practise of adding to the natural amount of sediment on a beach with material from elsewhere. This is also known as beach replenishment or beach nourishment.
MHWS	Level of Mean High Water Spring tides
MHWN	Level of Mean High Water Neap tides
MLWN	Level of Mean Low Water Neap tides
MLWS	Level of Mean Low Water Spring tides
Ordnance Datum	

Executive Summary

This report is an update of the report produced in 2008. There are some differences in the format and this report highlights where the presence of sea defences at Mean High Water Springs (MHWS) and Mean High Water Neaps (MHWN) determine that there is no trend.

On 6th December 2013 the largest storm surge in 60 years hit the East coast. As a result of this surge there was considerable damage to beaches and coastal defences in Norfolk and Suffolk. There was a high water level in Essex but there was nothing of the same significance as in its neighbouring counties to the north.

There has been significant erosion for all tide levels at Walton-on-the-Naze. At Mean Sea Level (MSL) and Mean Low Water (MLW) at Mersea Island.

At Dengie Flat, Ray Sand, Maplin Sands to Shoeburyness there has been significant accretion at MSL and MLW.

There has been moderate accretion at MLW along the Southend-on-Sea frontage.

There has been extensive works on the Clacton frontage, which commenced after the latest data used in this report. The scheme is made up of 23 fishtail rock groynes and approximately 950,000 cubic metres of sand and shingle beach recharge.

The works will be undertaken in two phases; the first phase of works is from Holland Haven to Cliff Road, Holland on Sea and the second phase will be from Cliff Road to Clacton Pier. The works are proposed to be completed by late autumn 2015. *See photos below.*

Barge anchored close inshore and being unloaded on to the beach. Photo courtesy of Mike Badger – Tendring District Council.

Material being placed and graded as required. Photo courtesy of Mike Badger – Tendring District Council.

1.0 Introduction

1.1 Purpose and application

The aim of this report is to present data collected along the Essex coast from Harwich to Canvey Island to provide an evidence-based assessment of beach changes. It is produced to assist coastal managers in a variety of their functions including: strategic planning, capital engineering works and maintenance programmes. In addition it will assist with general education and raising awareness of coastal issues.

1.2 Background

The Anglian coastline stretches from Grimsby, near the mouth of the River Humber, to Canvey Island on the northern side of the outer Thames estuary. A total length of approximately 470km the coast is a diverse mixture of dune fronted flood plains, shingle barrier beaches, saltmarsh and soft cliffs. There are no major geological 'hard rock' coastal areas and therefore significant proportions of the coast are vulnerable to marine flooding and coastal erosion, which is likely to be compounded by any climatic change and/or sea level rise in the future. Considerable investment has been made in both hard and soft engineering solutions over the last century in order to reduce the impacts of flooding and erosion upon the built and natural coastal environment. This has resulted in significant proportions of the coast being artificially protected to prevent loss of environment, amenities and infrastructure located in vulnerable areas.

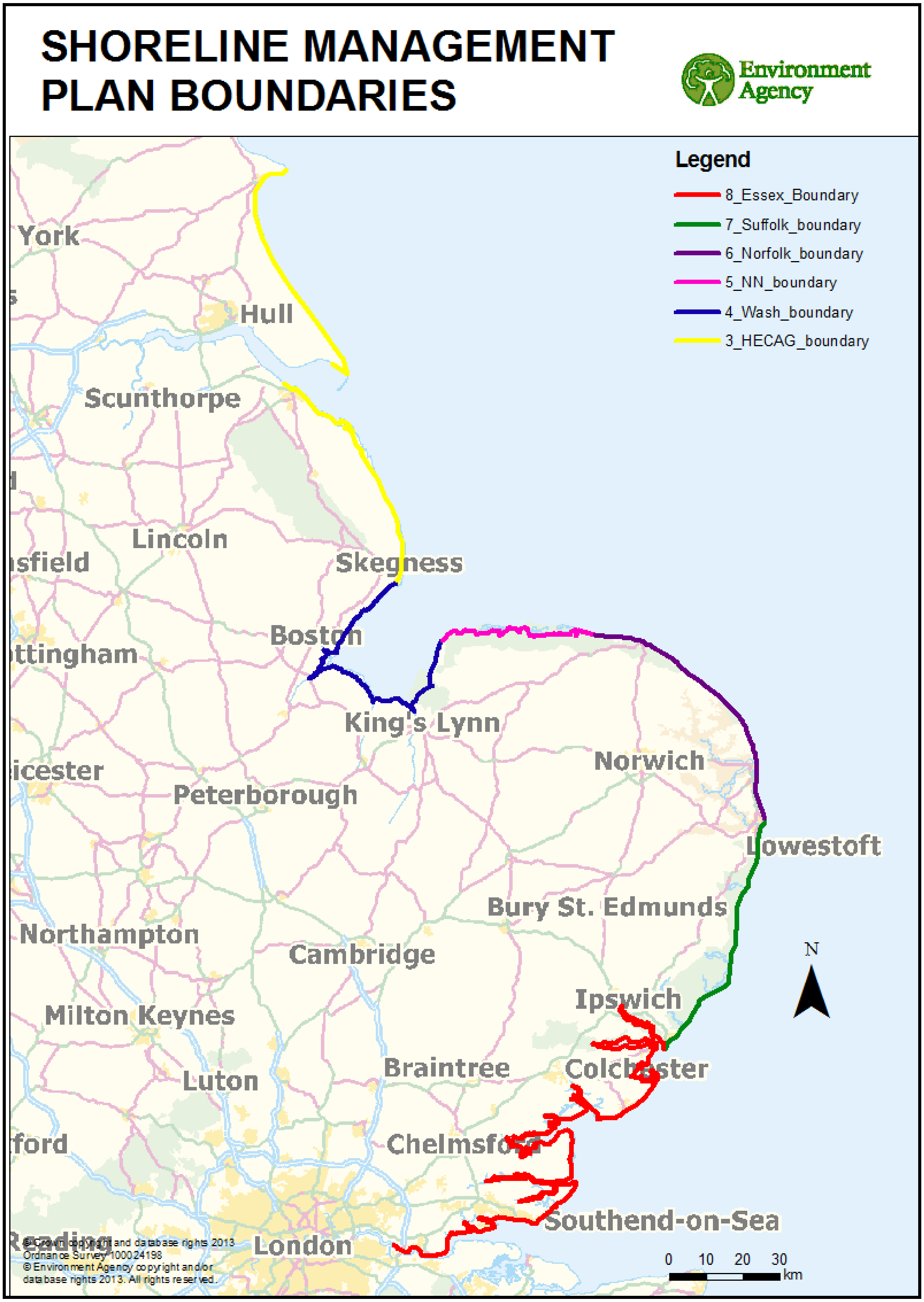
The Environment Agency (EA) has carried out a programme of annual strategic monitoring of the Anglian coast since 1991, namely Anglian Coastal Monitoring Programme (ACMP). The rationale behind the programme is to assist the implementation of appropriate and sustainable works on the coast, whether undertaken by the EA for the purpose of flood risk management or by various maritime district council partners for coastal protection. An additional output from the monitoring programme is the assessment of coastal dynamics to inform long term strategies for the coastline. The platform for this is the Shoreline Management Plan (SMP) process, which sets out coastal strategies for future epochs, based on evidence from monitoring programmes. *Map 1* (below) shows the SMP boundaries for the Anglian coast.

The Anglian Coastal Monitoring programme collects a variety of data including;

- Annual aerial photographs
- LIDAR surveys
- Bi-annual topographic beach surveys (winter and summer) at 1km intervals
- ATV surveys on recharge beaches
- Bathymetric surveys (nearshore)
- Continuous wave and tide recording

In addition, in-depth monitoring addresses specific sea defence scheme requirements at a variety of locations along the coast. At the time of writing, the Anglian monitoring programme is in Phase VIII (2011-2016).

Various reports, based upon data collected over the years, have been produced from time to time but until recently there has been an insufficiently long time series of data to identify any significant trends in coastal change. However, the Agency now possesses over twenty years of beach topographic data and it is therefore possible to analyse these data to determine indicators of longer-term trends. Data collected in the future can be readily added to this analysis to further ascertain the validity of the trends. Further copies of this report can be obtained by emailing ACM@environment-agency.gov.uk.



Map 1 - SMP Boundaries

1.3 Beach topographic profile data

The Environment Agency has collected beach topographic profile data at 1km intervals along the coast since 1991. Profile lines (transects) are surveyed twice yearly in the summer and in the winter to establish the cross-section of the beach. They are surveyed from behind the sea defence to Mean Low Water Springs (where possible). Generally the area of interest is the average rate of beach erosion or accretion along the coast. In addition to this, gradual change to the gradient or steepness of the beach is of particular interest to coastal managers as this can determine the resistance to wave energy.

The analysis of trends in beach morphological behaviour may have significant impacts upon coastal management decisions in the future. Artificially defended beaches that are experiencing erosion and steepening trends may prove to be increasingly difficult and expensive to maintain. Even with maintenance, the structures may fail because of inadequate structural support or ground movements from diminishing quantities of beach material and subsequent beach platform loss. However, it is not the intention of this report to ascertain such issues at a local scale. Reports of this nature are appropriate for the ongoing revisions of the Shoreline Management Plans (SMPs) and Coastal Strategic Studies, which are currently being compiled along the Anglian coast.

The length of the Anglian coast means that there are over 400 strategic topographic profiles for which data have been collected over the years. For the purposes of regional strategic coastal management, the entire UK coast has been divided up into sediment cells and sub-cells (HR Wallingford, 1994 & Defra, 2006). These are individual discrete sections of the coast that are considered to be independent from each other in terms of coastal processes. The relevant sections for the Anglian coast are:-

Humber Estuary Coastal Authorities Group (HECAG):

Flamborough Head to Gibraltar Point	*Sub-cell 3*

East Anglia Coastal Group (EACG):

Gibraltar Point to Old Hunstanton	*Sub-cell 4*
Old Hunstanton to Kelling	*Sub-cell 5*
Kelling to Lowestoft Ness	*Sub-cell 6*
Lowestoft Ness to Felixstowe	*Sub-cell 7*
Harwich to Canvey Island	*Sub-cell 8*

These boundaries are convenient divisions for the separation and publication of the results of the trends analysis reports. Sub-cell 8, Harwich to Canvey Island is the subject of this report.

1.4 Analysis methodology

The profile data presented in this report are in the form of beach level analysis. The data was analysed using a function of 'SANDS' software [(1)]. Tidal levels and conversions from Chart Datum to Ordnance Datum were kindly supplied by Proudman Oceanographic Laboratory from their 'POLTIPS' software [(2)].

Figure 1 (below) demonstrates the principle of beach profile change over time along with changes to beach gradient. Along certain stretches of coast where seawalls or other structures constrain the landward movement of the coast, beach volumetric change may be of interest. This is particularly relevant where artificial beach nourishment is undertaken. In other areas, where long frontages are unconstrained by linear defences, the quantification of beach volumetric change is of less importance.

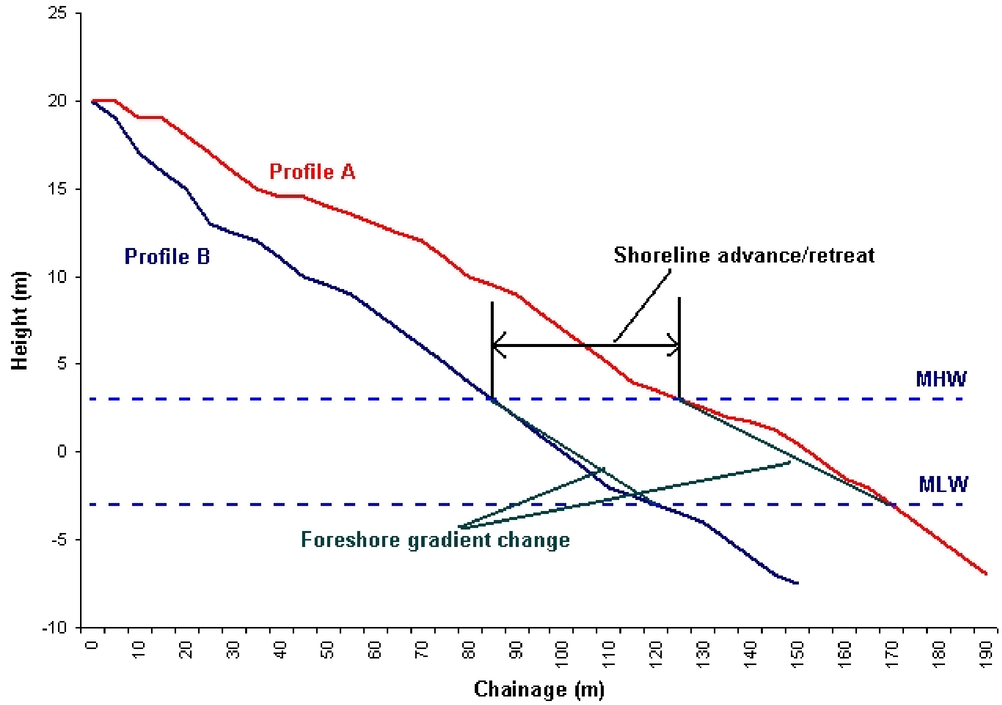


Figure 1 – Conceptual diagram of a beach profile showing shoreline advance/retreat and foreshore change parameter

Figure 2 (below) demonstrates how the analysis was performed and a trend is obtained. The example used in *Figure 2* is from an eroding beach, which is retreating with an average trend of -3.86m/yr. However, in any single year the actual erosion observed varies considerably. For example between 1996 and 2000 very little erosion occurred, whereas between 2000 and 2001 the beach retreated by almost 20m. Therefore the analyses indicated in this report relate to longer term general trends and cannot be used to determine short-term erosion or accretion rates.

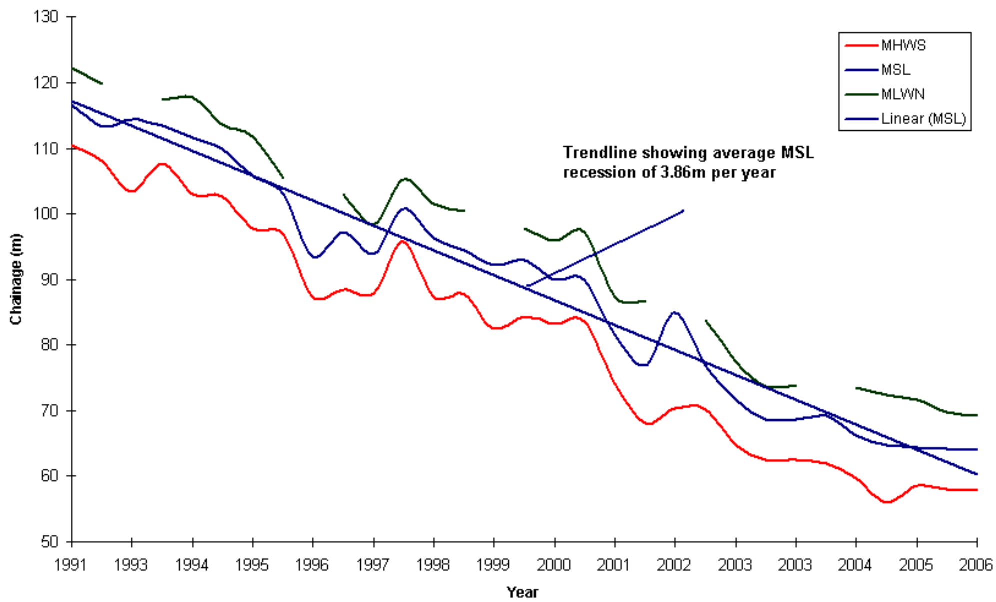


Figure 2 – Suite of coastal profiles after SANDS beach level analysis with linear regression of MSL giving annual trend (data gaps are due to certain profiles not extending down to MLW level)

An important factor in coastal risk management policy decision making is foreshore steepening. A wide flat beach can dissipate incoming wave energy much better than a narrow steep beach. Using historical Ordnance Survey data, Taylor *et al* (2004) concluded that 61% of the coastline of England and Wales had steepened since the first OS County Series Survey published between 1843 and 1901. Of the remainder 33% had flattened and 6% experienced no rotational movement.

Earlier work by Halcrow (1988) used the method to assess the Anglian coast to assist in the development of a management strategy for the Environment Agency's coastal flood defence predecessor, Anglian Water. This study concluded that 78% of the Anglian coast had experienced steepening between the mid 1800's to the 1970's. This is a higher percentage than the national average and confirms this coastline to be very dynamic along a large proportion of its length.

The analysis in this report uses a similar methodology to that of Taylor *et al* (2004) and although the length of time covered in this report is an order of magnitude less than their data-set, the data utilised here is likely to be of much greater accuracy. The positional accuracy quoted in Taylor *et al* for OS maps are +/-5m for pre-1945 County Series Maps and +/-3.5m for post-1945 National Grid mapping. Whereas the accuracy of the Anglian Coastal Monitoring profiles is +/-0.05m vertical and +/-0.02m horizontal.

Changes in the gradient of the beach between MHW and MLW are expressed in the form of the 'Foreshore Change Classification system' (Halcrow, 1988) shown in *Table 1* (below). Positive Foreshore Change Parameter (FCP) values indicate a beach system advancing seaward and negative values show a system retreating landward. The individual FCP numbers indicate flattening, steepening or no rotation.

As no pair of MHW and MLW trend lines was likely to possess exactly the same gradient, every profile could be described as either flattening or steepening. To eliminate insignificant rotational changes, any change of less than 1.0% of the mean width of the foreshore was considered to be 'no change'. In addition to this, judgement was used where some apparent rotational changes were deemed to be unreliable due to high degrees of foreshore variability.

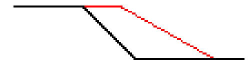
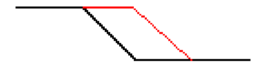
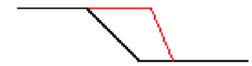
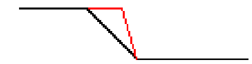
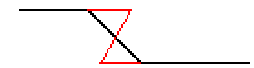
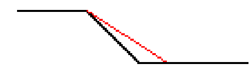
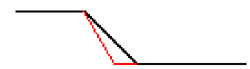
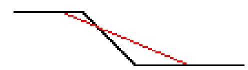
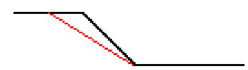
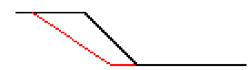
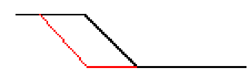
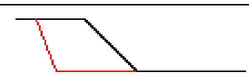
FCP	MHW	MLW	Inter-tidal (gradient)	Profile change
+6	Advance	Advance	Flattening	
+5	Advance	Advance	No rotation	
+4	Advance	Advance	Steepening	
+3	Advance	No movement	Steepening	
+2	Advance	Retreat	Steepening	
+1	No movement	Advance	Flattening	
0	No movement	No movement	No rotation	
-1	No movement	Retreat	Steepening	
-2	Retreat	Advance	Flattening	
-3	Retreat	No movement	Flattening	
-4	Retreat	Retreat	Flattening	
-5	Retreat	Retreat	No rotation	
-6	Retreat	Retreat	Steepening	

Table 1 – Foreshore change classification system (adapted from Halcrow, 1988). The change is indicated in red.

1.5 Future outputs

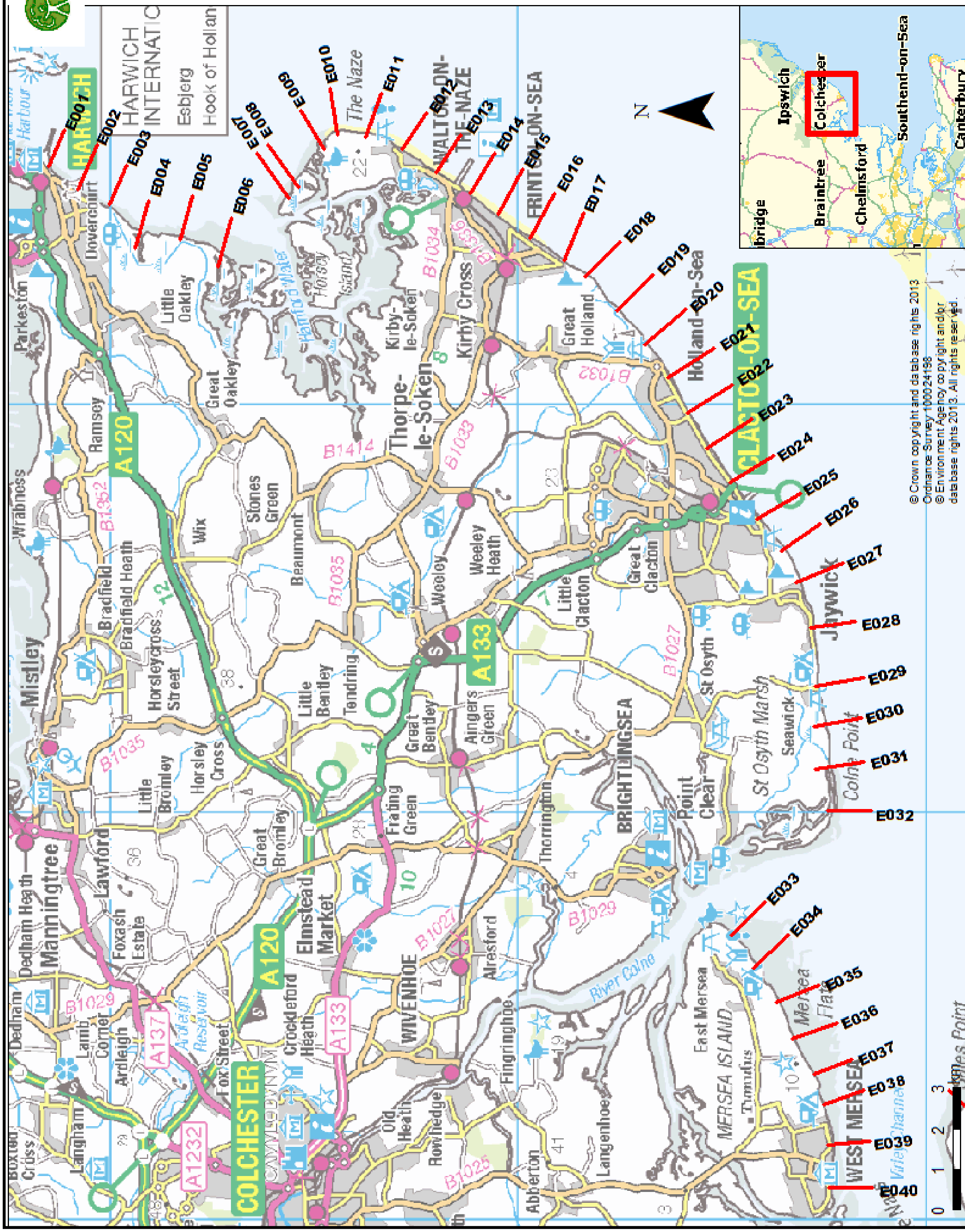
Future updates of this report will include updated information on beach trends using the latest available profile data. In addition to this, the report may include extended analysis utilising other data sets collected by Geomatics (now responsible for leading on the ACM).

1.6 Profile Maps

The following Maps show the position of the 80 profile lines for Essex, which are analysed in this report. However, the profile names have changed since the last analysis report was compiled in 2008 and the new naming convention was introduced in 2013 for simplification (*see Appendix 4.2).*

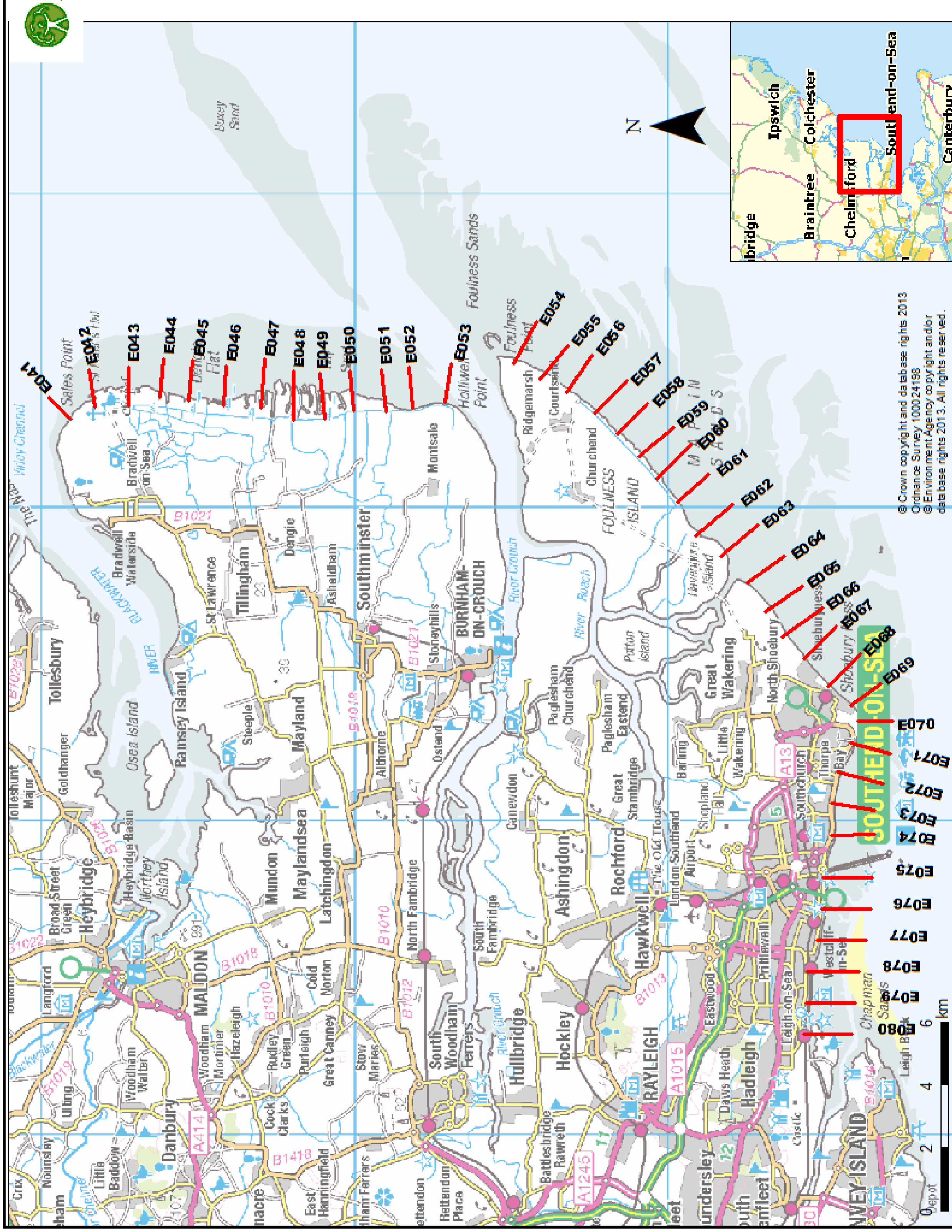
Environment Agency

Essex profile lines - Map 1 of 2



Environment Agency

Essex profile lines - Map 2 of 2



2.0 Essex (sub-cell 8) coastal trends

2.1 Introduction

The Essex study area for this report extends from Harwich on the southern bank of the Stour Estuary to Southend-on-Sea, on the northern bank of the River Thames. Canvey Island has not been included in this analysis as profiles here have been regarded as estuary (Thames) and not coastal.

Essex has an unusual coastline formed by a series of interlinked estuaries (Roach, Crouch, Blackwater, Colne and Hamford Water) giving rise to relatively discrete units of open coast in between – the Tendring, Dengie and Foulness peninsulars.

Much of the coastline is low lying and protected by earth/clay flood embankments with sea facing revetment works or sea walls together with groynes.

The highly developed Tendring peninsular is characterised by long-term shore recession with groyned sand and shingle beaches backed by sea walls. At Jaywick, a number of shore defence works have taken place between West Clacton and Cocketwick to try to keep longshore drift to a minimum, reduce beach scour and subsequent erosion in front of the existing 1930s sea wall.

The original scheme at Jaywick (1986–1988) consisted of four rock armoured fishtail breakwaters plus beach recharge and was only the second scheme of its kind to be implemented in the UK. Following construction, however, continued beach loss between the breakwaters confirmed that the fishtails had been spaced too far apart. This led to the instigation of the second Jaywick scheme in 1999 which introduced a further fishtail groyne, offshore breakwater and continued beach recharge. Works continued up to 2008/2009 to add an additional breakwater adjacent to Brooklands which had been omitted from the second scheme. In 2008/2009 approx 250,000 tonnes of sand renourishment was provided to Bay 3.

The adjacent frontage at Seawick, west of Cocketwick breakwater, has seen new sea defences established in 1998 consisting of a series of shore normal rock groynes together with a shore parallel rock groyne to replace an old groyne system. Further west of here the beach continues to erode to the sea wall.

Works to improve the 2.3km frontage to the Tendring and Holland sea wall were completed in 2001/2002. These sea defences protect properties and land in Holland-on-Sea and Frinton-on-Sea.

Significant erosion rates along the cliffs at the Naze led to several proposals for protection works to reduce cliff erosion by stabilising the beach fronting the cliffs. A rock hard point has been constructed at the southern end of the Naze and the beach material imported at the northern end to offset the effects of foreshore erosion.

The cliffs at the Naze represent the only example of cliffs of any significant height in the county. They are a designated Geological SSSI and archaeologically significant due to their nationally important Pleistocene exposures which contain some of the first evidence of human occupation in this country.

In additional to Tendring, Southend-on-Sea and Harwich represent the other developed areas along the Essex coastline and are characterised by sand/shingle beaches with groynes, backed by sea walls. Recharging of the beach to the east of Southend Pier as far as Thorpe Esplanade in 2002 has created a new beach at Southend-on-Sea.

The remainder of the coastal frontage is largely rural and supports agricultural land, some nationally and internationally important wildlife habitats and conservation sites.

On Dengie and Foulness the shoreline is largely artificial in nature due to a succession of sea wall enclosures and extensive reclamation of saltmarshes during the period 1650 to 1850. These low wave energy environments form rare examples of open coast marsh. The protected land here is lower than the saltmarsh on the seaward side of the embankments. Large extents of saltmarsh and mudflat play important roles in coastal defence and is the first line of defence to the land, reducing the pressures on the embankments – the formal flood defence.

Thames lighter barges, now redundant, were introduced along sections of the Essex coast from the mid 1980s and sunk in the nearshore zone to reduce wave energy and help maintain the saltmarshes. These are located at two sections along the Dengie peninsular and also at Horsey Island in Hamford Water.

The saltmarshes are amongst the most extensive in the country with the mudflats and drainage ditches at Maplin Sands forming the largest continuous intertidal area in Britain extending several kilometres offshore down to MLWS. Much of the saltmarsh areas are designated SSSIs. Maplin Sands regularly supports around 130,000 waterfowl, ranking this site (along with the Thames estuary) fourth largest in the country.

Major centres of tourism, leisure and recreation along the Essex coastline are located at Southend-on-Sea, Tendring (particularly Clacton-on-Sea and Walton-on-the-Naze) and at Canvey Island. Harwich is a predominantly industrial and has the second largest passenger port in the country.

Fishing is a major industry – the most productive cockle beds in the UK are located at Maplin Sands. Oyster beds and winkle fisheries are also of significant importance. West Mersea supports the largest concentration of trawlers operating from the Essex coast.

This study deals with the coastline only and does not analyse any data that has been collected further inland or along the estuaries. The Environment Agency has collected beach profile data, on a bi-annual basis,for 80 transects along the Essex coastline at 1km intervals since 1991.

2.2 General description – Harwich to Canvey Island

Figure 3 (overleaf), shows the general results of the analysis, which are summarised in *Table 2* and *Table 3* below. Percentages are worked out from the total of 80 beach profiles along this section of coast. In addition, *Figure 4* and *Figure 5* show the trends analyses split into two sections, between Harwich to Mersea Island and Dengie Flat to Southend-on-Sea respectively. This is to show with greater clarity the smaller variation in trends between Harwich and Mersea. *Appendix 4.2* shows the Transect IDs and Old Profile names as well as the Monitoring Cell locations of the profiles. **NB.** Some profiles did not have sufficient MLWN data to determine a reliable FCP score.

Movement	No of Profiles	Percentage (%)
Accretion	45	56
None	13	16
Erosion	22	28
Totals	80	100

Table 2 – profiles showing movement

Beach gradient	No of Profiles	Percentage (%)
Flattening	48	60
No rotation	16	20
Steepening	16	20
Totals	80	100

Table 3 – profiles showing rotation

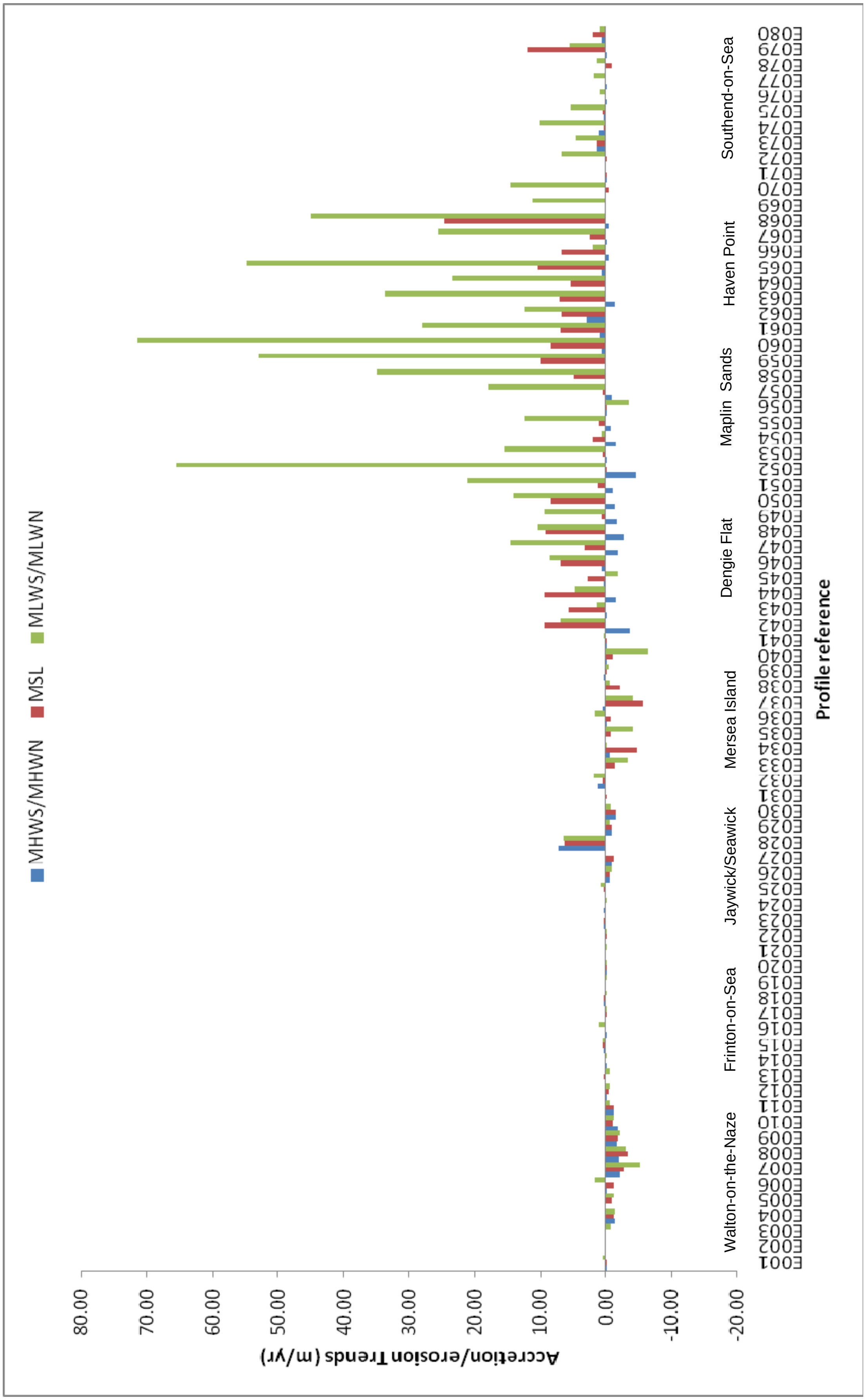

MHWS/MHWN
MSL
MLWS/MLWN
Accretion/erosion Trends (m/yr)
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
-10.00
-20.00
Walton-on-the-Naze
Frinton-on-Sea
Jaywick/Seawick
Mersea Island
Dengie Flat
Maplin Sands
Haven Point
Southend-on-Sea
Profile reference

Figure 4 – Coastal trends 1991 to 2014 – Harwich to Mersea Island. Note main areas of erosion at Walton-on-the-Naze and Mersea Island. NB Vertical scale differs between Figures. 3, 4 and 5.

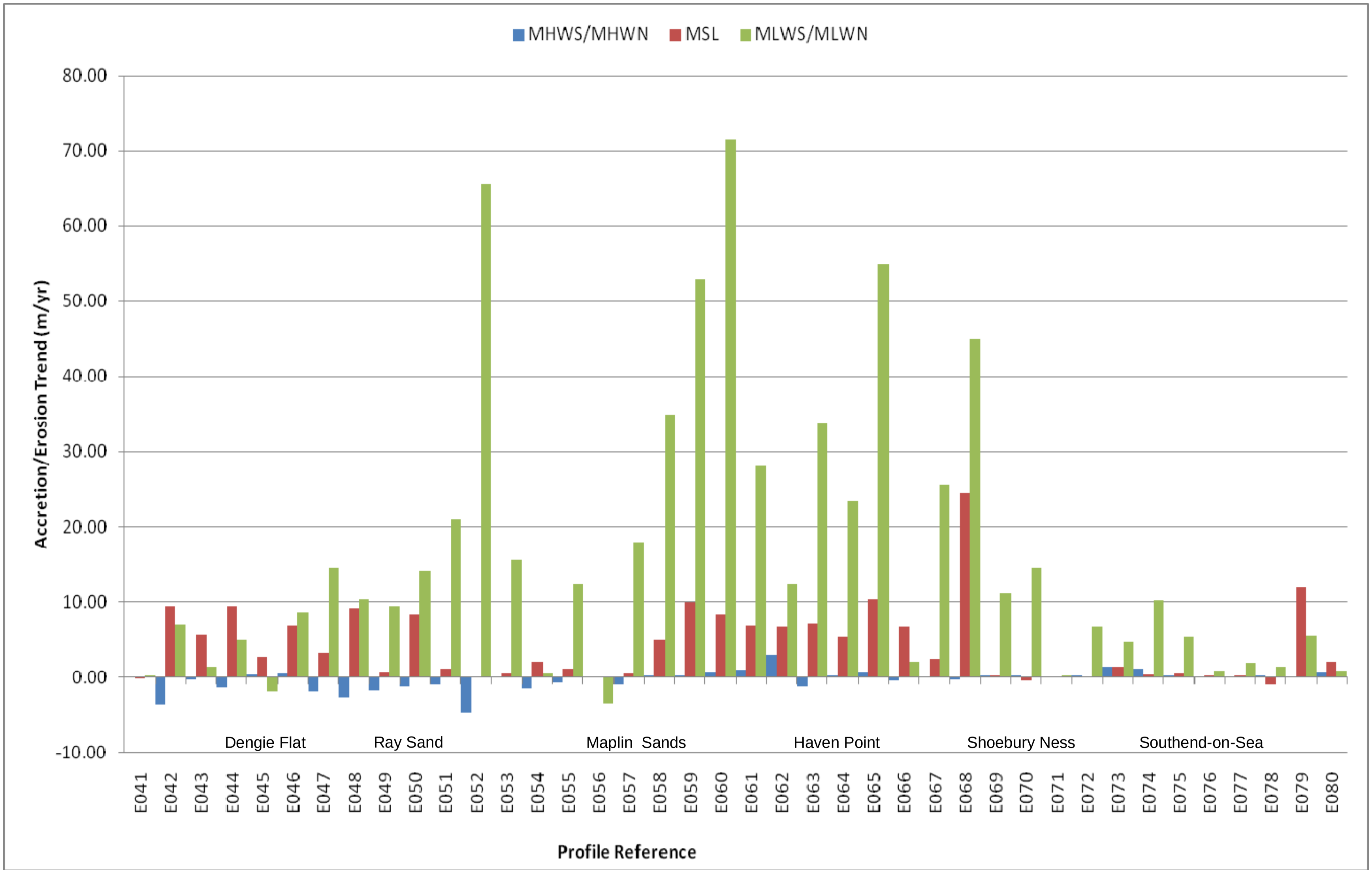


Figure 5 – Coastal trends 1991 to 2014 – Dengie Flat to Leigh-on-Sea. Note significant accretion at MSL and MLW along much of this section of coast. NB Vertical scale differs between Figures 3, 4 and 5.

2.3 Outline observations

The majority of the Essex coastline is artificially held by defences. Along the developed sections of coast at Harwich, Walton-on-the-Naze to Jaywick and at Southend-on-Sea beaches are backed by concrete sea walls with groynes. Clay or earth embankments back the expanses of mudflat and saltmarshes at Dengie Flat and Maplin Sands. As a result of these man-made constructions, beaches may have been unable to behave naturally (to a significant degree) and, where applicable, ‘roll back’ in response to natural processes.

A little over half (56%) of the 80 profiles along this stretch of coastline have shown a general accretion trend over the last 22 years. Significant trends of accretion were apparent along the broad expanses of mudflats at Dengie Flat, Maplin Sands and Shoeburyness where the foreshore can extend several kilometres seaward of MHWS.

Over a quarter (28%) of profiles showed some erosional trend of the foreshore. Significant erosion was observed at the Naze and on the east of Mersea Island.

The majority of profiles (60%) show a flattening trend of the foreshore and around a fifth (20%) show a foreshore steepening trend.

The remaining 20% of profiles have shown no change in the general trend and no change in rotation of the foreshore gradient.

The following section offers a description of the results of the analysis as well as graphically showing the trends overlaid over a suite of aerial photographs that were taken during summer 2013.

The descriptions are divided into six sections which broadly relate to the divisions concluded by Halcrow (1988). Mean annual longshore wave energy values for the entire study area were 0 – 500 kN/s except for the section of coast from Stone Point on the Naze to Holland-on-Sea where values increased to 500 – 1000 kN/s (Halcrow, 1988).

The following analysis is profile by profile.

The first table show accretion/erosion rates at MHW, MSL and MLW levels (vary from Spring tides to Neap tides depending on data availability and existing sea defence).

The second table shows movement of the Mean Low Water Neap (MLWN) line from an early survey (normally 1992), one from 2006 (used in the 2008 trends analysis) and the latest from 2014. Some of the profiles show very erratic behaviour at MLWN, which may have distorted the calculated trends.

The profile cross-sections are screenshots from bespoke software and show an early survey (normally 1992), one from 2006 (used in the 2008 trends analysis) and the latest from Winter 2014. The text is a summary of the changes in the profile.

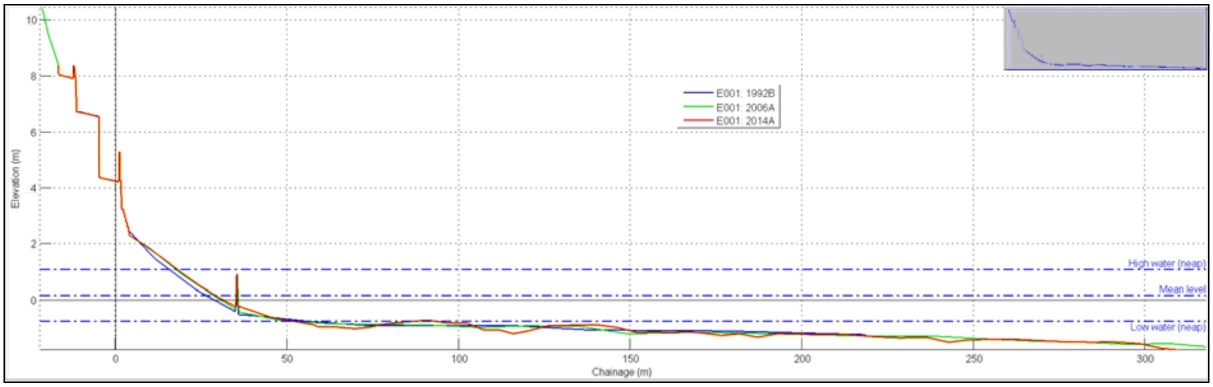
NB. Old profile names in parentheses.

2.3.1 Harwich to Hamford Water

E001 (E1D1A) – Harwich, Marine Parade. *Defence type: recurved stepped concrete sea wall and groyne.*

Accretion/Erosion Rates (metres/year)			
MHWS	MSL	MLWS	Mean
-0.01	-0.22	0.40	0.06

MLWN chainage (metres)		
1992	2006	2014
55	51	52

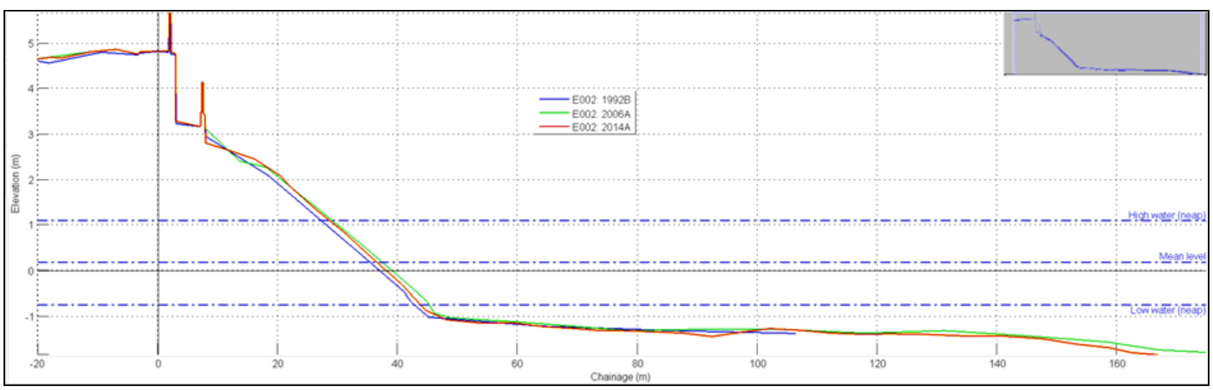


Profile is stable at MHWS. Minimal erosion trend at MSL due to groyne protection. MLWS has shown a small accretion trend. MLWN has remained more or less around 50m offshore until 2013 when an additional bar appears intermittently, giving a range of MLWN of 50 to nearly 100m offshore in 2014. Surveyed profile crosses groyne between 30m and 40m chainage.

E002 (E1D2) – Harwich, Lower Marine Parade. *Defence type: concrete sea wall.*

Erosion Rates (metres/year)			
MHWS	MSL	MLWS	Mean
0.03	0.04	0.11	0.06

MLWN chainage (metres)		
1992	2006	2014
43	45	44

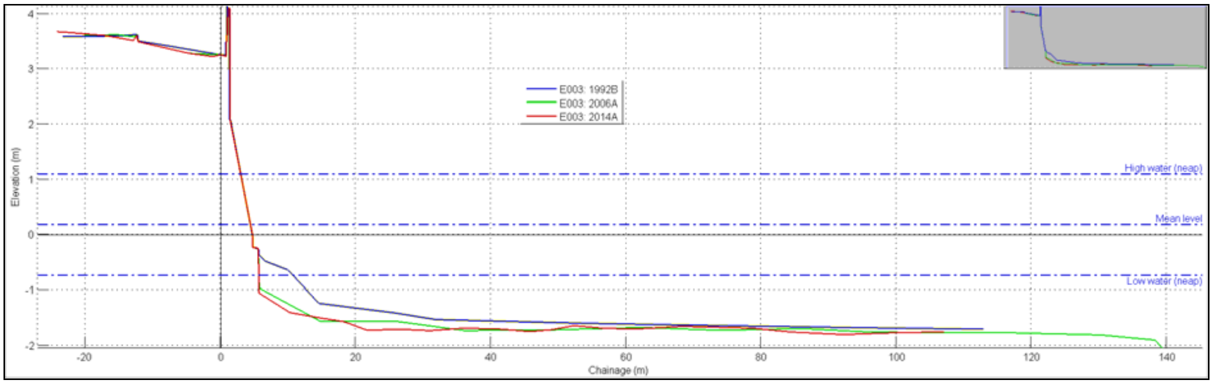


Insignificant trends at all levels. No movement and no rotation.

E003 (E1D3) – Smack. *Defence type: recurved concrete sea wall.*

Erosion Rates (metres/year)			
MHWS	MSL	MLWS	Mean
0.00	0.01	-0.69	-0.23

MLWN chainage (metres)		
1992	2006	2014
11	6 (sea defence)	6 (sea defence)

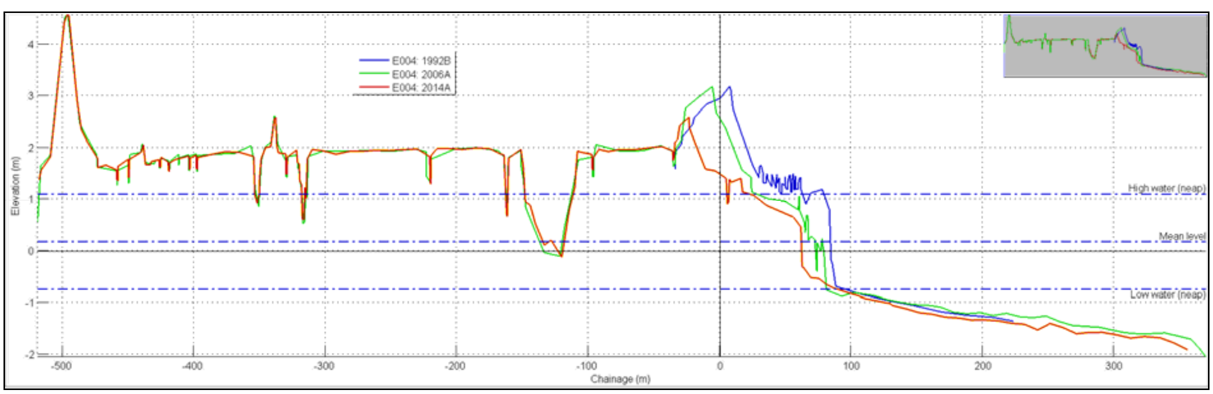


No movement at MHWN and MSL due to hard sea defence. Beach erodes at MLWN and meets the sea defence in 2004. Erosion trend at MLWS indicating lowering of the beach. Profile shows steepening, mainly due to the hard sea defence.

E004 (E1D4A) – Middle Beach. *Defence type: grassed clay embankment.*

Erosion Rates (metres/year)			
MHWS	MSL	MLWS	Mean
-1.39	-1.20	-1.39	-1.33

MLWN chainage (metres)		
1992	2006	2014
95	81	89

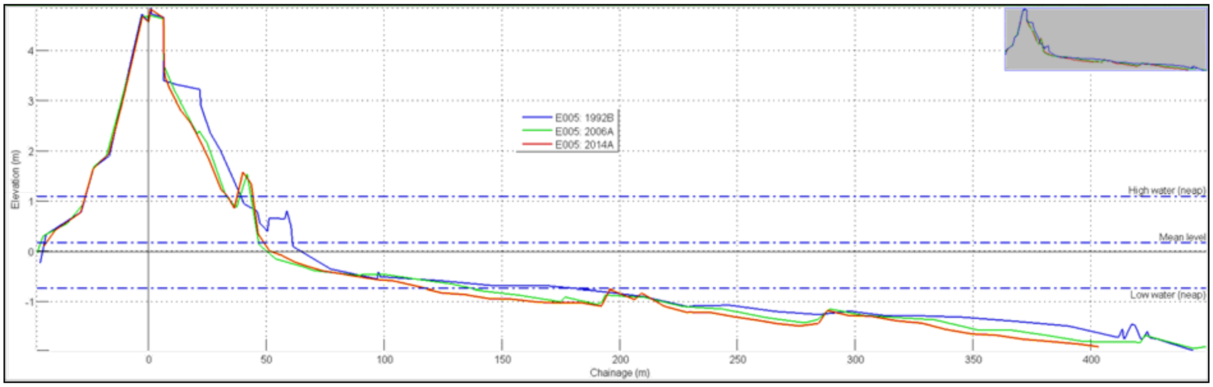


Erosion trend at all levels. No rotation. There has been a rollback of the dune in the region of 32m since 1992 resulting in reduction of saltmarsh behind the dune.

E005 (E1D5) – Long Bank. *Defence type: embankment and rock groyne (shore parallel).*

Erosion Rates (metres/year)			
MHWS	MSL	MLWS	Mean
0.00	-0.80	-1.17	-0.66

MLWN chainage (metres)		
1992	2006	2014
181	137	117

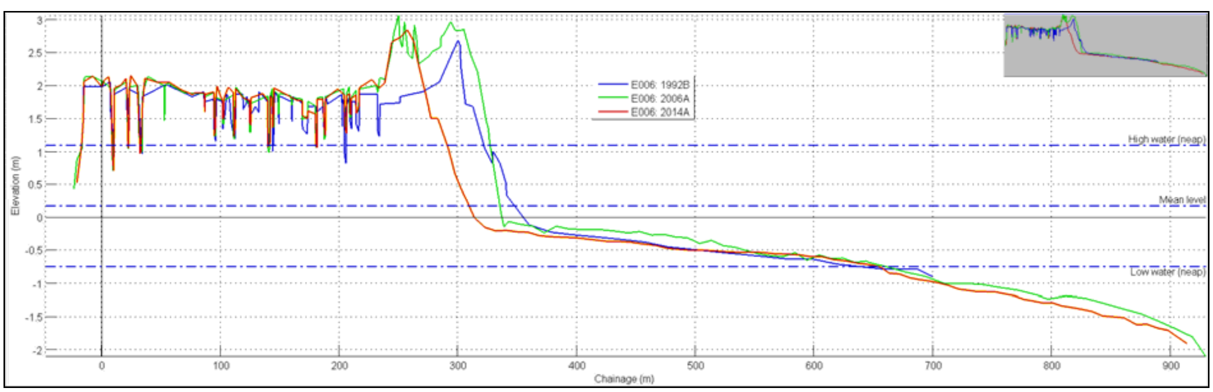


Stable at MHW due to sea defence above MHWS and rock at MHWN. Erosion trend at MSL and at MLWS. Approximate 12m retreat at MSL from 1992 to 2006 but little movement since. Slightly steepening profile.

E006 (E1D6) – Irlam's Beach. *Defence type: none*.

Erosion Rates (metres/year)			
MHWS	MSL	MLWN	Mean
-0.29	-1.28	1.68	0.04

MLWN chainage (metres)		
1992	2006	2014
634	659	652



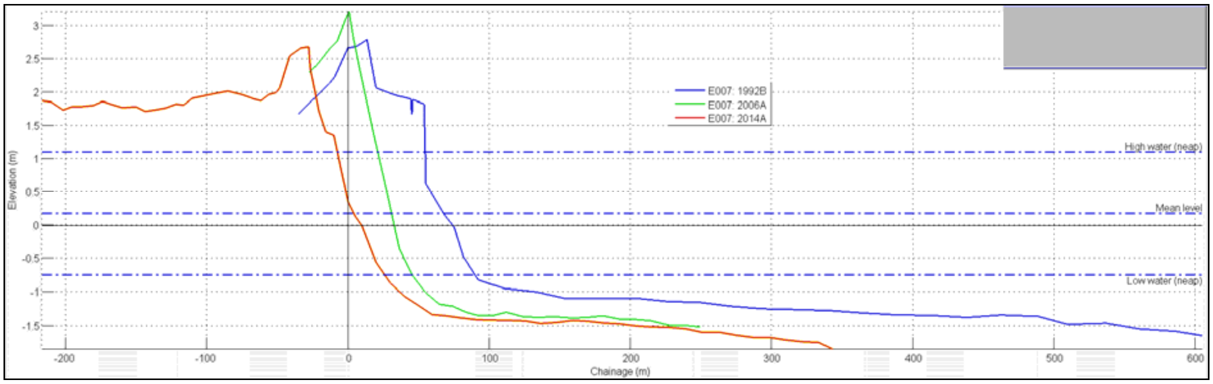
Erosion trends at MHWN and at MSL but accretion trend at MLWN giving a stable mean trend. Profile shows slight flattening. Profile shows an erosion trend up to 2000, then accretes until 2005 when it reverts to an erosion trend from then onwards.

2.3.2 The Naze (Stone Point) to Lee-over-Sands (Colne Point)

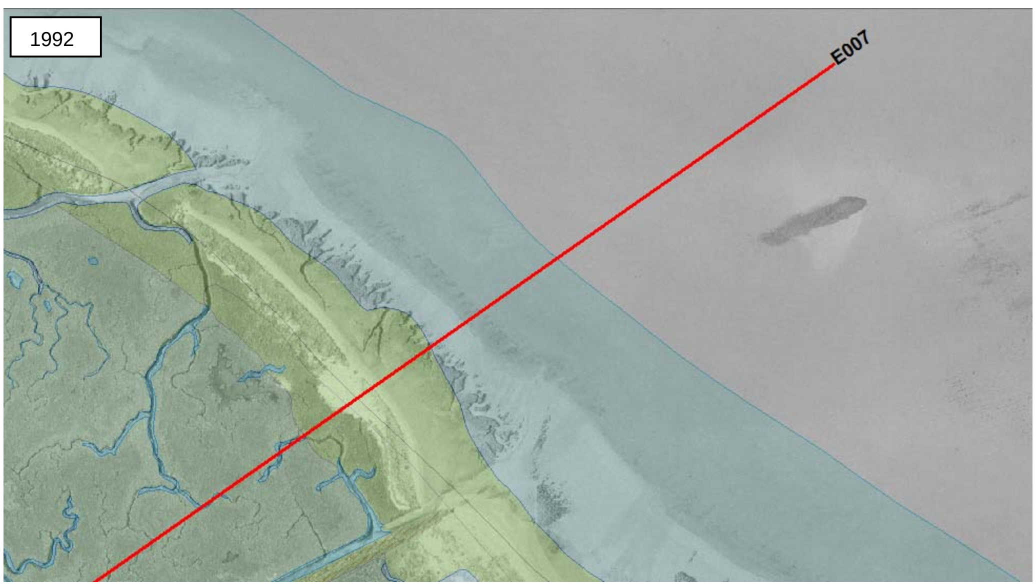
E007 (E1C1) – Stone Marsh. *Defence type: none.*

Erosion Rates (metres/year)			
MHWS	MSL	MLWN	Mean
-2.15	-2.85	-5.22	-3.41

MLWN chainage (metres)		
1992	2006	2014
102	51	31



Erosion trend at all levels. MLWN has moved shoreward by 60m since 1992. Profile showed slight steepening up to 2006 but has flattened slightly since to give no rotation. Large amount of erosion between 2001 and 2003. See aerial photos below.



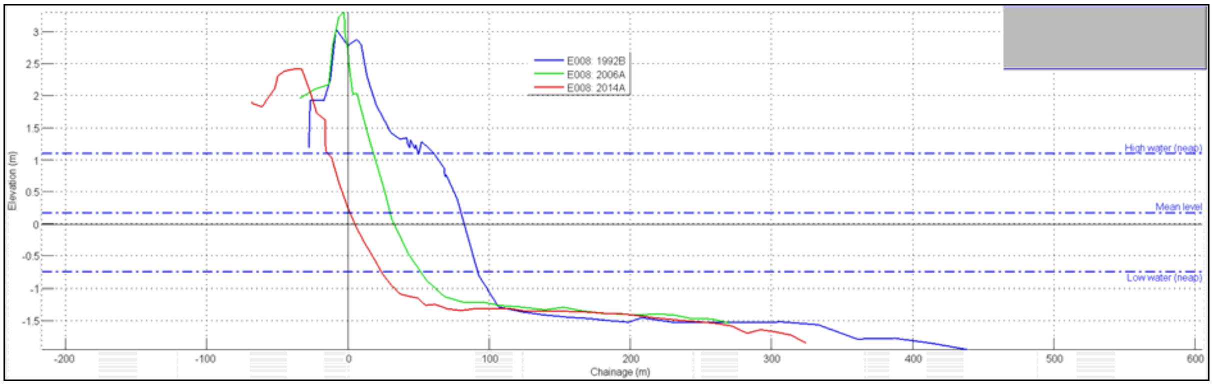

2006
E007


2013
E007

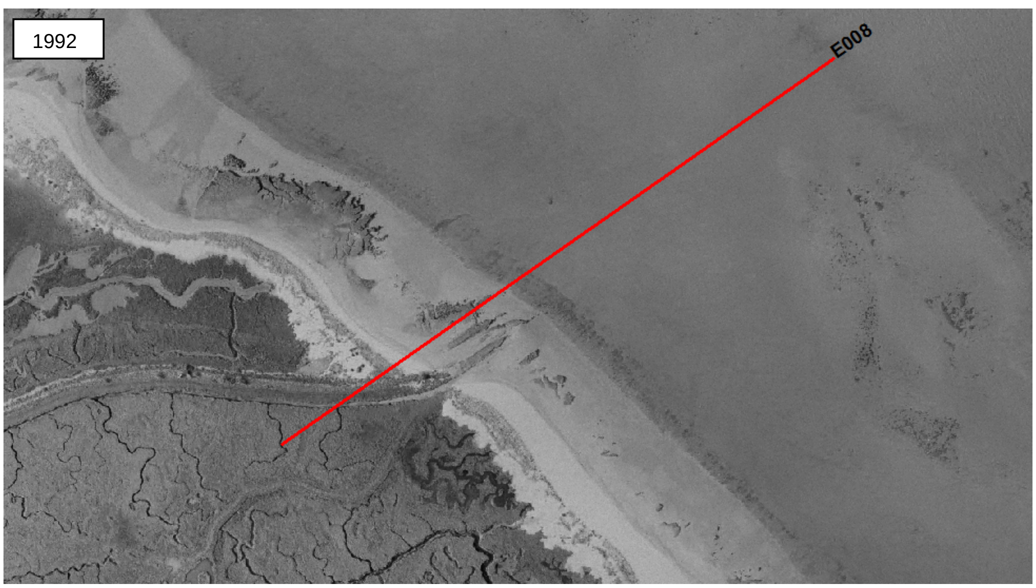
E008 (E1C2) – Stone Creek. *Defence type: clay embankment.*

Erosion Rates (metres/year)			
MHWS	MSL	MLWN	Mean
-2.08	-3.25	-2.99	-2.77

MLWN chainage (metres)		
1992	2006	2014
95	56	28



Erosion trend at all levels. Slight flattening of profile. Overall retreat at MSL of around 80m since 1992. See aerial photos below.



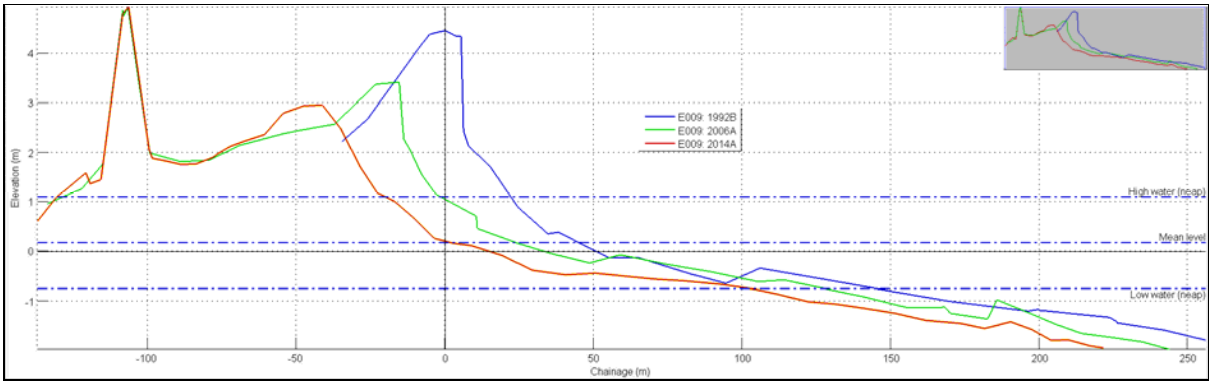

2006
E008


2013
E008

E009 (E1C3) – The Naze. *Defence type: clay sea wall with concrete slab revetment and asphalt crest path.*

Erosion Rates (metres/year)			
MHWS	MSL	MLWS	Mean
-1.68	-1.79	-2.15	-1.87

MLWN chainage (metres)		
1992	2006	2014
159	139	114

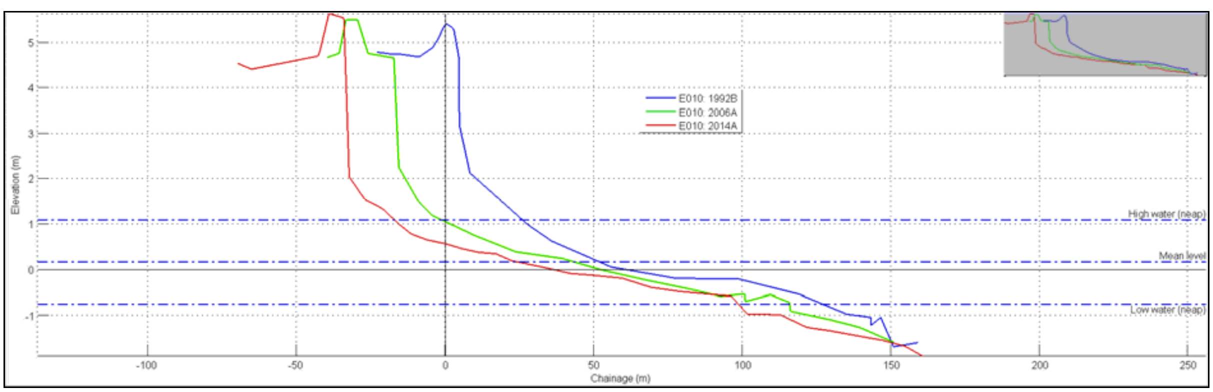


Erosion trend at all levels but showed slight accretion in 2000/2001. Flattening profile.

E010 (E1C4A) – The Naze. *Defence type: none.*

Erosion Rates (metres/year)			
MHWS	MSL	MLWS	Mean
-1.79	-1.10	-1.13	-1.34

MLWN chainage (metres)		
1992	2006	2014
132	116	100

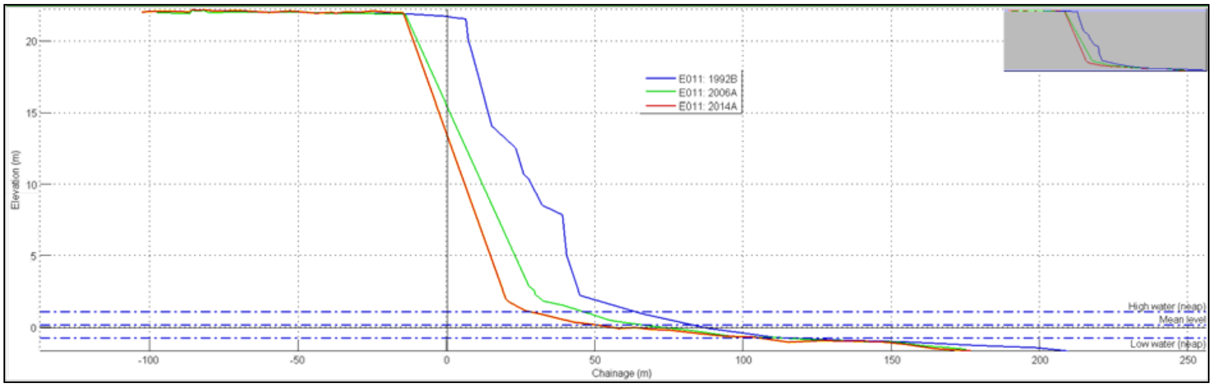


Erosion trend at all levels with greater erosion at MHWN but showed a blip of slight accretion in 2000/2001. Flattening profile.

E011 (E1C5A) – East Cliffs. *Defence type: none.*

Erosion Rates (metres/year)			
MHWS	MSL	MLWS	Mean
-1.20	-1.13	-0.62	-0.99

MLWN chainage (metres)		
1992	2006	2014
132	126	110



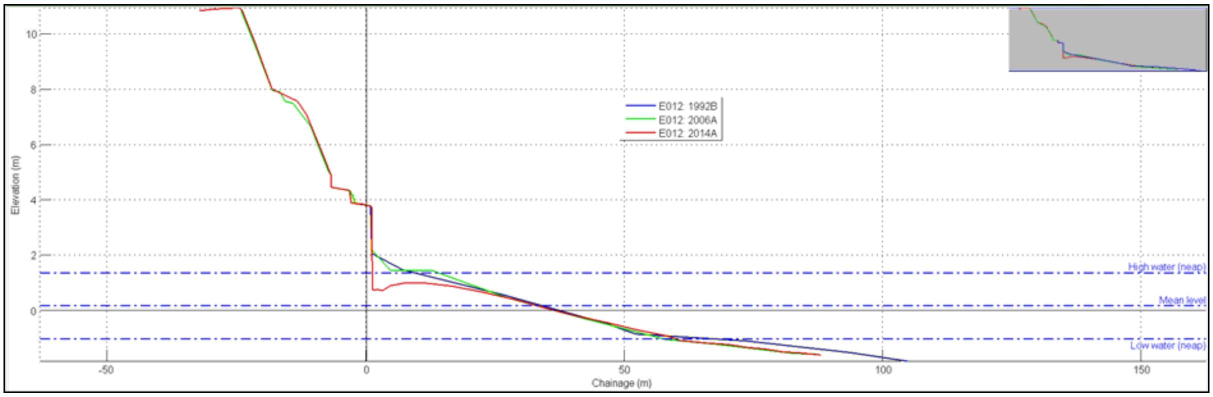
Slightly lower erosion trends of cliff recession than the rest of the Naze and lower erosion trend at MLWN compared to MSL and MHWN. The base of the cliff has retreated by approx 35m in the period 1992 to 2014. Flattening profile.

Cliff slumping at the Naze.

E012 (E1C6) – Jubilee Beach. *Defence type: concrete recurved sea wall.*

Erosion Rates (metres/year)			
MHWN	MSL	MLWN	Mean
-0.15	-0.40	-0.47	-0.34

MLWN chainage (metres)		
1992	2006	2014
55	54	57

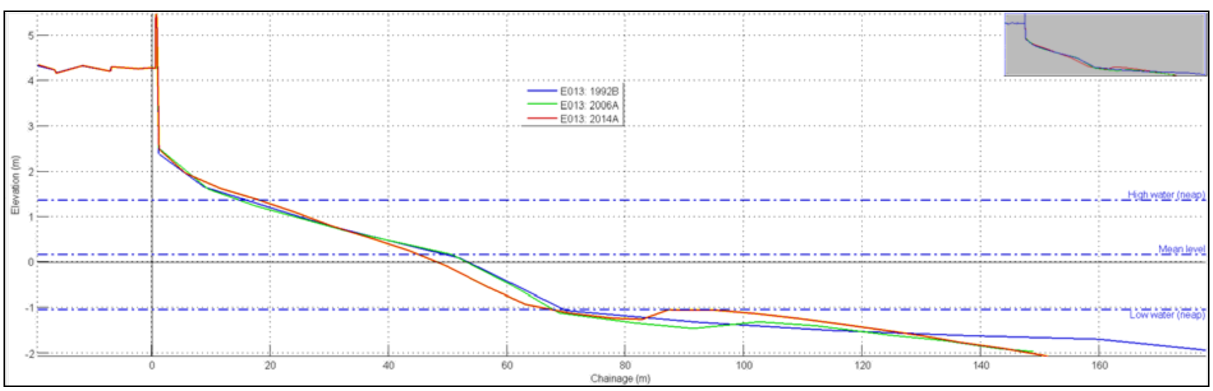


Erosion trends at all levels but minimal at MSL and MLWN. Higher at MHWN until beach eroded back to the concrete sea defence around 1997. Profile exhibits sediment loss in the winter and gain in the summer but general overall erosion trend. Profile frequently erodes back to sea defence at MHWS and MHWN.

E013 (E1C7) – Walton-on-the-Naze, Albion Breakwater. *Defence type: concrete recurved sea wall.*

Erosion Rates (metres/year)			
MHWN	MSL	MLWS	Mean
0.04	0.29	-0.47	-0.05

MLWN chainage (metres)		
1992	2006	2014
67	66	62

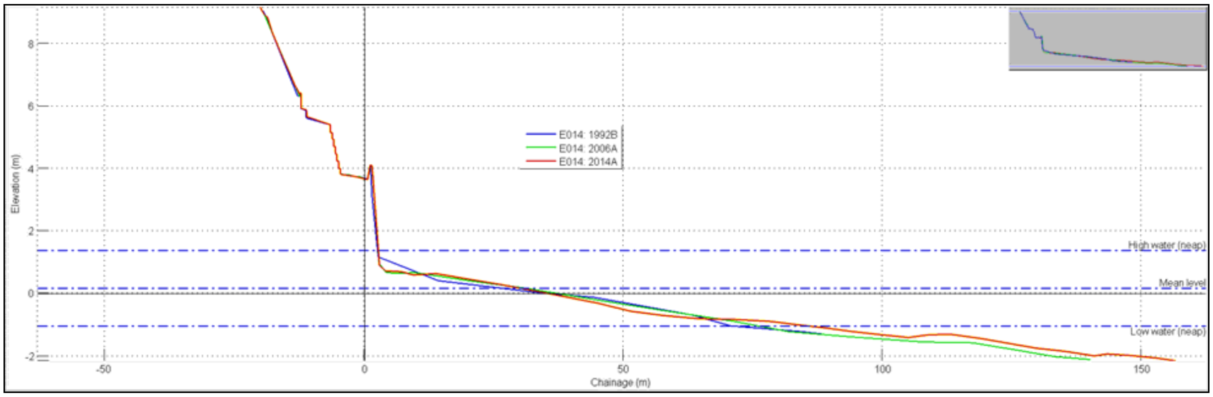


Stable at MHWN due to sea defence. Minimal accretion trend at MSL and minimal erosion trend at MLWS. Very slight steepening of profile.

E014 (E1B1) – Walton-on-the-Naze, Burnt House Breakwater. *Defence type: concrete recurved sea wall.*

Erosion Rates (metres/year)			
MHWN	MSL	MLWN	Mean
-0.07	0.04	-0.07	-0.04

MLWN chainage (metres)		
1992	2006	2014
68	71	78

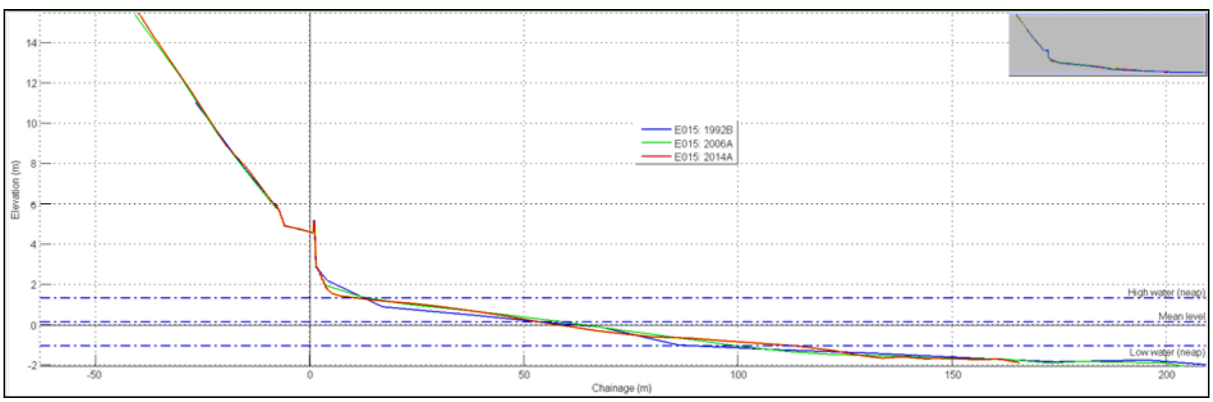


Stable at MHWN due to hard sea defence. High variability of lower beach at MLWN and MSL with a slight general trend of erosion. No significant change in profile.

E015 (E1B2) – Frinton-on-Sea, Sandy Hook Breakwater. *Defence type: concrete recurved sea wall, stepped revetment and groyne.*

Erosion Rates (metres/year)			
MHWN	MSL	MLWN	Mean
0.26	0.47	0.40	0.38

MLWN chainage (metres)		
1992	2006	2014
84	95	104

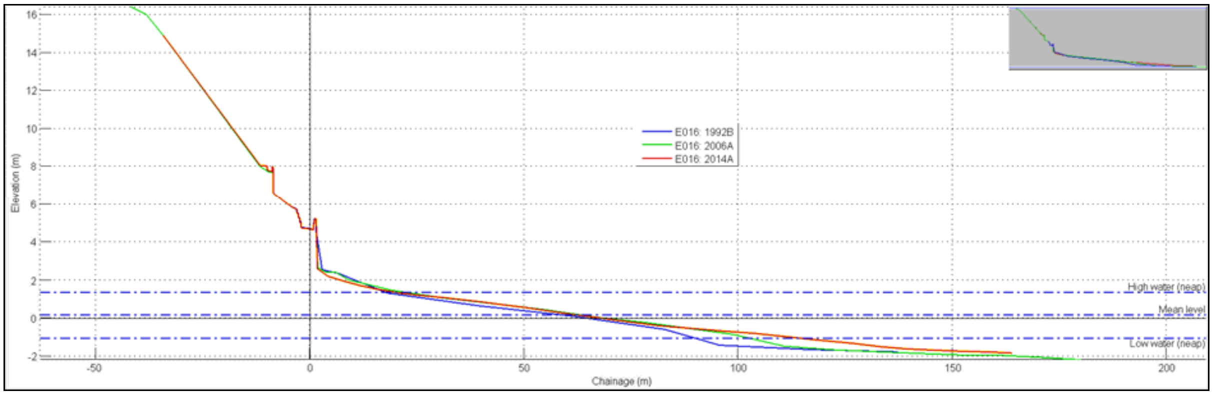


Sea defence at MHWS. Relatively stable at MHWN but variable at MSL and MLWN. Accretion trend at MSL and MLWN. Slightly flattening profile.

E016 (E1B3) – Frinton-on-Sea, The Greensward. *Defence type: concrete recurved sea wall and groyne.*

Erosion Rates (metres/year)			
MHWS	MSL	MLWS	Mean
-0.07	0.15	1.10	0.39

MLWN chainage (metres)		
1992	2006	2014
87	99	108

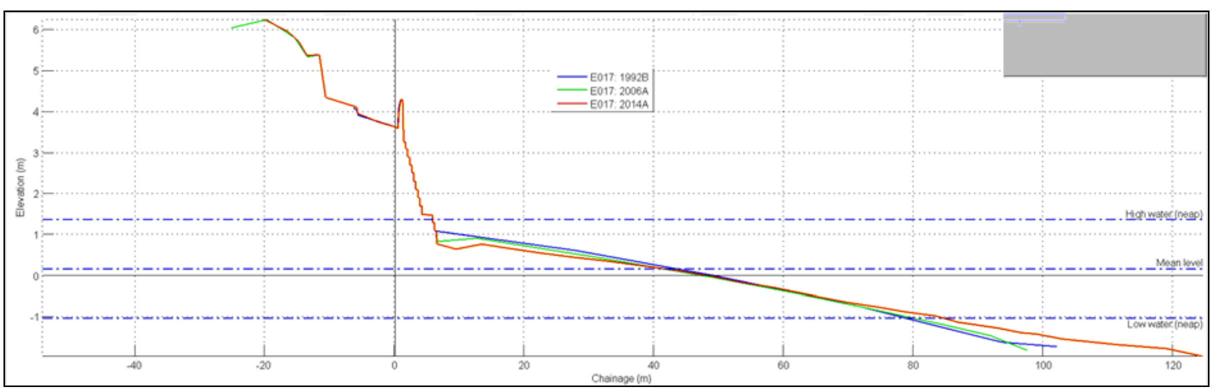


Variable at MHWN. Very slight accretion trend at MSL. Larger accretion trend and MLWN. Slightly flattening profile.

E017 (E1B4) – Frinton Golf Club. *Defence type: concrete recurved sea wall and stepped revetment and groyne.*

Erosion Rates (metres/year)			
MHWN	MSL	MLWN	Mean
0.01	-0.22	-0.11	-0.11

MLWN chainage (metres)		
1992	2006	2014
75	76	79

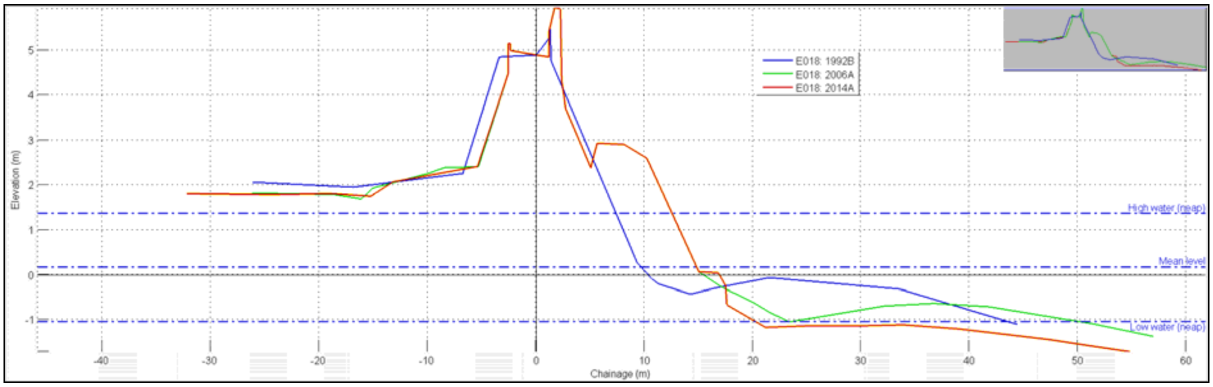


Profile stable at MHWN due to hard sea defence. Minimal erosion trend at MSL and MLWN. Very slight flattening of profile.

E018 (E1B5A) – Holland Gap. *Defence type: rock armour, stone revetment and concrete crest wall.*

Erosion Rates (metres/year)			
MHWN	MSL	MLWN	Mean
0.29	0.26	-0.26	0.10

MLWN chainage (metres)		
1992	2006	2014
42	46	19

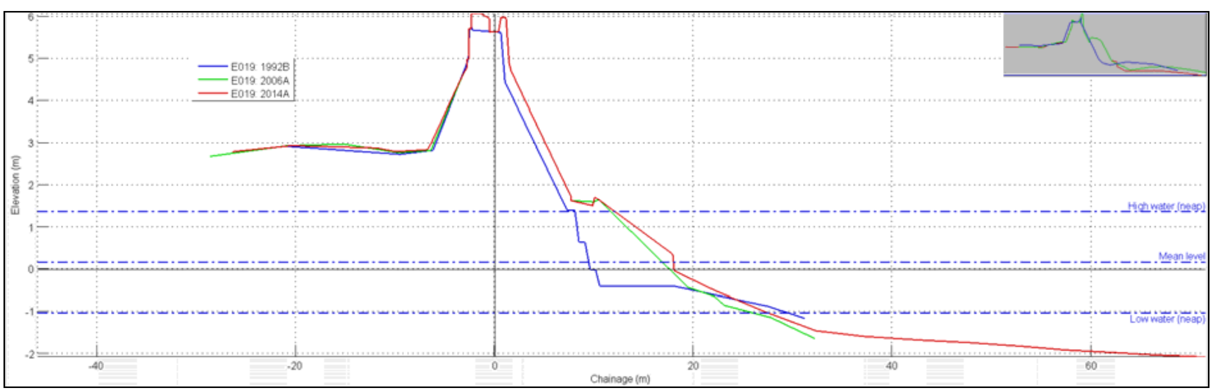


Stable at MHWN and MSL due to hard sea defence with an accretion jump in 2002 due to rock armour placed at seawall after which levels remain stable. MLWN trends are variable but overall trend is erosion. Steepening of profile.

E019 (E1B6) – Chevaux de frise Point. *Defence type: rock armour, slab revetment and concrete crest wall.*

Erosion Rates (metres/year)			
MHWN	MSL	MLWN	Mean
0.07	0.15	-0.22	0.00

MLWN chainage (metres)		
1992	2006	2014
30	26	28

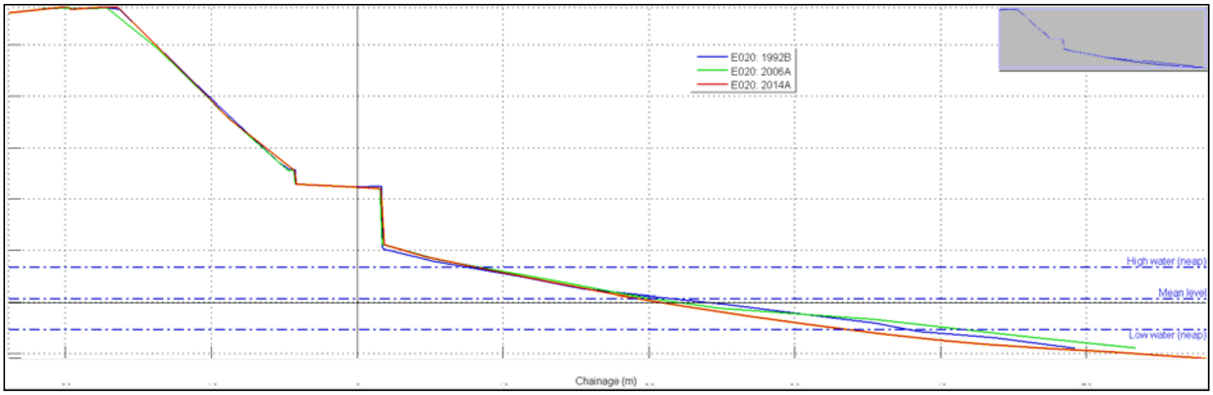


Stable at MHWN and MSL due to hard sea defence. Rock armour has been placed along sea wall here (circa 1994) and shore normal rock groynes near the profile removed during the study period. Profile shows slight steepening trend at MLWN. Showing no overall movement but data points are highly variable.

E020 (E1A1S) – Holland-on-Sea. *Defence type: piling.*

Erosion Rates (metres/year)			
MHWN	MSL	MLWN	Mean
-0.02	0.00	-0.22	-0.08

MLWN chainage (metres)		
1992	2006	2014
38	41	33

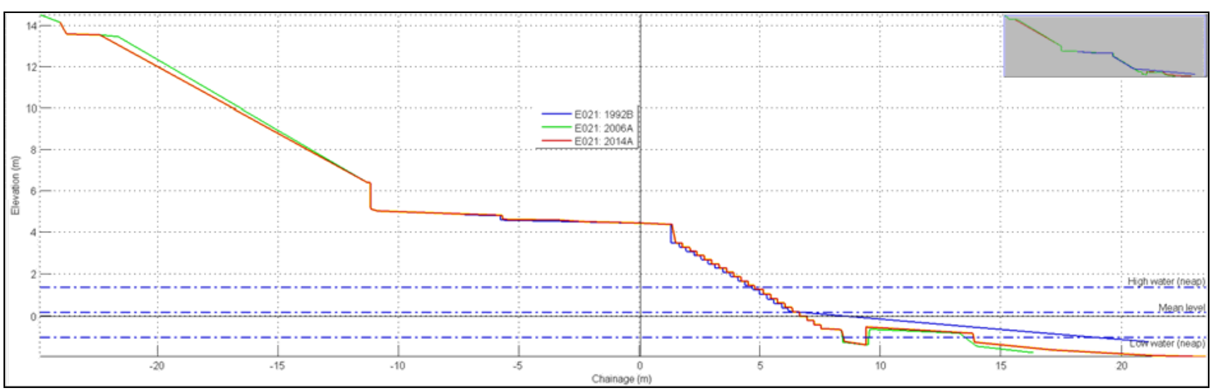


Profile located between groynes and backed by piling. Hard sea defence at MHWS. Insignificant trends at all levels. Slightly steepening profile.

E021 (E1A1) – Holland-on-Sea. *Defence type: concrete sea wall with stepped revetment, rock armour.*

Erosion Rates (metres/year)			
MHWN	MSL	MLWN	Mean
0.00	0.00	-0.11	-0.03

MLWN chainage (metres)		
1992	2006	2014
19	14 (sea defence)	14 (sea defence)

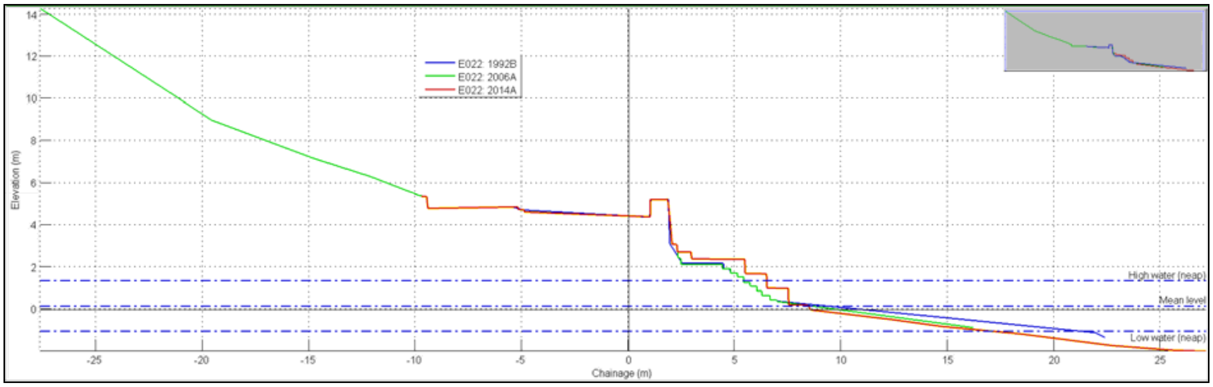


Stable at MHWN and MSL due to hard sea defence. Rock armour added to sea wall circa 2001/2002 meaning insignificant trend at MLWN.

E022 (E1A2) – Holland-on-Sea. *Defence type: concrete stepped wall and groyne.*

Erosion Rates (metres/year)			
MHWN	MSL	MLWN	Mean
0.04	-0.07	-0.29	-0.11

MLWN chainage (metres)		
1992	2006	2014
21	18	17

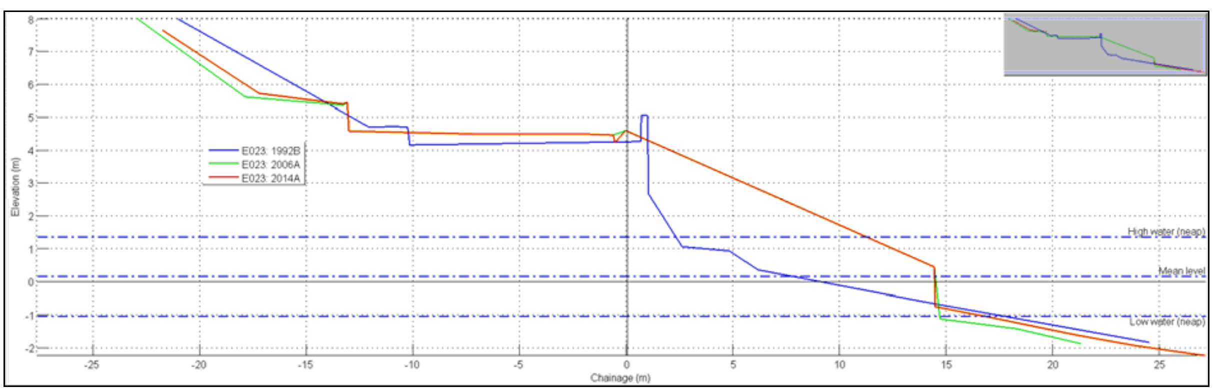


Stable at MHWN due to hard sea defence. MSL and MLWN show a slight accretion trend from 1996 to around 2001 and then show a very slight erosional trend. Very slightly steepening profile. New sea defence built in 2007. From 2003 profile frequently erodes back to sea defence at MSL.

E023 (E1A3) – Clacton-on-Sea. *Defence type: recurved sea wall, revetment and rock armour.*

Erosion Rates (metres/year)			
MHWN	MSL	MLWN	Mean
0.22	0.22	0.14	0.19

MLWN chainage (metres)		
1992	2006	2014
18	15 (sea defence)	17

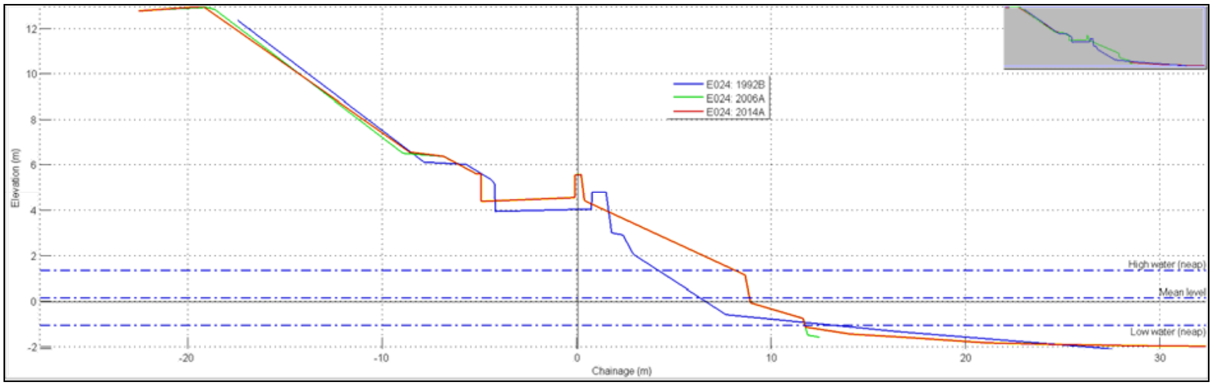


Rock armour placed along sea wall circa 1993/1994. Accretional trend in this period is due to rock armour placement and hence no movement after this period at MHWN and MSL. Highly variable at MLWN but this is due to presence of rock armour. Profile frequently erodes to rock armour at MLWN.

E024 (E1A4) – Clacton-on-Sea. *Defence type: recurved concrete sea wall, concrete revetment and toe piling.*

Erosion Rates (metres/year)			
MHWN	MSL	MLWN	Mean
0.18	0.11	-0.15	0.05

MLWN chainage (metres)		
1992	2006	2014
13	12	12

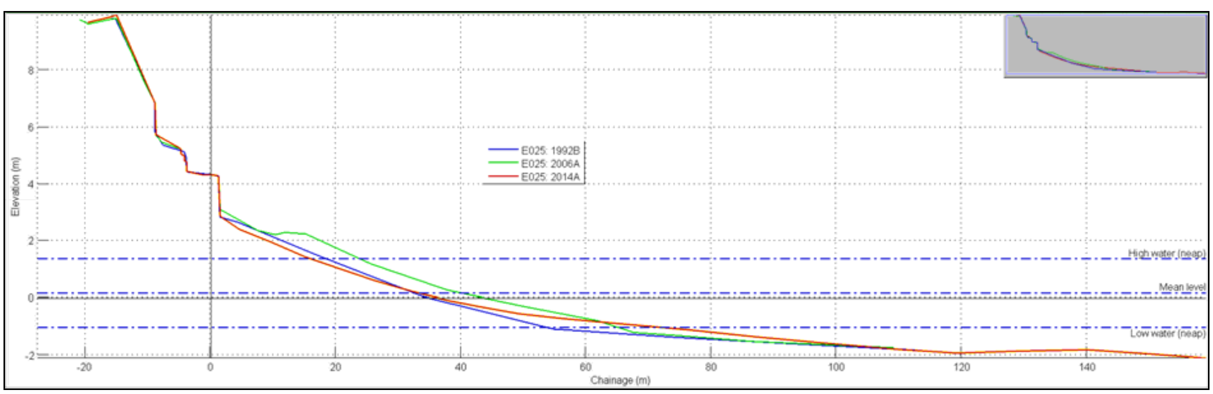


Groynes removed and toe piling put in between 1992 and 1997. Sea defence is present at MHWN, MSL and MLWN (from 1999) – hence no Trends at these levels. Below MLWN profile is very variable.

E025 (E1A5) – South Clacton, Martello Tower. *Defence type: concrete sea wall.*

Erosion Rates (metres/year)			
MHWS	MSL	MLWN	Mean
0.15	0.33	0.80	0.43

MLWN chainage (metres)		
1992	2006	2014
54	65	72

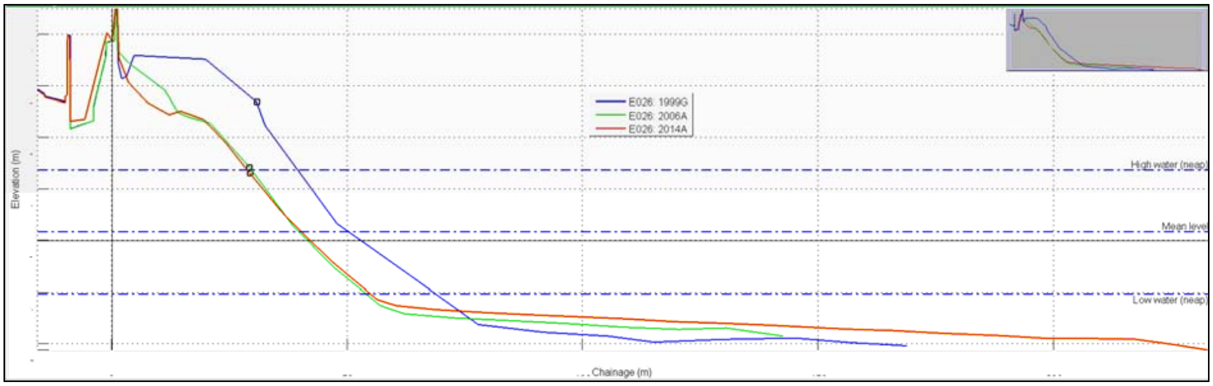


Accretion trend at all levels. Most significant accretion is at MLWN. Slightly flattening profile.

E026 (E1A6) – West Clacton to Jaywick, Burnham Court. *Defence type: recurved concrete wall, concrete revetment and beach recharge.*

Erosion Rates (metres/year)			
MHWS (1999)	MSL	MLWN	Mean
-0.52	-0.47	-0.80	-0.60

MLWN chainage (metres)		
1999	2006	2014
65	54	55

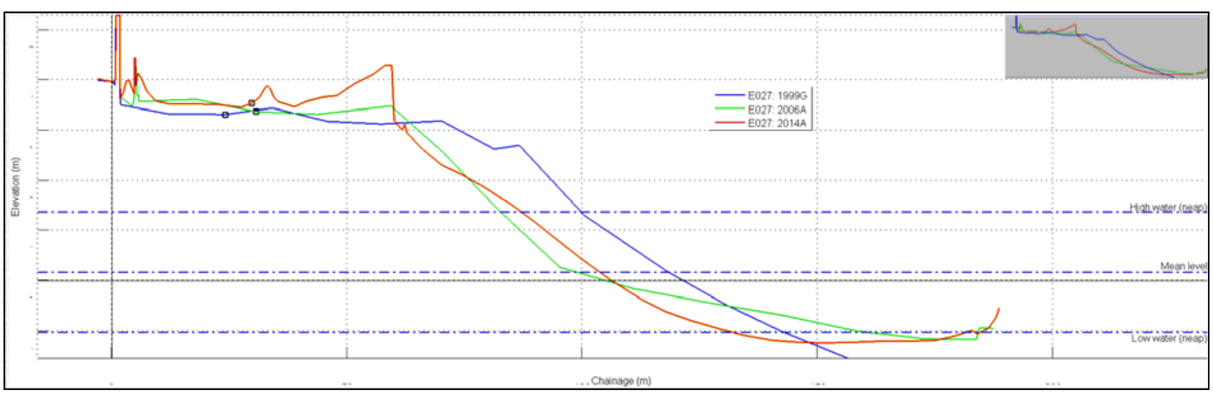


Trends for this profile have been calculated from 1999 when an additional fishtail breakwater, a shore parallel breakwater and arm extensions to an existing fishtail breakwater were constructed. These additions, along with beach recharge, took place as part of the West Clacton to Jaywick Sea Defences. This was in addition to the original scheme of 1986 to 1988 when four fishtail breakwaters were constructed together with beach recharge. Pre-1999 trends showed significant erosion trend. Post 1999 trends show a different pattern with slight erosion trend for 3 years, stabilising around 2003 and have remained relatively stable ever since. From around 2006 profile accretes in winter and erodes in summer. Profile shows flattening.

E027 (E1A7) – West Clacton to Jaywick, The Close. *Defence type: recurved concrete sea wall, concrete revetment, fishtail groyne and beach recharge.*

Erosion Rates (metres/year)			
MHWS (1999)	MSL	MLWN	Mean
-0.93	-1.20	0.15	-0.66

MLWN chainage (metres)		
1992	2006	2014
143	184 (rock groyne)	184 (rock groyne)

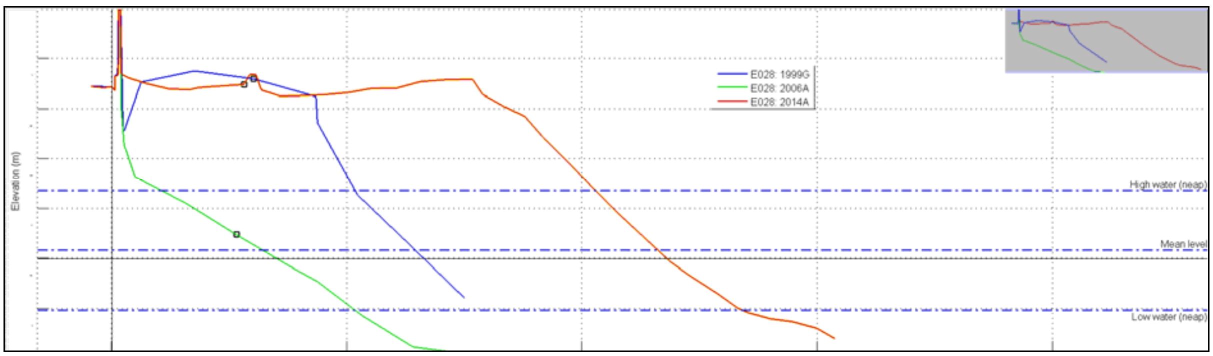


Trends for this profile have been calculated from 1999 when an additional fishtail breakwater, a shore parallel breakwater and arm extensions to an existing fishtail breakwater were constructed. These additions, along with beach recharge, took place as part of the West Clacton to Jaywick Sea Defences. This was in addition to the original scheme of 1986 to 1988 when four fishtail breakwaters were constructed together with beach recharge. Pre-1999 trends showed significant erosion trend at all levels. Post 1999 trends show relative stability up to 2002, significant erosion in 2002/2003 then remaining stable ever since. Profile shows slight flattening.

E028 (E1A8) – West Clacton to Jaywick, Lion Point. *Defence type: recurved sea wall, blockwork revetment, rock groynes (shore parallel) and beach recharge.*

Erosion Rates (metres/year)			
MHWS (1999)	MSL	MLWN	Mean
7.19	6.24	6.46	6.63

MLWN chainage (metres)		
1992	2006	2014
51	52	134



Trends for this profile have been calculated from 1999 when an additional fishtail breakwater, a shore parallel breakwater and arm extensions to an existing fishtail breakwater were constructed. These additions, along with beach recharge, took place as part of the West Clacton to Jaywick Sea Defences. This was in addition to the original scheme of 1986 to 1988 when four fishtail breakwaters were constructed together with beach recharge. Pre-1999 trends showed significant erosion trend. Post 1999 trends show a similar story with significant erosion event in 1999/2000 followed by steady erosion until the end of 2008 when an additional shore-parallel rock groyne was constructed on the line of the profile. Since 2009 the profile has remained stable.

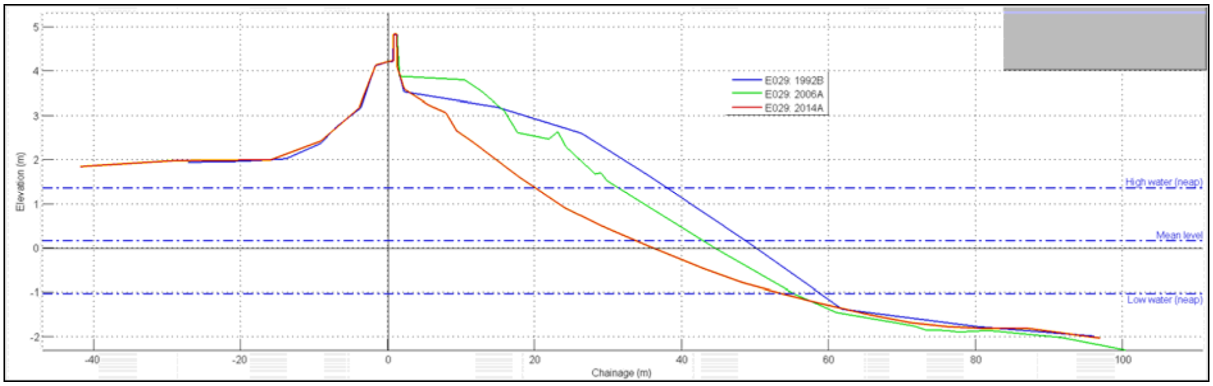
Before Breakwater construction

After Breakwater construction

E029 (E1A9) – Seawick, Hutley's Caravan Park. *Defence type: recurved sea wall and concrete revetment.*

Erosion Rates (metres/year)			
MHWS	MSL	MLWN	Mean
-0.88	-0.80	-0.55	-0.74

MLWN chainage (metres)		
1992	2006	2014
59	55	54



Prior to 1998 there was an erosion trend at all levels. In 1998 new defences were added at Seawick consisting of a series of shore normal rock groynes to replace the old groyne system, which has stabilised the beach to the east of this profile. In addition there was reinforcement of a shore parallel rock groyne (Hutley's platform) adjacent to this profile together with beach recharge. However, the beach has continued eroding since 1998 but shows slight flattening. Beach tends to erode in summer and accrete in winter.

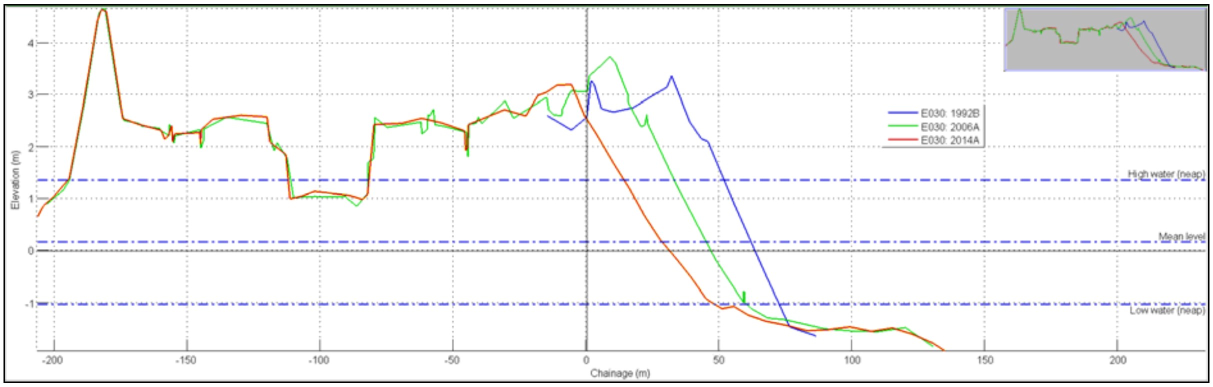
Before groyne construction

After groyne construction

E030 (E1A10) – Seawick, St Osyth Beach. *Defence type: clay tidal sea wall and block revetment.*

Erosion Rates (metres/year)			
MHWS	MSL	MLWN	Mean
-1.57	-1.50	-0.77	-1.28

MLWN chainage (metres)		
1992	2006	2014
72	60	48

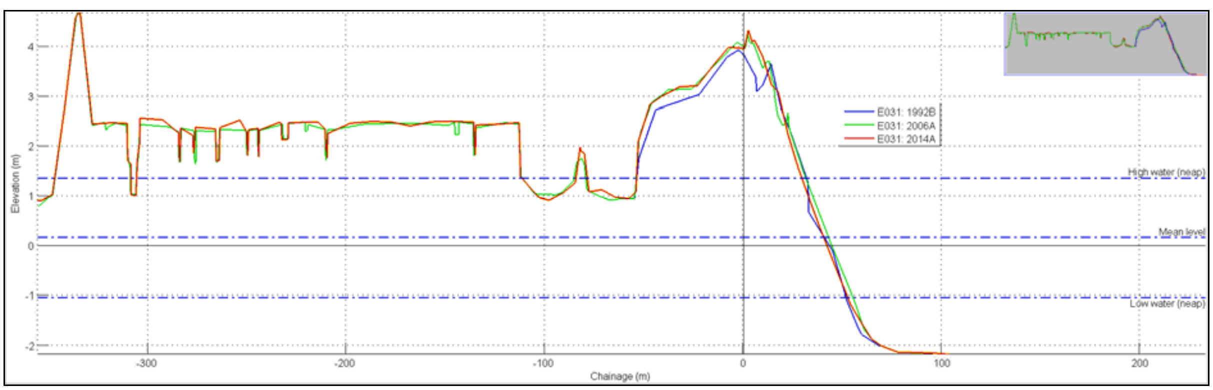


Erosion trend at all levels but larger at MHWN and MSL. Significant erosion event in 1996. Smaller erosion trend at MLWN to give flattening profile.

E031 (E1A11) – Lee-over-Sands. *Defence type: clay tidal sea wall and block revetment.*

Erosion Rates (metres/year)			
MHWS	MSL	MLWS	Mean
0.01	-0.01	0.15	0.05

MLWN chainage (metres)		
1992	2006	2014
52	55	53

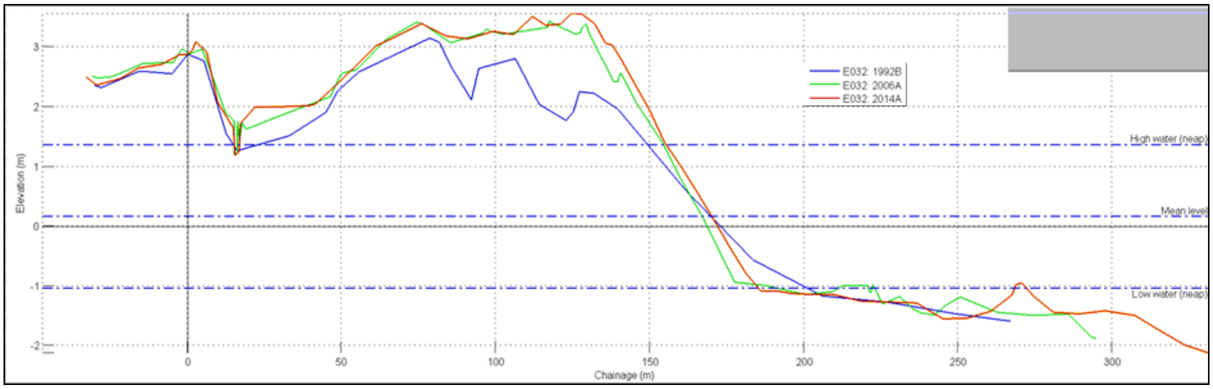


Profile has remained stable with only seasonal variations. Profile appears to flatten in winter and steepen in summer.

E032 (E1A12) – Colne Point. *Defence type: none.*

Erosion Rates (metres/year)			
MHWS	MSL	MLWN	Mean
1.28	0.40	1.93	1.20

MLWN chainage (metres)		
1992	2006	2014
201	223	272



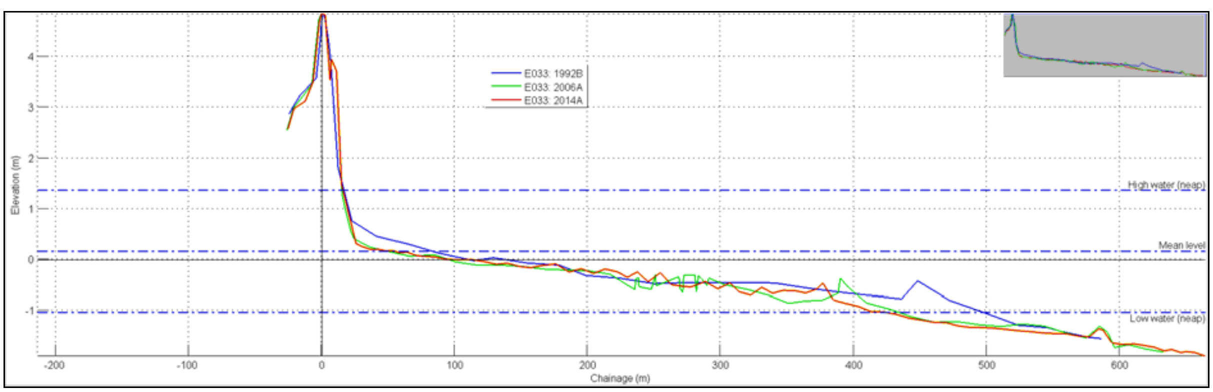
Strong accretional trends at all levels particularly at MLWN to give flattening profile. Profile appears to go through periods of erosion followed by periods of accretion. Notably significant accretion and erosion in 1998, and large accretion in 2004.

2.3.3 Mersea Island

E033 (E2A1) – Cudmore Grove Country Park. *Defence type: clay embankment and block revetment.*

Erosion Rates (metres/year)			
MHWS	MSL	MLWN	Mean
0.15	-1.42	-3.29	-1.52

MLWN chainage (metres)		
1992	2006	2014
499	436	428



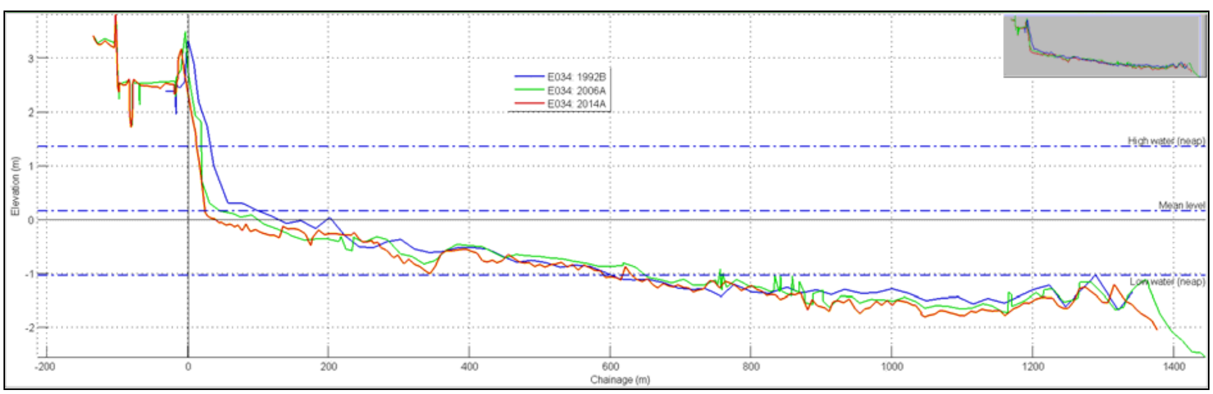
No movement at MHWS due to sea defence. Erosion trend at MSL may be misleading as profile erodes to sea defence at MSL on several occasions from 2001 onwards. Strong erosion trend at MLWN. Profile is steepening slightly. Immediately west of this profile are the remains of a polder site in front of the cliffs (see below) and immediately north, a spit which protrudes into the Colne estuary. Between 1992 and 2013 the base of the spit has accreted north of the profile by c40m, erosion mid-way c25m and a width accretion at the end of the spit by c17m. Immediately adjacent to the northeast of the profile a headland has established between 1992 - 2013 (see below) extending c120m and an extended width of c40m.

Accretion immediately north of E033 (E2A1) and at distal end of spit with erosion midway along spit from 1992 - 2013

E034 (E2A2) – Fen Farm Caravan Park. *Defence type: none*

Erosion Rates (metres/year)			
MHWS	MSL	MLWN	Mean
-0.51	-4.75	-0.18	-1.81

MLWN chainage (metres)		
1992	2006	2014
600	628	631

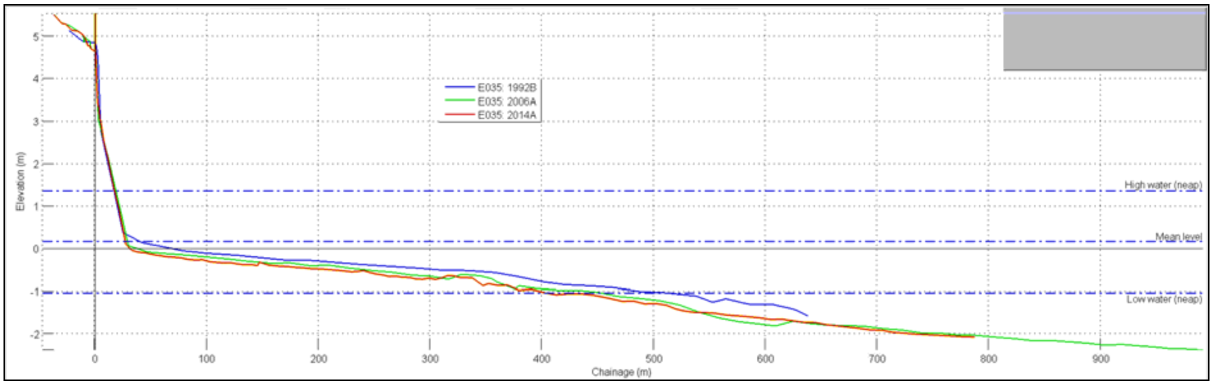


Erosion trend at MHWS. Significant erosion trend at MSL and small erosion trend at MLWN. MLWN appears to be relatively stable compared to the upper beach – may be due to a shallow sloping profile at MLWN which gives a very variable MLWN chainage. Steepening profile.

E035 (E2A3) – Hall Farm Caravan Park. *Defence type: concrete block wall and revetment.*

Erosion Rates (metres/year)			
MHWS	MSL	MLWN	Mean
0.04	-0.66	-4.09	-1.57

MLWN chainage (metres)		
1992	2006	2014
519	456	435

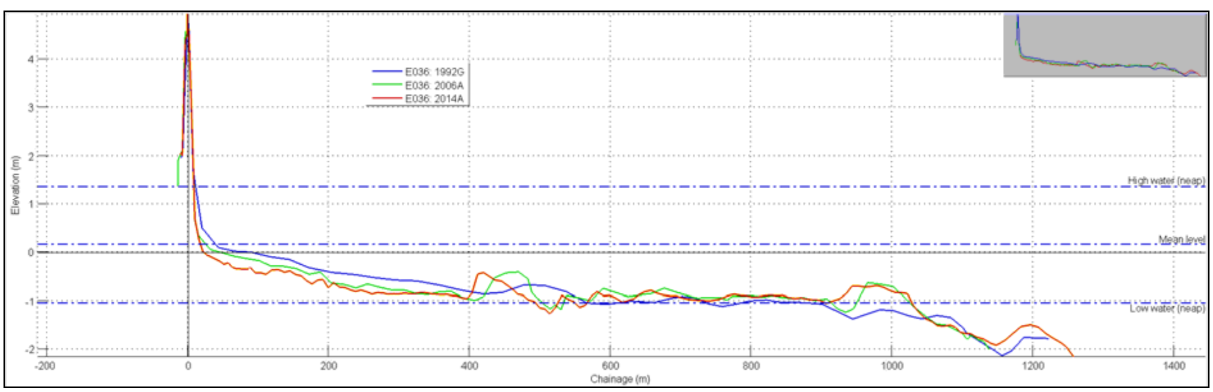


Little movement at MHWN. Steady erosion at MSL and severe at MLWN. Slightly steepening profile. Clay embankment with revetment has been extended alongshore in front of the caravan park since 1997.

E036 (E2A4) – Youth Camp. *Defence type: clay embankment with and concrete revetment.*

Erosion Rates (metres/year)			
MHWS	MSL	MLWN	Mean
-0.04	-0.69	1.75	0.34

MLWN chainage (metres)		
1993	2006	2014
553	1025	1028

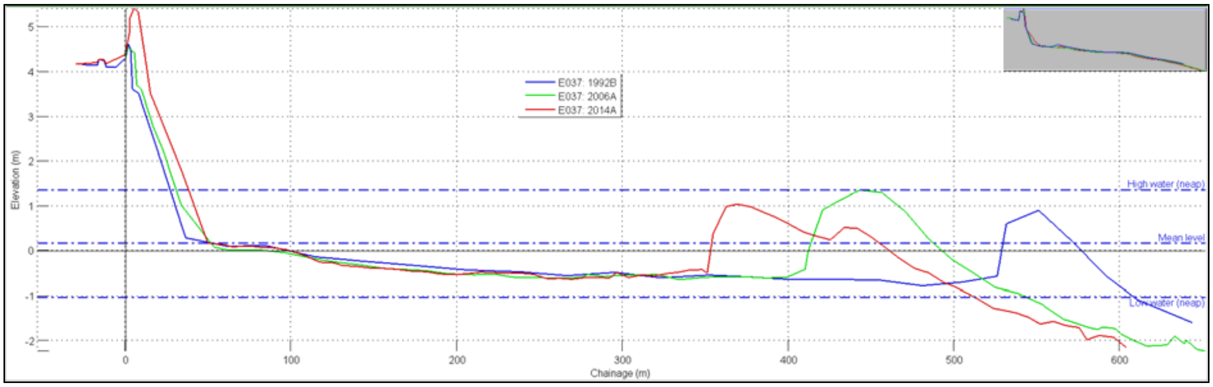


No movement at MHWS due to sea defence. Little movement at MHWN. Moderate erosion trend at MSL. Accretion trend at MLWN – may be misleading as the MLWN chainage is very variable, which may distort the data.

E037 (E2A5) – Waldegraves Farm. *Defence type: clay embankment with revetment*

Erosion Rates (metres/year)			
MHWS	MSL	MLWN	Mean
0.44	-5.66	-4.20	-3.14

MLWN chainage (metres)		
1992	2006	2014
609	544	513

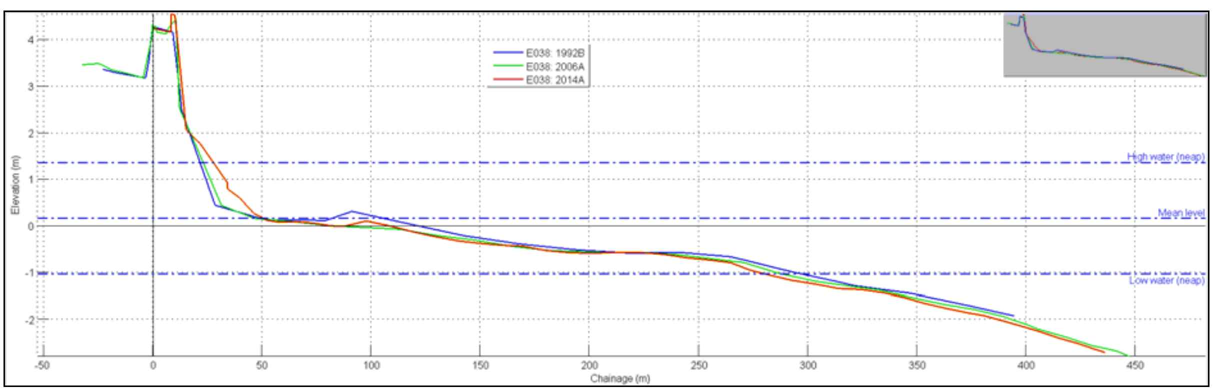


Accretion trend at MHWS. Significant erosion trends at MSL and MLWN. The gravel and sand bar which was at approximate chainage 550m in the early 1990s has since rolled back approximately 200m.

E038 (E2A6) – West Mersea, Sewage Works. *Defence type: revetment*

Erosion Rates (metres/year)			
MHWS	MSL	MLWN	Mean
0.11	-2.19	-0.47	-0.85

MLWN chainage (metres)		
1992	2006	2014
299	290	282

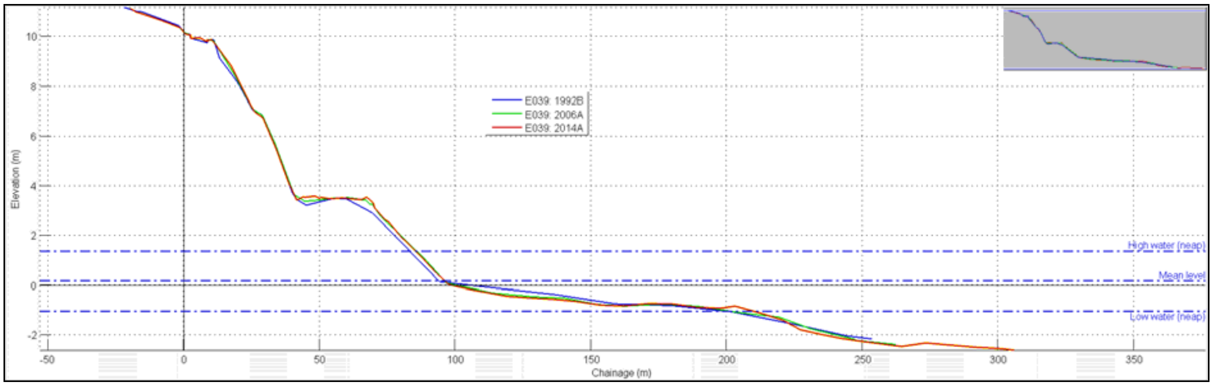


No movement at MHWN. Moderate erosion trend at MSL. Minimal erosion trend at MLWN.

E039 (E2A7) – West Mersea. *Defence type: none*

Erosion Rates (metres/year)			
MHWS	MSL	MLWS	Mean
0.26	-0.02	-0.33	-0.03

MLWN chainage (metres)		
1992	2006	2014
201	202	210

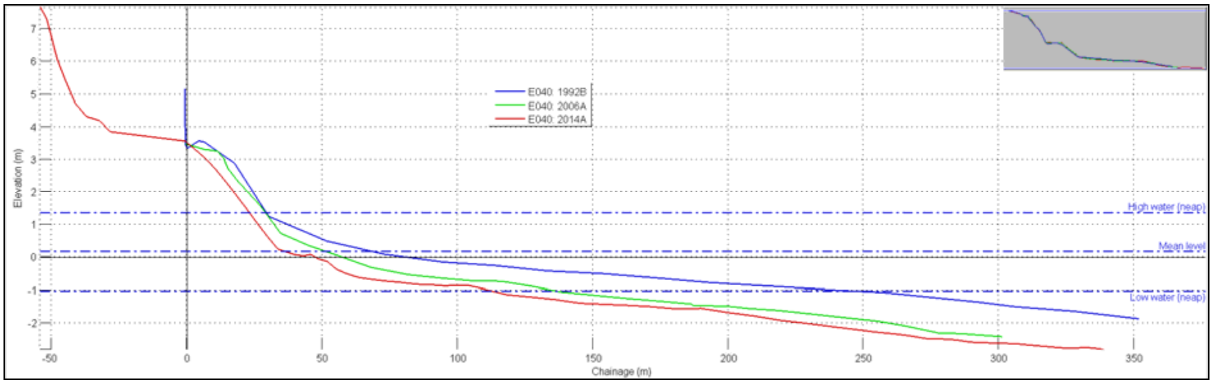


Accretion trend at MHWS. Stable at MSL. Small erosion trend at MLWS. Slight steepening of profile.

E040 (E2A8) – West Mersea, King's Hard. *Defence type: none*

Erosion Rates (metres/year)			
MHWS	MSL	MLWN	Mean
-0.22	-1.02	-6.35	-2.53

MLWN chainage (metres)		
1992	2006	2014
252	138	114



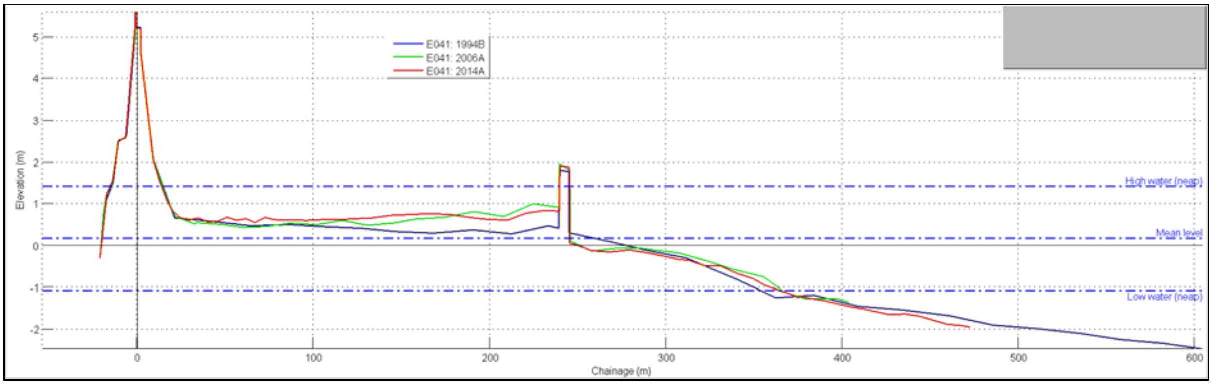
Erosion trend at all levels. Small erosion trend at MHWS. Moderate erosion at MSL. Significant erosion at MLWN. Steepening of beach. Erosion jump in 2003.

2.3.4 Dengie Flat (Bradwell Peninsular to Ray Sand)

E041 (E2A15) – Sales Point. *Defence type: clay seawall, block revetment and lighter barge.*

Erosion Rates (metres/year)			
MHWS	MSL	MLWN	Mean
0.00	-0.22	0.18	-0.01

MLWN chainage (metres)		
1994	2006	2014
353	366	364



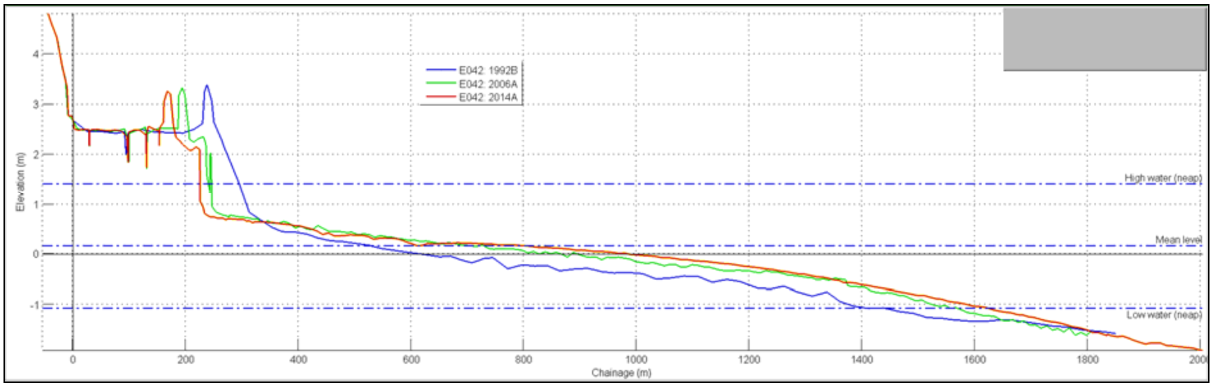
Lighter barges (see photo below) placed on profile in late 1980s at 240m chainage. There has been a steady build up of mud landward side of the lighter barges since their installation. No movement at MHWS due to sea defence. No movement at MHWN due to lighter barge. Slight erosion trend at MSL but is adjacent lighter barge. Slight accretion at MLWN. No rotatio

Lighter barges with embankment in the foreground

E042 (E3E1) – Othona Roman Fort. *Defence type: grassed embankment.*

Erosion Rates (metres/year)			
MHWS	MSL	MLWN	Mean
-3.58	9.42	6.97	4.27

MLWN chainage (metres)		
1992	2006	2014
1436	1567	1622

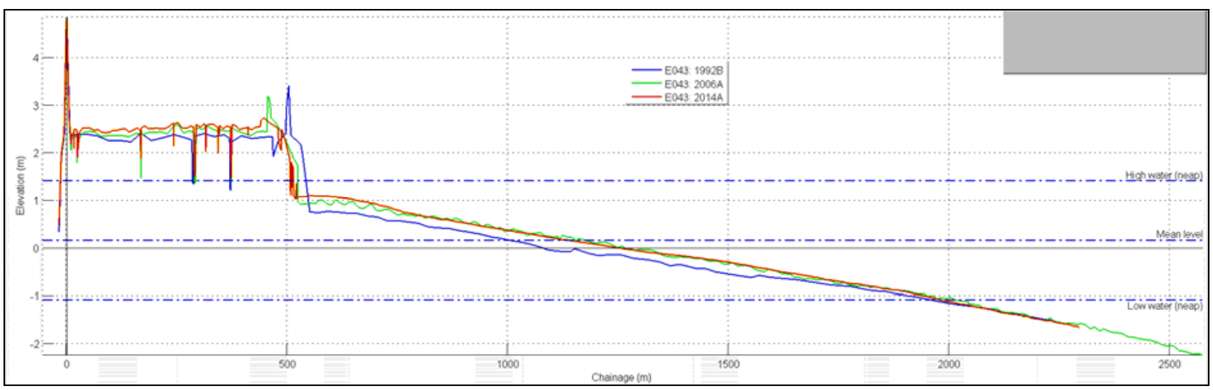


Strong erosion trend at MHWS and MHWN. Significant accretion trends at MSL and MLWN. There is saltmarsh and mudflats on seaward side of embankment and saltmarsh extent has receded by c75m since 1992 as the embankment has rolled back. Large erosion in winter 2009/2010 followed by large accretion in summer 2010. Flattening profile.

E043 (E3E2) – Dengie Flat, Gunners Creek. *Defence type: clay sea wall, block revetment and timber wave break.*

Erosion Rates (metres/year)			
MHWS	MSL	MLWN	Mean
-0.29	5.62	1.42	2.25

MLWN chainage (metres)		
1992	2006	2014
1956	2012	1980

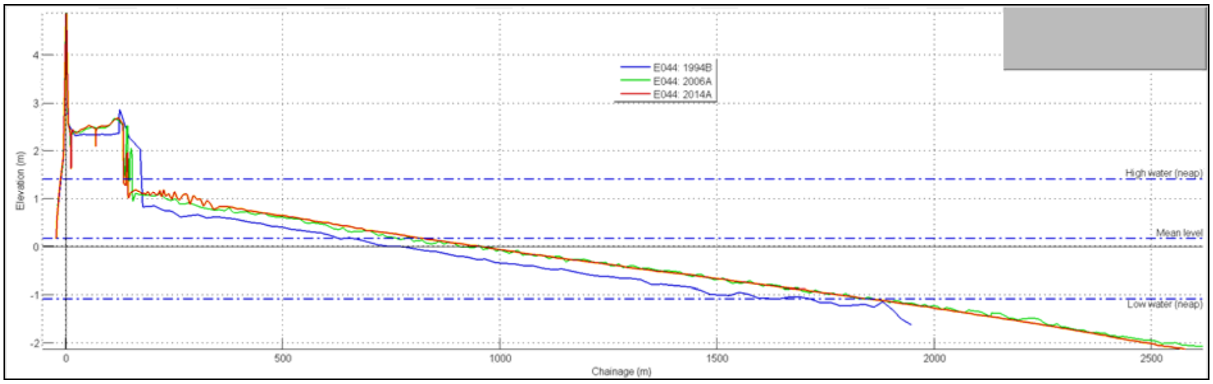


Slight erosion trend at MHWS at edge of saltmarsh. Slight erosion at MHWN. Significant accretion trend at MSL and to a lesser extent at MLWN. The saltmarsh extent has receded by c45m since 1992. Slightly flattening profile.

E044 (E3E3) – Dengie Flat, Glebe Outfall. *Defence type: clay sea wall, block revetment and concrete wave break.*

Erosion Rates (metres/year)			
MHWN	MSL	MLWN	Mean
-1.46	9.34	4.85	4.25

MLWN chainage (metres)		
1994	2006	2014
1710	1856	1839

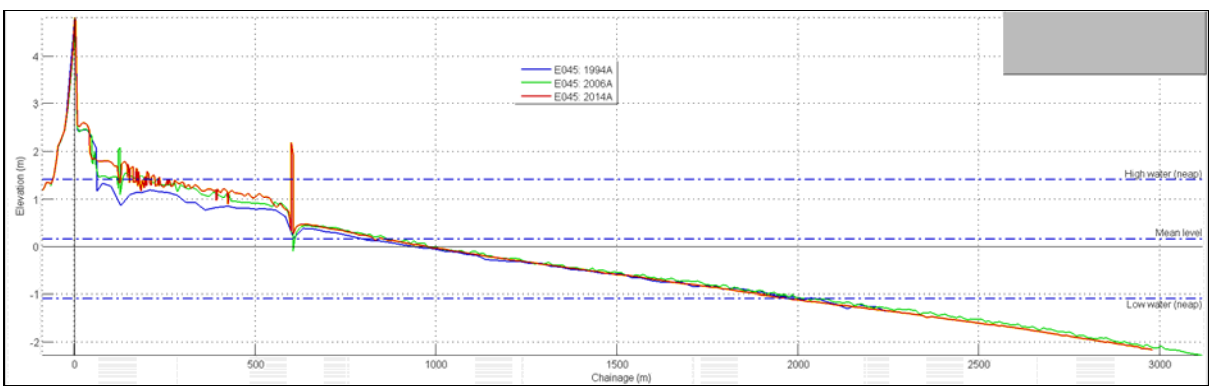


Erosion trend at MHWS but relatively stable after 2000. Steady erosion trend at MHWN. Significant accretion trend at MSL and MLWN. Slight flattening of profile.

E045 (E3E4) – Dengie Flat, Sandbeach Outfall. *Defence type: clay seawall, block revetment, lighter barge, and timber wave break*.

Erosion Rates (metres/year)			
MHWS	MSL	MLWN	Mean
0.29	2.63	-1.90	0.34

MLWN chainage (metres)		
1994	2006	2014
2041	2023	1968

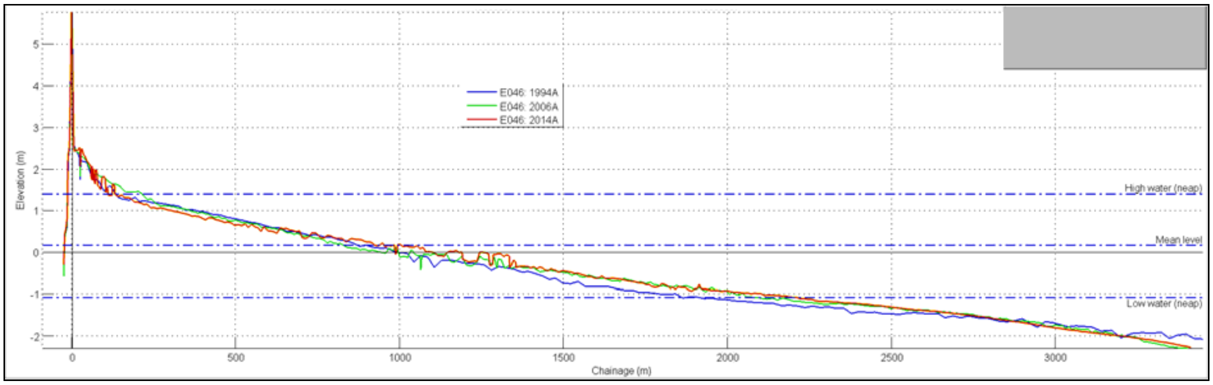


Lighter barge placed on profile in early to mid 1980s at approximately 600m chainage. Slight accretion trend of saltmarsh at MHWS – mainly due to lighter barge at MHWN. No movement at MHWN due to lighter barge. Significant accretion trend at MSL but profile is very erratic. Moderate erosion trend at MLWN but profile is very erratic. Almost negligible steepening of profile.

E046 (E3E5) – Dengie Flat, Marshhouse Outfall. *Defence type: clay sea wall and block revetment.*

Erosion Rates (metres/year)			
MHWN	MSL	MLWN	Mean
0.51	6.90	8.61	5.34

MLWN chainage (metres)		
1994	2006	2014
1913	2094	2210

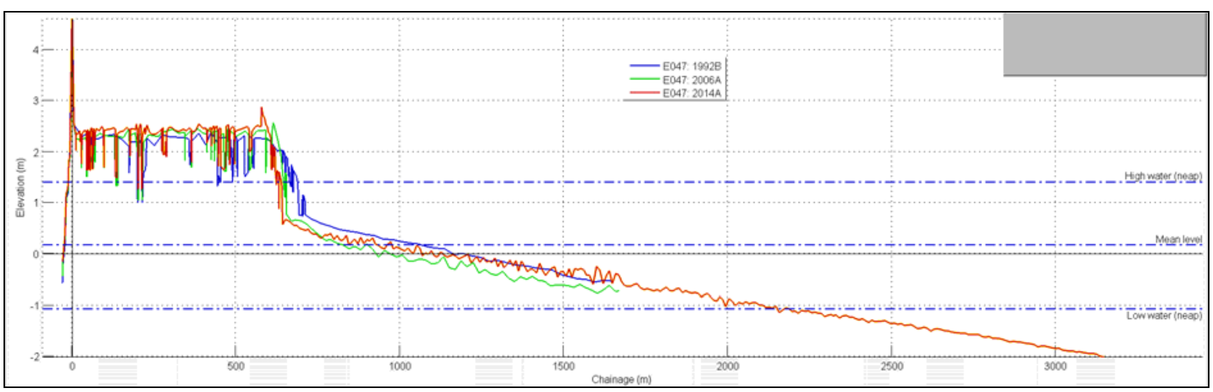


No movement at MHWS due to sea defence. Slight accretion trend at MHWN. Significant accretion at MSL but profile is very erratic. Significant accretion trend at MLWN. Very slightly flattening profile but varies considerably due to erratic nature of profile.

E047 (E3E6) – Dengie Flat, Howe Outfall. *Defence type: clay sea wall, block revetment and concrete wave break.*

Erosion Rates (metres/year)			
MHWN	MSL	MLWN	Mean
-1.90	3.25	14.49	5.28

MLWN chainage (metres)		
1992	2006	2014
1066	814	2186

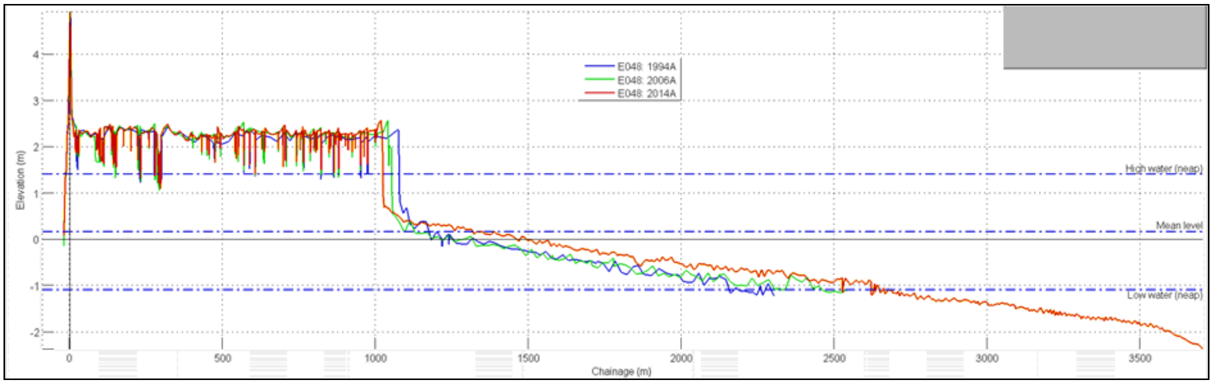


Saltmarsh at MHWS and has retreated by c75m since 1992. Moderate erosion trend at MHWN. Significant accretion trend a MSL. Very significant accretion trend at MLWN, however data only regularly available after 2007. Profile shows very slight flattening.

E048 (E3D1) – Ray Sand, Grange Outfall. *Defence type: earth embankment and concrete revetment*.

Erosion Rates (metres/year)			
MHWN	MSL	MLWN	Mean
-2.77	9.16	10.29	5.56

MLWN chainage (metres)		
1994	2006	2014
2290	2457	2675

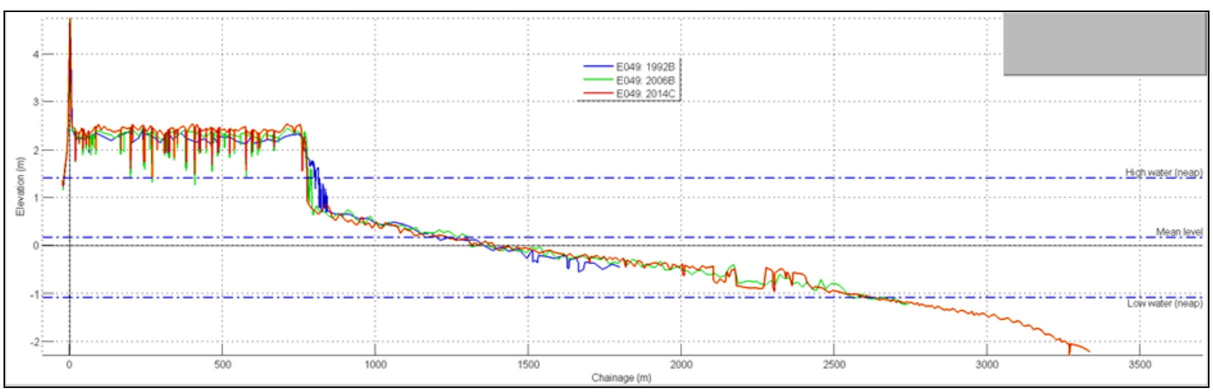


Erosion at MHWS, saltmarsh has retreated c50m since 1992. Erosion trend at MHWN. Significant accretion trends at MSL and MLWN but both are erratic. Flattening profile.

E049 (E3D2) – Ray Sand, Round Barn. *Defence type: earth embankment and concrete revetment.*

Erosion Rates (metres/year)			
MHWN	MSL	MLWN	Mean
-1.75	0.62	9.34	2.74

MLWN chainage (metres)		
1995	2006	2014
1164	2657	2633

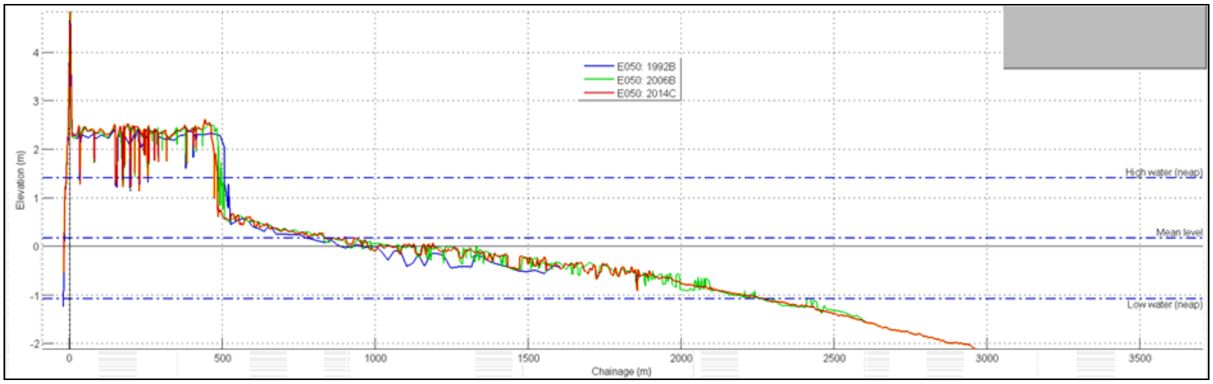


Saltmarsh at MHWS. Moderate erosion trend at MHWN. Slight accretion trend at MSL. Significant accretion trend at MLWN, however, survey only reaches MLWN from 2003 onwards.

E050 (E3D3) – Ray Sand, Bridgewick Outfall. *Defence type: clay sea wall, block revetment and timber wave break.*

Erosion Rates (metres/year)			
MHWN	MSL	MLWN	Mean
-1.31	8.36	14.13	7.06

MLWN chainage (metres)		
1992-2003	2006	2014
Not surveyed to MLWN	2419	2268

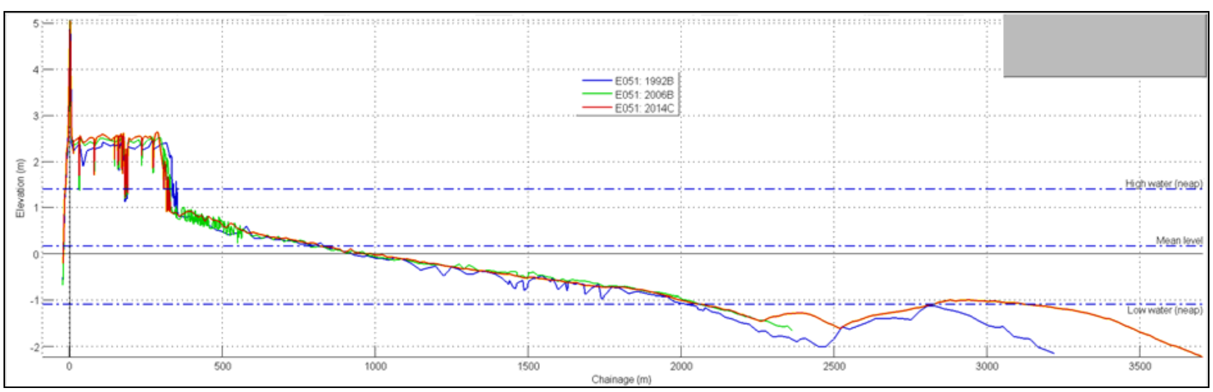


Saltmarsh at MHWS. Moderate erosion trend at MHWN. Significant accretion trends at MSL and MLWN. Very slightly flattening profile.

E051 (E3D4) – Ray Sand, Coate Outfall. *Defence type: clay sea wall, block revetment, timber wave break and old polder site.*

Erosion Rates (metres/year)			
MHWN	MSL	MLWN	Mean
-0.99	1.17	20.99	7.06

MLWN chainage (metres)		
1992	2006	2014
2009	2054	3113

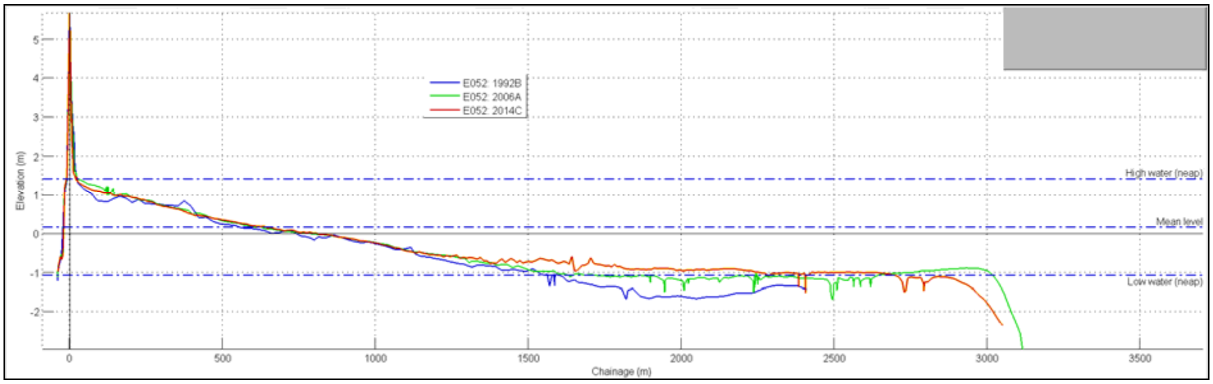


Saltmarsh at MHWS. Slight erosion trend at MHWN. Moderate accretion trend at MSL. Significant accretion trend at MLWN (very mobile at MLWN, which may distort the trend). Profile shows very slight flattening.

E052 (E3D5) – Ray Sand, Shell Bank. *Defence type: clay sea wall, block revetment and old polder site.*

Erosion Rates (metres/year)			
MHWN	MSL	MLWN	Mean
-4.64	-0.15	65.59	20.27

MLWN chainage (metres)		
1992	2006	2014
1617	3025	2889

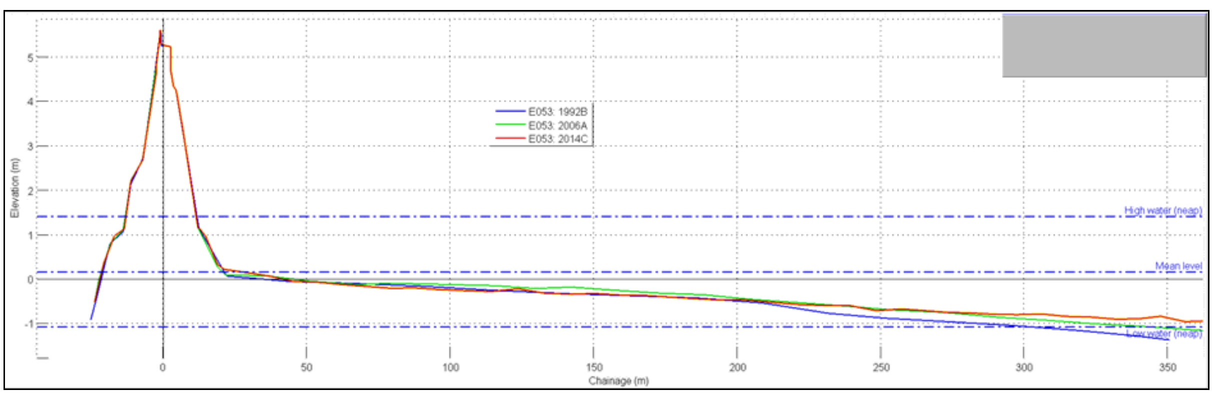


Significant erosion trend at MHWN. Dramatic erosion trend at MLWN. However, profile is very erattic at MHWN and MLWN and therefore trends at these levels may be unreliable. There is a slight erosion trend at MSL. Profile shows slight flattening.

E053 (E3D6) – Ray Sand, Holliwell Point. *Defence type: clay sea wall and block revetment.*

Erosion Rates (metres/year)			
MHWN	MSL	MLWN	Mean
-0.01	0.40	15.51	5.30

MLWN chainage (metres)		
1992	2006	2014
320	364	659



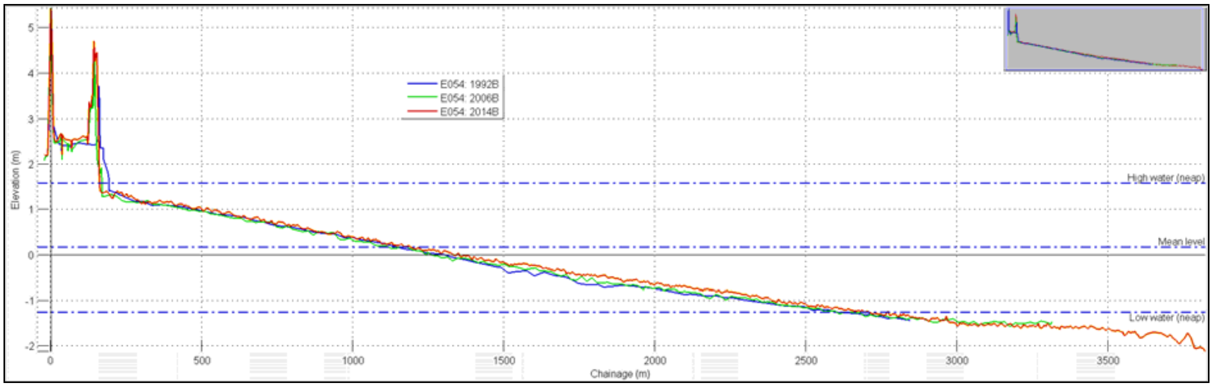
Sea defence and MHWS and MHWN gives no trend. Slight accretion trend at MSL. Significant accretion trend at MLWN with large jump in 2008/2009. Flattening profile.

2.3.5 Maplin Sands (Foulness Point to Havengore Head)

E054 (E3C1) – Foulness Point. *Defence type: earth embankment and concrete revetment.*

Erosion Rates (metres/year)			
MHWN	MSL	MLWN	Mean
-1.57	1.97	0.51	0.30

MLWN chainage (metres)		
1992	2006	2014
2503	2540	2604

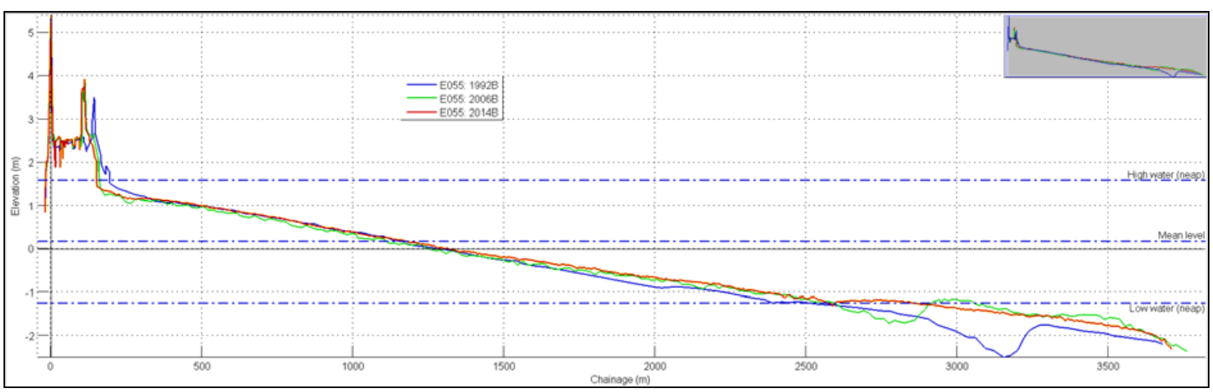


Little movement at MHWS due to sea defence. Moderate erosion trend at MHWN. Moderate accretion trend at MSL. Slight accretion trend at MLWN but profile is very erratic. Flattening profile.

E055 (E3C2) – Foulness Point. *Defence type: earth embankment and concrete revetment.*

Erosion Rates (metres/year)			
MHWS	MSL	MLWN	Mean
-0.73	1.13	12.45	4.28

MLWN chainage (metres)		
1992	2006	2014
2350	2957	2535

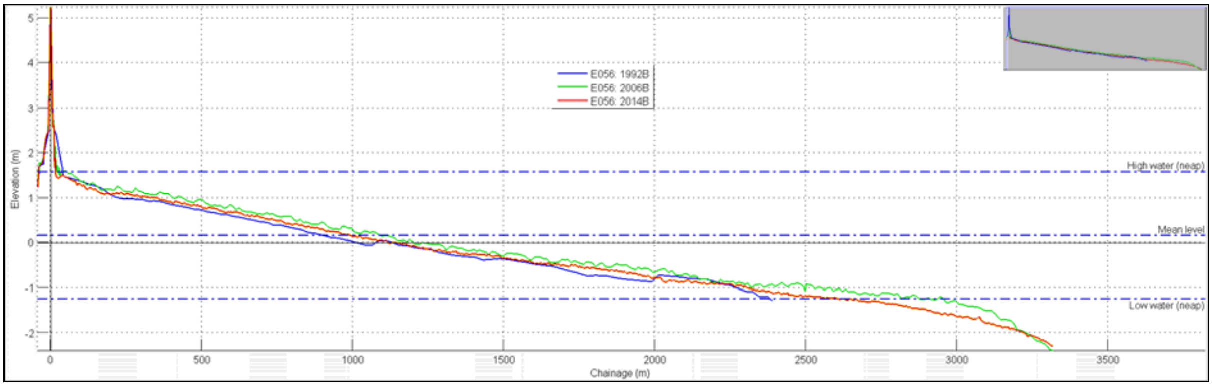


Moderate erosion trend at MHWS – this is mainly due to saltmarsh and secondary sea defence (embankment). Moderate accretion trend at MSL. Very significant accretion trend at MLWN. Profile shows slight flattening.

E056 (E3C3) – Fisherman's Head. *Defence type: earth embankment, concrete revetment and rock armour.*

Erosion Rates (metres/year)			
MHWN	MSL	MLWN	Mean
-0.11	-0.15	-3.54	-1.27

MLWN chainage (metres)		
1992	2006	2014
2336	2804	2448

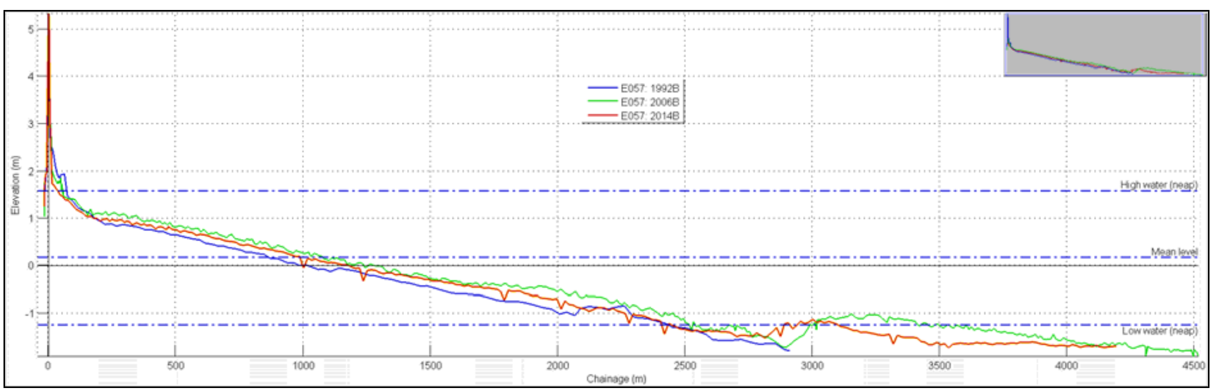


No movement at MHWS and MHWN due to saltmarsh. Little or no movement at MSL. Erosion trend at MLWN although very erratic. No rotation.

E057 (E3C4) – Fisherman's Head. *Defence type: earth embankment, concrete revetment and rock armour.*

Erosion Rates (metres/year)			
MHWN	MSL	MLWN	Mean
-0.95	0.40	17.96	5.80

MLWN chainage (metres)		
1992	2006	2014
2384	3398	3007

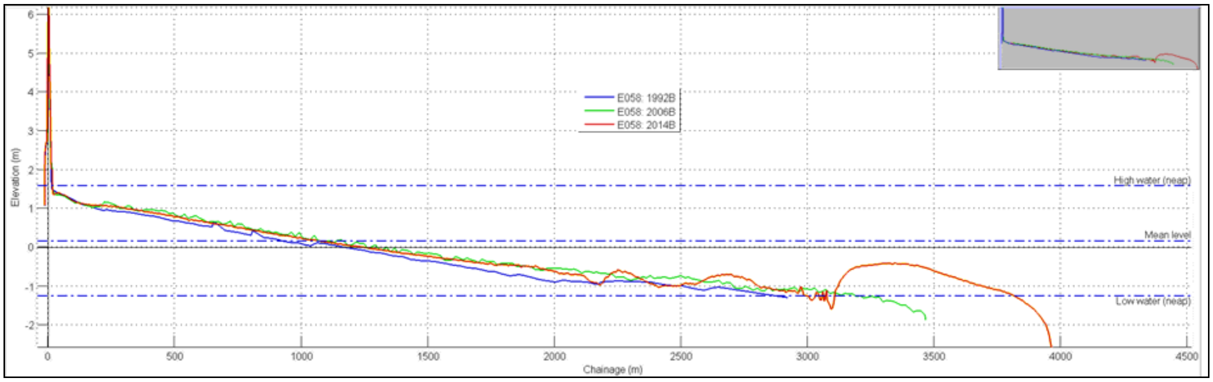


No movement at MHWS due to sea defence. Slight erosion trend at MHWN but mainly saltmarsh, which shows little overall movement so might be some unreliable data. Very significant accretion at MLWN but very erratic and the profiles were often not surveyed far enough to pick up the small bank at approx 3200m chainage, which may distort this trend. Profile shows very slight flattening.

E058 (E3C5) – Eastwick Head. *Defence type: earth embankment, concrete revetment and rock armour.*

Erosion Rates (metres/year)			
MHWN	MSL	MLWN	Mean
0.15	4.96	34.86	13.32

MLWN chainage (metres)		
1992	2006	2014
2781	3080	3779

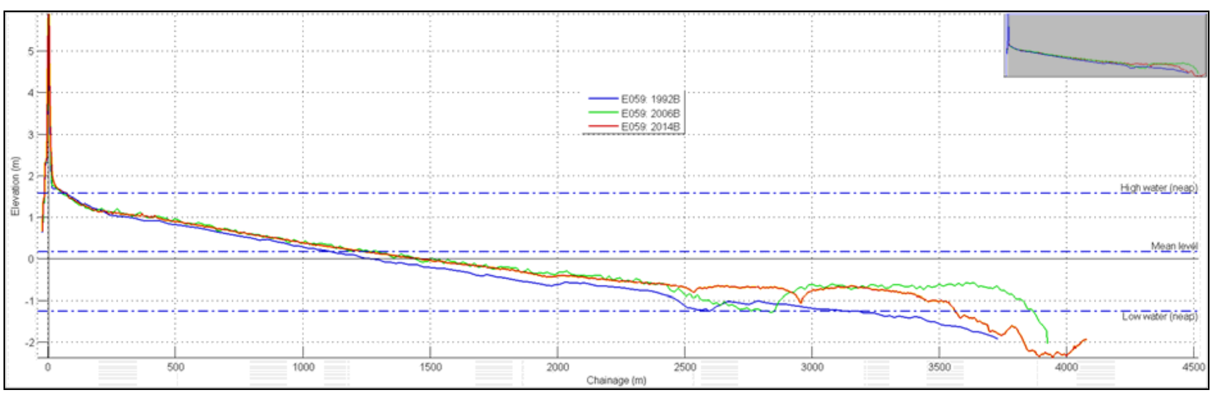


No movement at MHWS due to sea defence. No movement at MHWN due to rock. Significant accretion trend at MSL. Very significant accretion trend at MLWN. Profile shows very slight flattening.

E059 (E3B1) – Rugwood Head. *Defence type: earth embankment, concrete revetment and rock armour.*

Erosion Rates (metres/year)			
MHWN	MSL	MLWN	Mean
0.07	9.96	52.93	20.99

MLWN chainage (metres)		
1992	2006	2014
2971	3839	3550

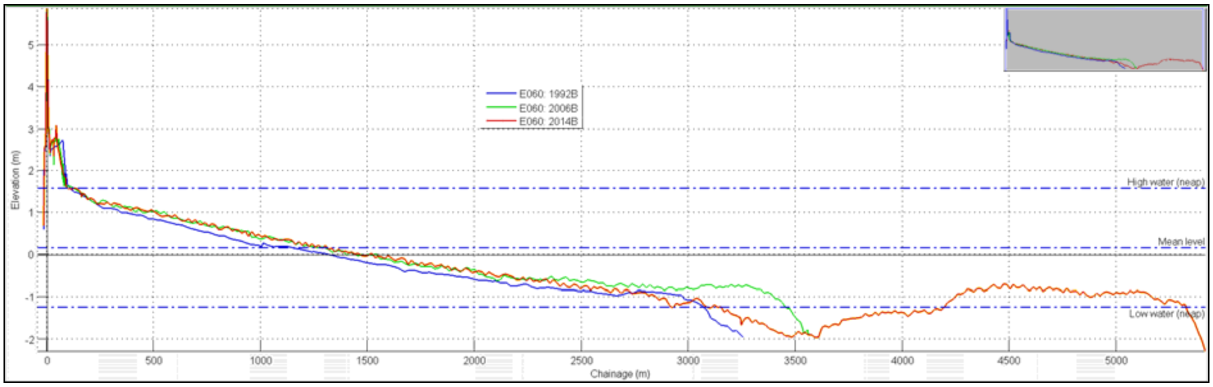


No movement at MHWS due to sea defence. No movement at MHWN. Significant accretion trend at MSL. Very significant accretion at MLWN, very erratic and some profiles stop short of outer bank. Flattening profile.

E060 (E3B2) – Asplin's Head. *Defence type: earth embankment and concrete revetment.*

Erosion Rates (metres/year)			
MHWN	MSL	MLWN	Mean
0.62	8.32	71.47	26.80

MLWN chainage (metres)		
1992	2006	2014
3045	3439	5294

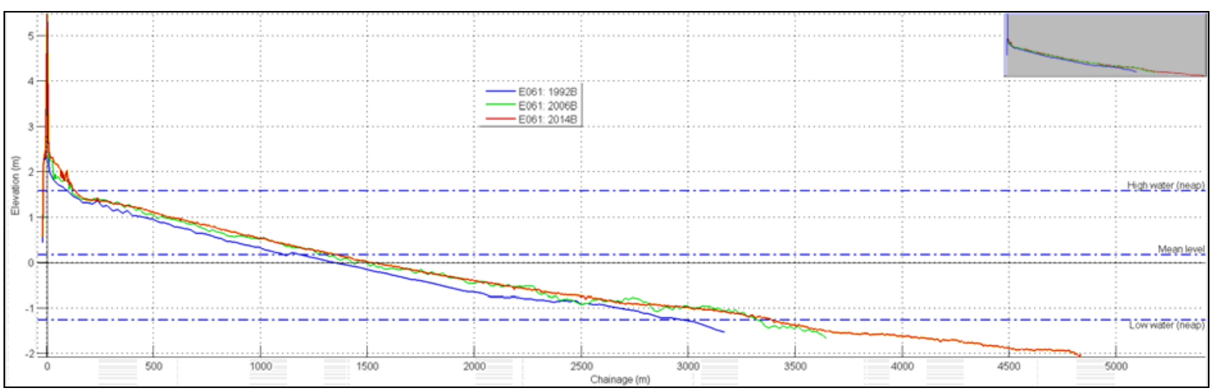


Saltmarsh at MHWS. Moderate accretion trend at MHWN. Significant accretion trend at MSL. Very significant accretion at MLWN – profile is erratic at this level and many profile surveys do not reach MLWN at the seaward side of the outer bank, which may distort the trend. Profile shows no rotation.

E061 (E3B3) – New Burwood Farm. *Defence type: earth embankment and concrete block revetment.*

Erosion Rates (metres/year)			
MHWN	MSL	MLWN	Mean
0.91	6.86	28.07	11.95

MLWN chainage (metres)		
1992	2006	2014
2963	3315	3383

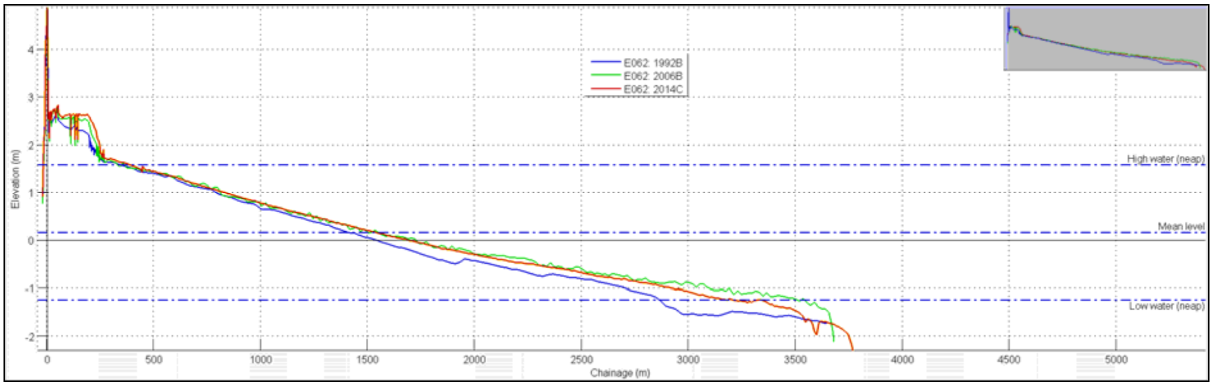


No movement at MHWS due to sea defence. Saltmarsh at MHWN showing accretion trend. Significant accretion at MSL. Very significant accretion trend at MLWN – most profiles surveys don't go as far as the outer bank, which distorts the trend. Profile shows no rotation.

E062 (E3B4) – Sharpsness Head. *Defence type: grassed earth embankment and concrete revetment.*

Erosion Rates (metres/year)			
MHWN	MSL	MLWN	Mean
2.92	6.72	12.41	7.35

MLWN chainage (metres)		
1992	2006	2014
2862	3540	3340

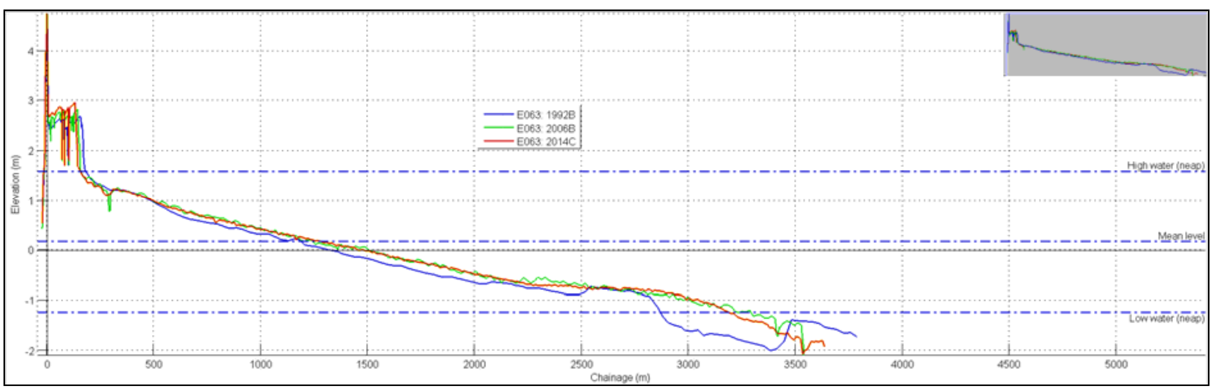


No movement at MHWS due to sea defence. Moderate accretion trend at MHWN. Moderate to strong accretion at MSL. Significant accretion at MLWN. Flattening profile.

E063 (E3B5) – Havengore Head. *Defence type: grassed earth embankment.*

Erosion Rates (metres/year)			
MHWN	MSL	MLWN	Mean
-1.31	7.12	33.73	13.18

MLWN chainage (metres)		
1992	2006	2014
2866	3289	3186



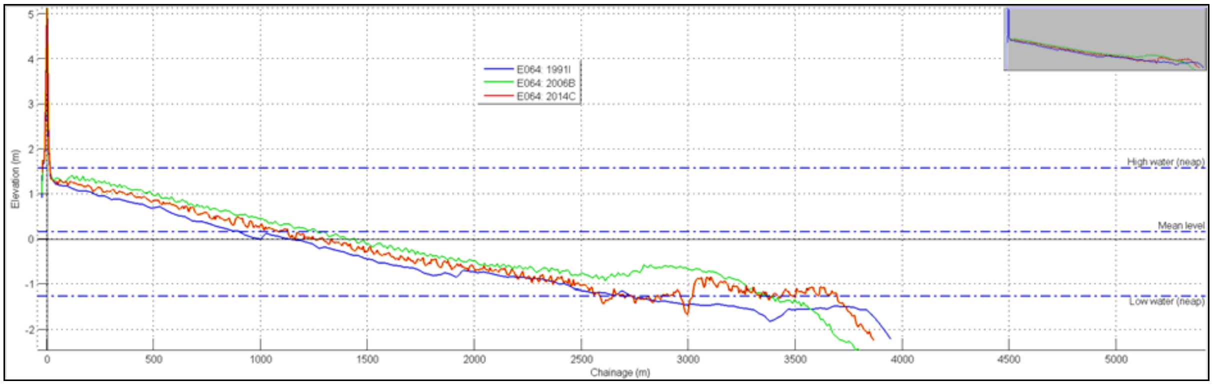
Saltmarsh at MHWS. Slight erosion trend at MHWN. Significant accretion trend at MSL. Very significant accretion trend at MLWN – erratic profile at this level and many profiles are not surveyed far enough to pick up further banks, which may distort the trend. Flattening profile.

2.3.6 Southend-on-Sea (Haven Point to Leigh-on-Sea)

E064 (E3A1) – Haven Point. *Defence type: embankment, block revetment and rock armour.*

Erosion Rates (metres/year)			
MHWN	MSL	MLWN	Mean
0.07	5.33	23.51	9.64

MLWN chainage (metres)		
1995	2006	2014
3300	3376	3691

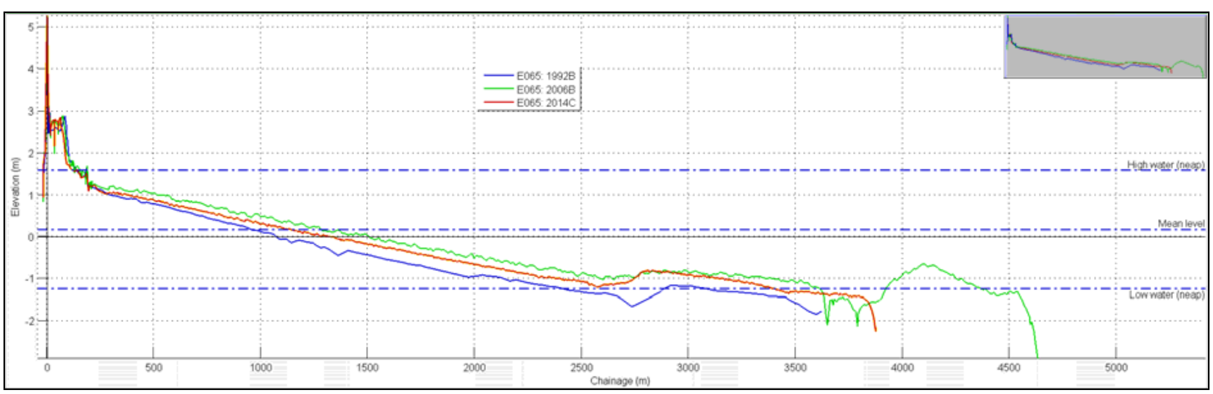


No movement at MHWS due to sea defence. No movement at MHWN due to rock armour. Significant accretion trend at MSL. Very significant accretion at MLWM – erratic profile at this level, which may distort the trend. Slightly flattening profile.

E065 (E3A2) – Shoeburyness New Ranges. *Defence type: embankment and concrete revetment.*

Erosion Rates (metres/year)			
MHWN	MSL	MLWN	Mean
0.55	10.29	54.86	21.90

MLWN chainage (metres)		
1992	2006	2014
3083	4384	3401

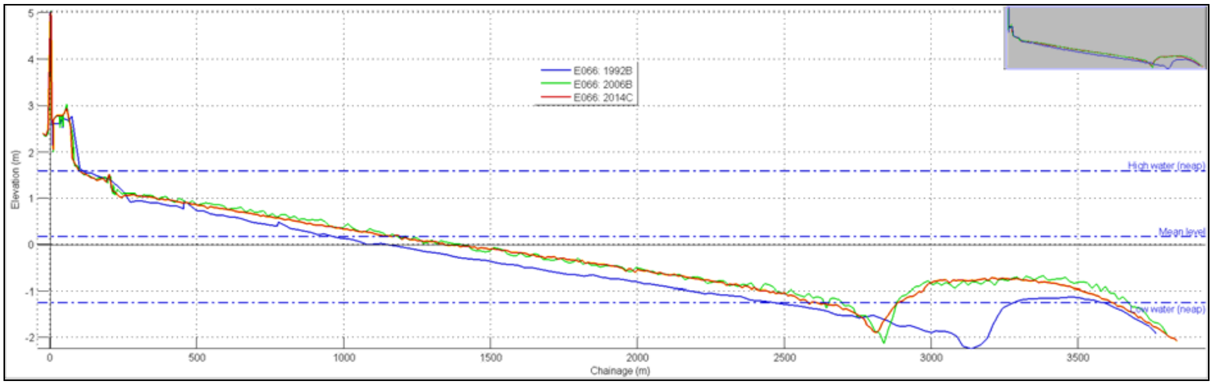


No movement at MHWS due to sea defence. No movement at MHWN due to sea defence. Significant accretion trend at MSL. Very significant accretion at MLWN – erratic profile at this level and many early profile surveys never reached the outer bank at 4500m chainage, which may distort the trend. Flattening profile.

E066 (E3A3) – Poynter's Point. *Defence type: grassed earth embankment.*

Erosion Rates (metres/year)			
MHWN	MSL	MLWN	Mean
-0.44	6.83	2.04	2.81

MLWN chainage (metres)		
1992	2006	2014
3581	3667	3613

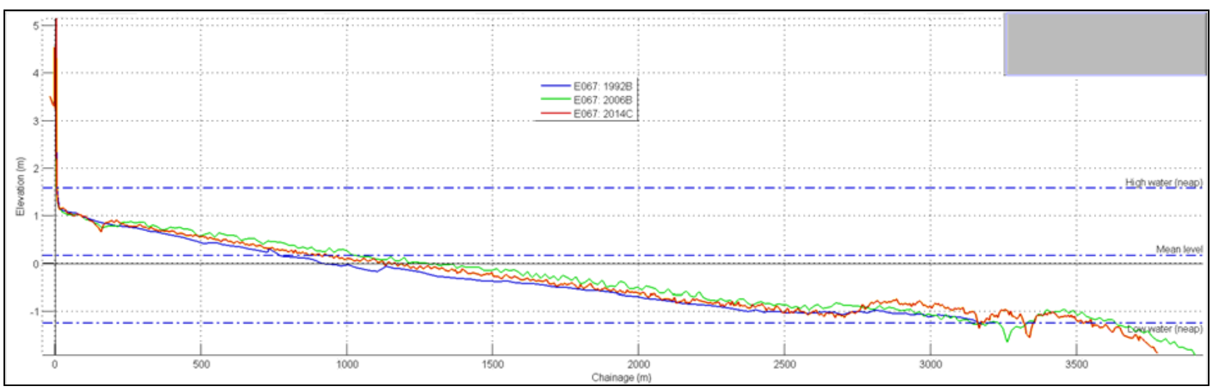


Slight erosion at MHWS – saltmarsh has retreated by approx. 10m since 1992. Slight erosion trend at MHWN. Strong accretion trend at MSL. Moderate accretion trend at MLWN. Flattening profile.

E067 (E3A4) – Suttons. *Defence type: concrete sea wall.*

Erosion Rates (metres/year)			
MHWN	MSL	MLWN	Mean
-0.04	2.41	25.62	9.33

MLWN chainage (metres)		
1992	2006	2014
3164	3630	3548

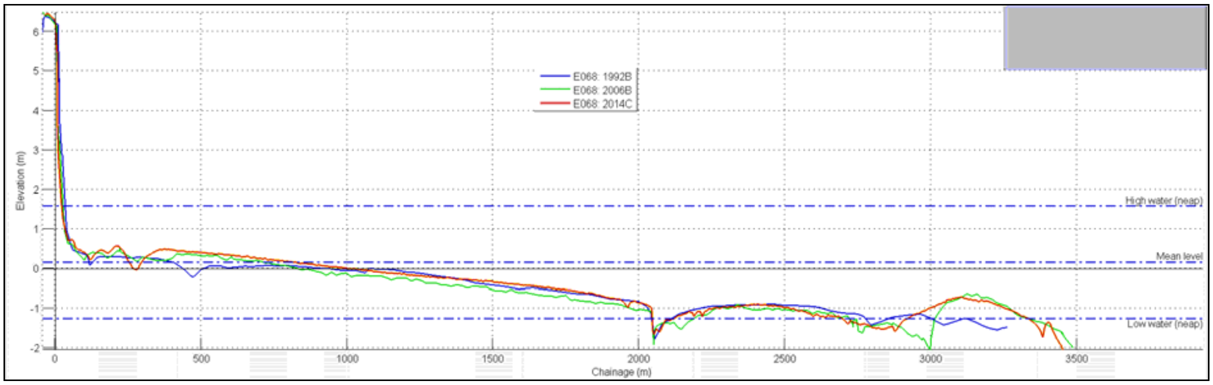


No movement at MHWS or MHWN due to sea defence. Moderate accretion trend at MSL. Significant accretion trend at MLWN – many of the early profile surveys did not reach MLWN at the outer bank at approx. 3600m chainage. Slightly flattening profile.

E068 (E3A5) – Shoeburyness. *Defence type: embankment and gabions.*

Erosion Rates (metres/year)			
MHWN	MSL	MLWN	Mean
-0.40	24.56	44.90	23.02

MLWN chainage (metres)		
1992	2006	2014
2998	3329	3330

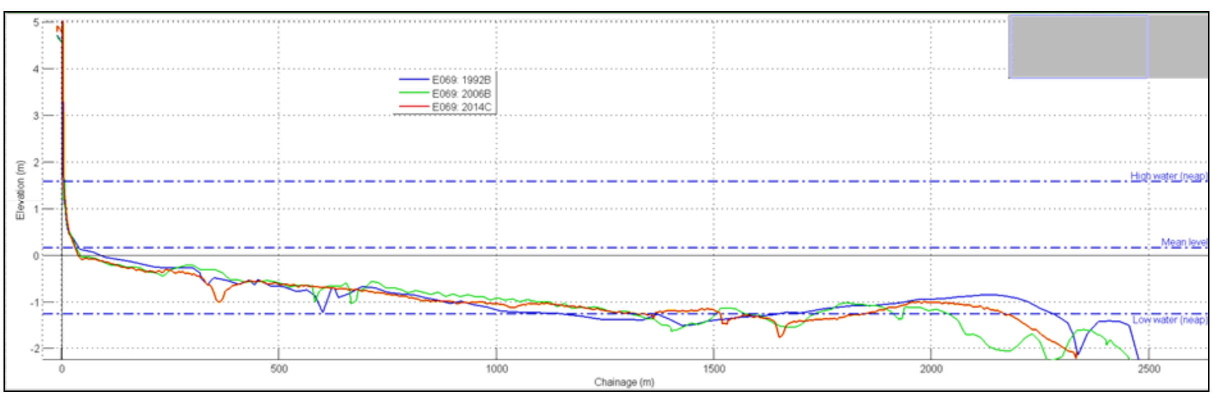


Minimal movement at MHWS and MHWN. Significant accretion trend at MSL. Very significant accretion trend at MLWN – profile is erratic at this level and some of the early profile surveys don't achieve MLWN seaward side of outer bank at approx. 3200m chainage, which may distort the trend. Very slight flattening profile.

E069 (E3A6) – Shoeburyness, The Hilly Marsh. *Defence type: recurved concrete sea wall.*

Erosion Rates (metres/year)			
MHWN	MSL	MLWN	Mean
0.11	0.07	11.10	3.76

MLWN chainage (metres)		
1992	2006	2014
2276	2034	2163

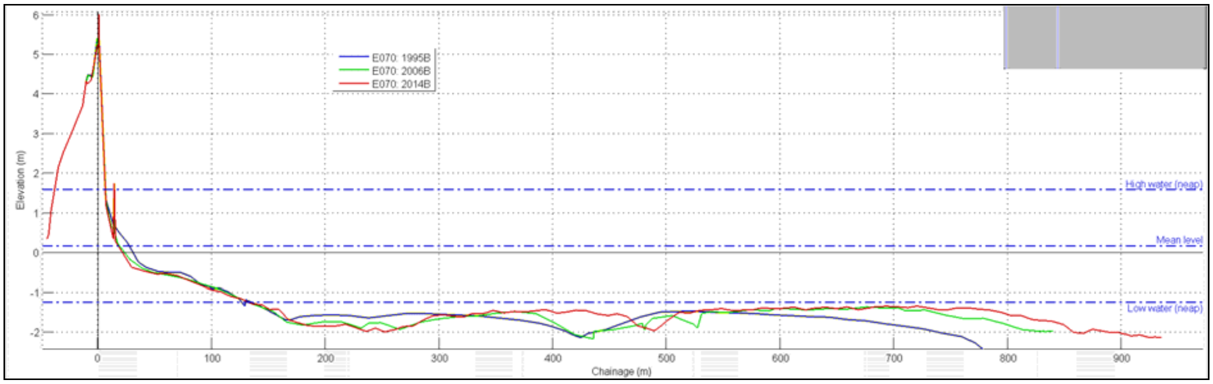


No movement at MHWS or MHWN due to sea defence. Minimal movement at MSL due to close proximity of sea defence. Significant accretion trend at MLWN - profile is erratic at this level and some of the early profile surveys don't achieve MLWN seaward side of outer bank at approx. 2000m chainage, which may distort the trend. Very slight flattening profile.

E070 (E4A1) – Shoebury Ness. *Defence type: recurved concrete sea wall, revetment and timber groyne.*

Erosion Rates (metres/year)			
MHWN	MSL	MLWN	Mean
0.00	-0.44	14.56	4.71

MLWN chainage (metres)		
1995	2006	2014
138	135	136

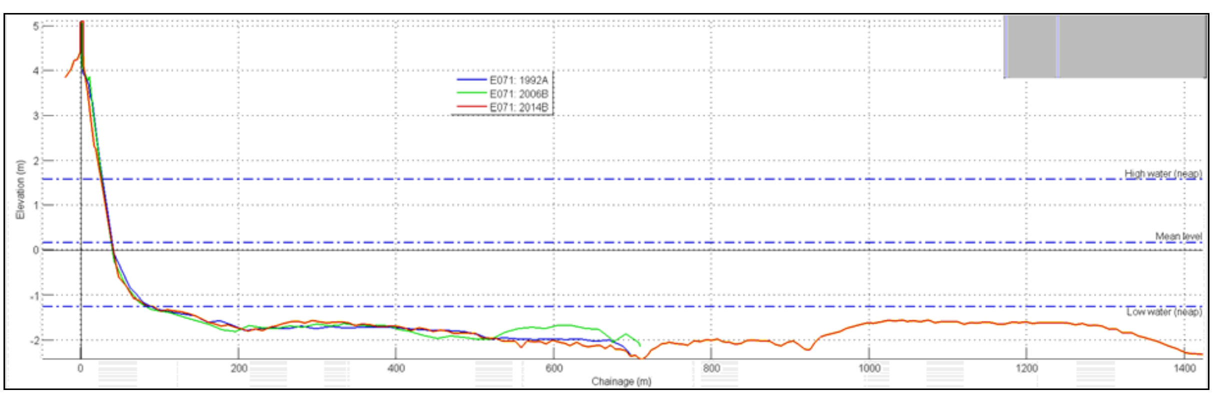


Profile crosses shore normal groyne near sea defence. No movement at MHWS or MHWN due to sea defence and groyne. Very slight erosion trend at MSL due to close proximity of sea defence and shore normal groyne. Significant accretion trend at MLWN – very erratic profile at this level. Slightly flattening profile.

E071 (E4A2) – Shoebury Common. *Defence type: recurved concrete sea wall, block revetment and timber groyne.*

Erosion Rates (metres/year)			
MHWN	MSL	MLWN	Mean
-0.02	-0.11	0.07	-0.02

MLWN chainage (metres)		
1992	2006	2014
91	85	99

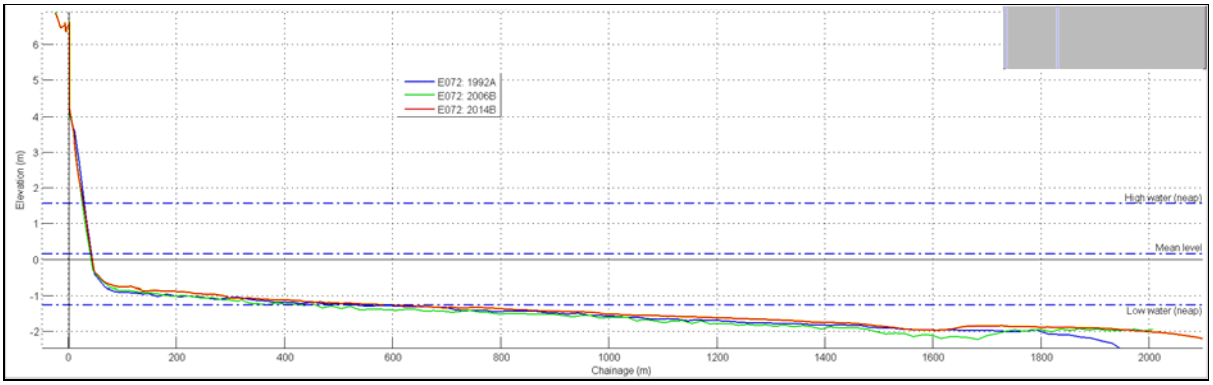


Stable profile. Profile is very flat out to around 2000m chainage. No movement at MHWS, MHWN, MSL and MLWN. No rotation.

E072 (E4A3) – Thorpe Esplanade. *Defence type: concrete sea wall.*

Erosion Rates (metres/year)			
MHWS	MSL	MLWN	Mean
0.00	-0.04	6.79	2.25

MLWN chainage (metres)		
1992	2006	2014
532	457	638

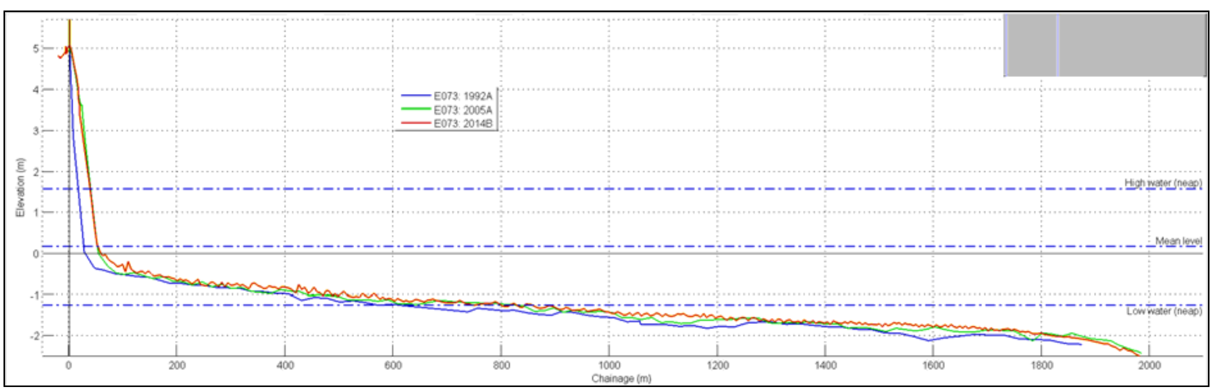


No movement at MHWS, MHWN and MSL. Strong accretion trend at MLWN – erratic profile at this level. Slightly flattening profile.

E073 (E4A4) – Eastern Esplanade, Warwick Road. *Defence type: concrete sea wall.*

Erosion Rates (metres/year)			
MHWN	MSL	MLWN	Mean
1.42	1.39	4.67	2.49

MLWN chainage (metres)		
1992	2006	2014
636	877	895

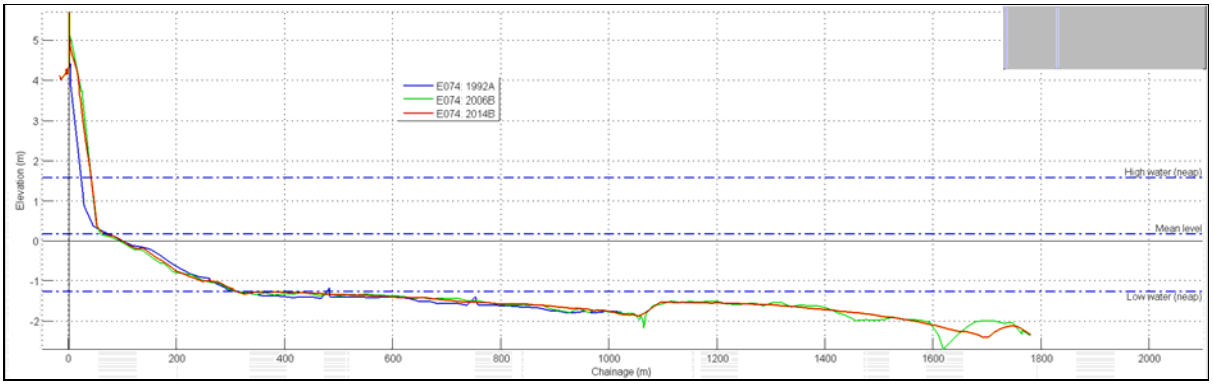


Accretion trends at all levels. Moderate at MHWS, MHWN and MSL and more significant at MLWN. No rotation. Reasonably stable up to 2002, large amount of accretion during 2002 and then stable ever since.

E074 (E4A5) – Eastern Esplanade, Victoria Road. *Defence type: concrete sea wall.*

Erosion Rates (metres/year)			
MHWS	MSL	MLWN	Mean
1.10	0.29	10.22	3.87

MLWN chainage (metres)		
1992	2006	2014
482	436	435

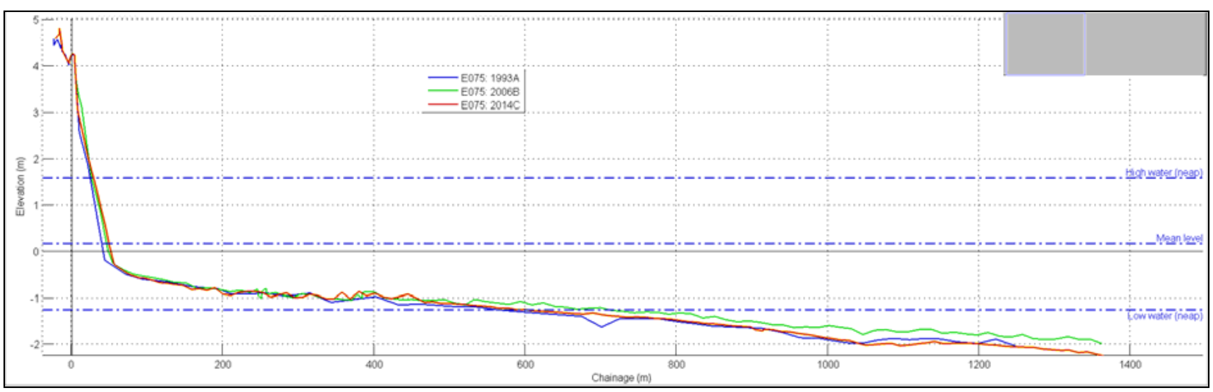


Accretion trend at all levels – moderate at MHWS, slight at MSL and significant at MLWN. No rotation. Stable up to Feb 2002 and then massive accretion upto Sep 2002 and then stable ever since.

E075 (E4B1) – Southend-on-Sea Pier. *Defence type: concrete block revetment.*

Erosion Rates (metres/year)			
MHWS	MSL	MLWN	Mean
0.22	0.47	5.29	2.00

MLWN chainage (metres)		
1993	2006	2014
584	725	619

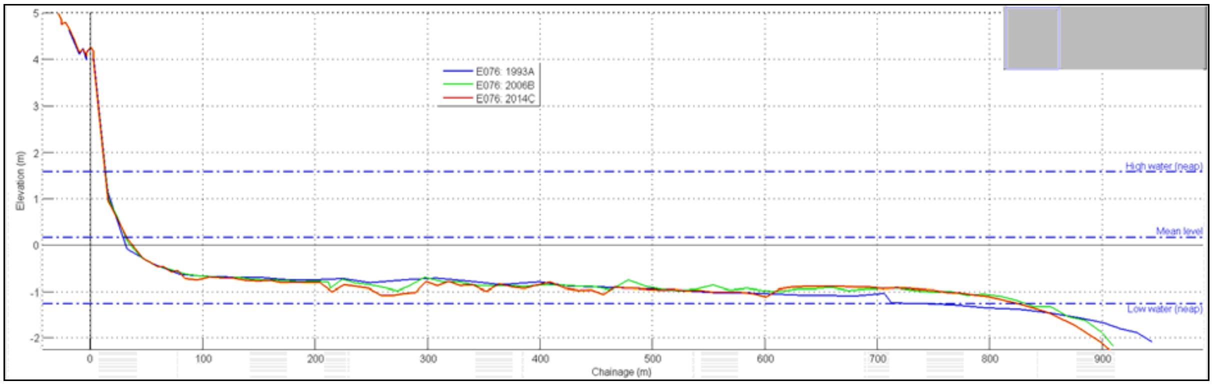


Very little movement at MHWS due to adjacent sea defence. Moderate accretion trend at MSL. Significant accretion trend at MLWN. Slightly flattening profile.

E076 (E4B2) – Western Esplanade. *Defence type: stone revetment.*

Erosion Rates (metres/year)			
MHWS	MSL	MLWN	Mean
-0.01	0.07	0.84	0.30

MLWN chainage (metres)		
1995	2006	2014
833	834	828

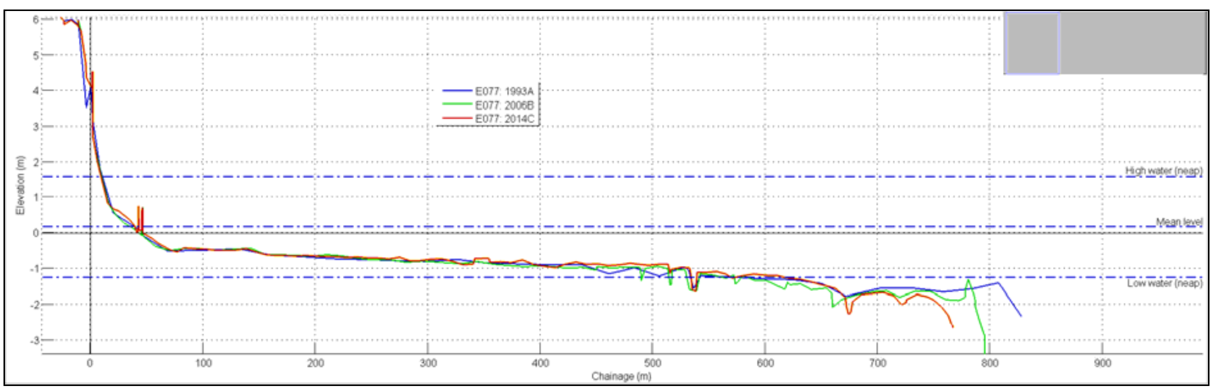


No movement at MHWS or MHWN due to sea defence. No movement at MSL. Moderate accretion trend at MLWN. Slightly flattening profile.

E077 (E4B3) – The Leas. *Defence type: concrete and stone sea wall and groyne enclosure.*

Erosion Rates (metres/year)			
MHWN	MSL	MLWN	Mean
-0.07	0.03	1.93	0.63

MLWN chainage (metres)		
1994	2006	2014
619	586	631

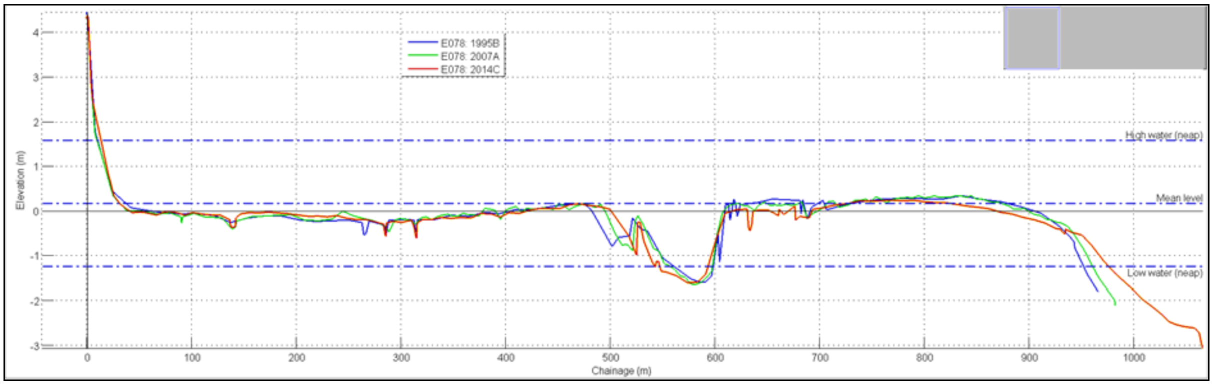


No movement at MHWS, MHWN and MSL due to sea defence. Accretion trend at MLWN. Slightly flattening profile.

E078 (E4B4) – Chalkwell Station. *Defence type: pitching*

Erosion Rates (metres/year)			
MHWN	MSL	MLWN	Mean
0.15	-0.95	1.39	0.19

MLWN chainage (metres)		
1995	2005	2014
952	957	980

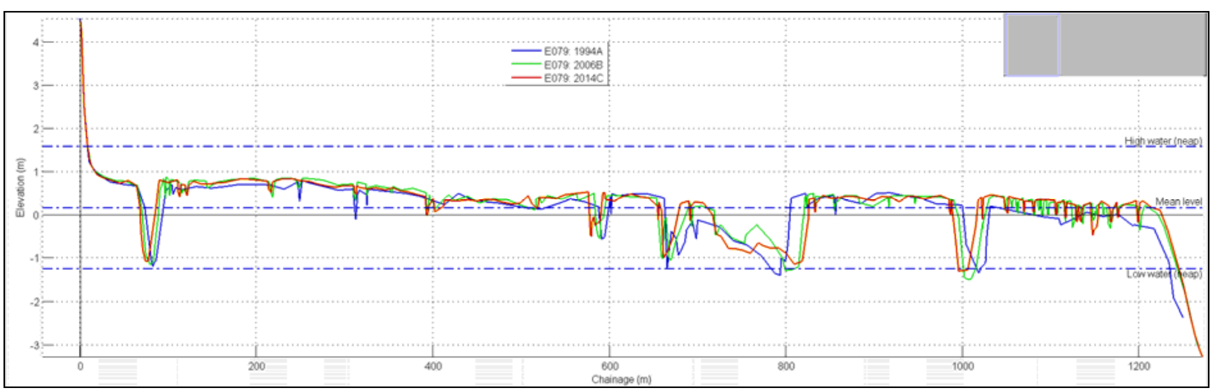


The Leigh Swatch (offshore channel) lies 580m offshore from sea wall. No movement at MHWS due to sea defence. Very little movement at MHWN due to proximity of sea defence. Moderate erosion trend at MSL – profile crosses MSL several times and this may have distorted the trend. Accretion trend at MLWN - profile crosses MLWN several times and this may have distorted the trend. Profile appears to be relatively stable at all levels when looking at all the survey cross-sections. No rotation of profile.

E079 (E4B5) – Leigh Cliffs. *Defence type: pitching.*

Erosion Rates (metres/year)			
MHWS	MSL	MLWN	Mean
-0.01	11.97	5.40	5.79

MLWN chainage (metres)		
1994	2006	2014
1234	1243	1244

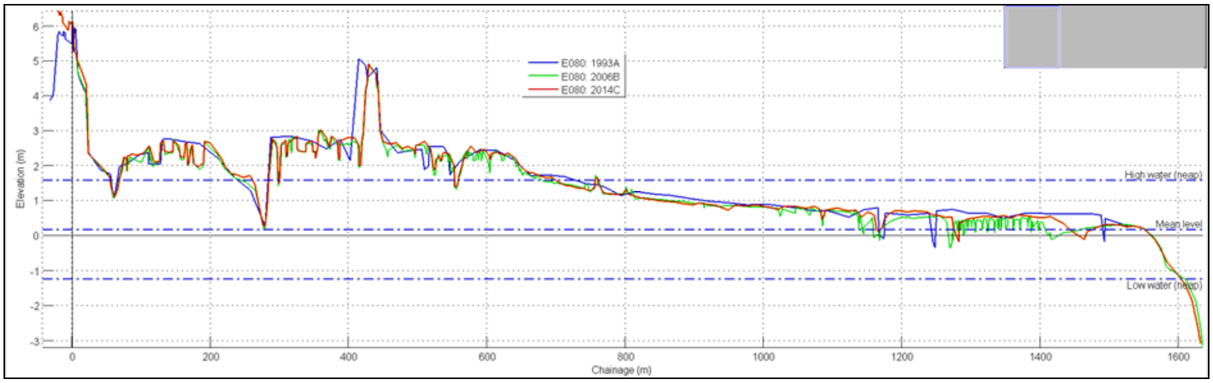


No movement at MHWS or MHWN due to sea defence. Significant accretion trend at MSL and MLWN – profile crosses MSL several times and this may have distorted the trend. Profile appears to be relatively stable at all levels when looking at all the survey cross-sections. Slightly flattening profile.

E080 (E4B6) – Leigh-on-Sea Station. *Defence type: earth embankment and concrete revetment.*

Erosion Rates (metres/year)			
MHWN	MSL	MLWN	Mean
0.66	1.97	0.84	1.16

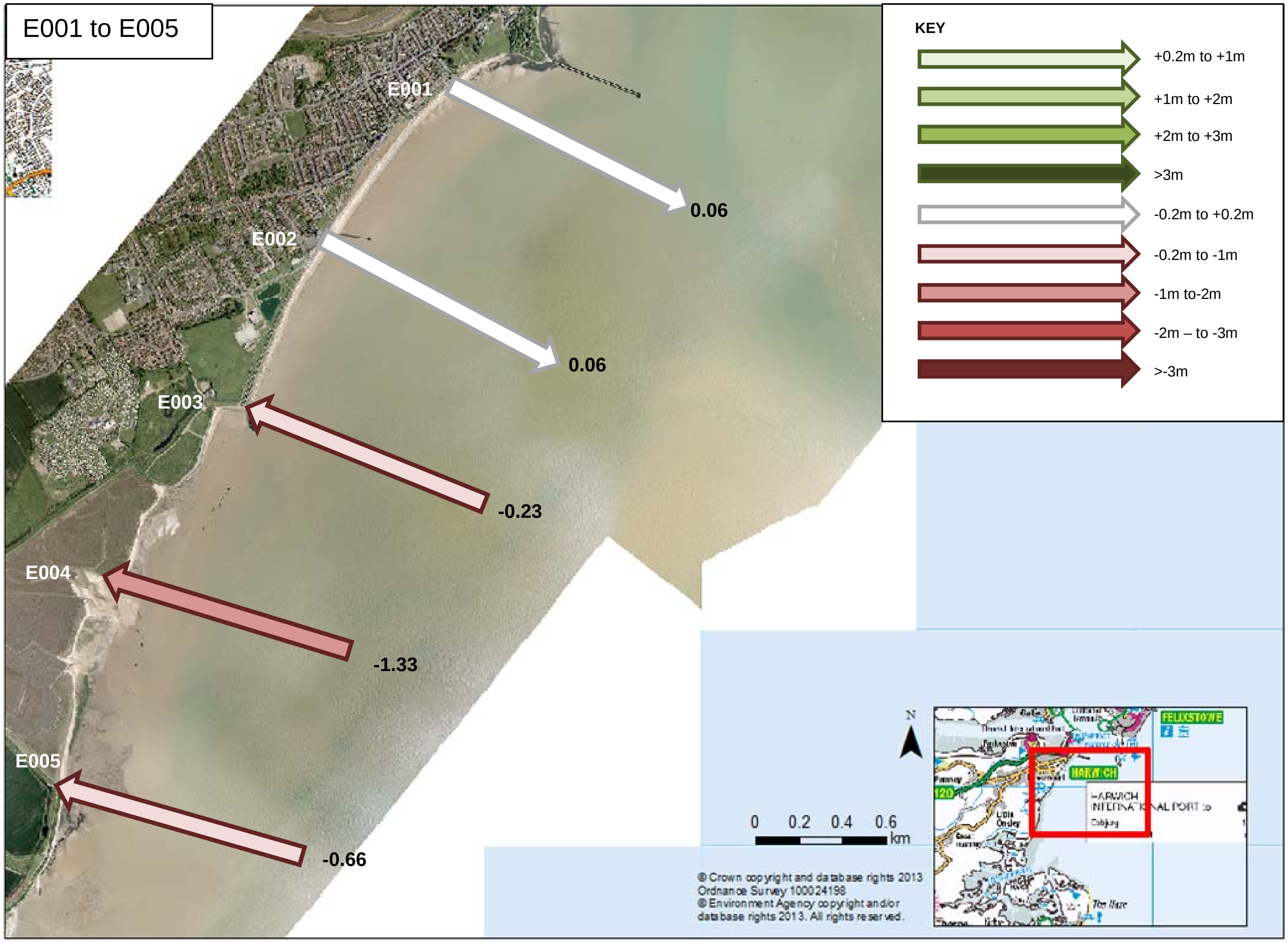
MLWN chainage (metres)		
1994	2006	2014
1585	1610	1604



Little movement at MHWS and MHWN due to saltmarsh. Moderate accretion trend at MSL and MLWN. Profile appears to be relatively stable at all levels when looking at all the survey cross-sections. No rotation of profile.

3.0 Graphical View of Results

The following images show the results of the analysis as arrows along the profile (transect) lines. The white number at the landward end indicates the profile reference (transect id) and the black number at the seaward end indicates the mean rate/year of erosion (-ve) or accretion (+ve).



E001 to E005
E001
0.06
E002
0.06
E003
-0.23
E004
-1.33
E005
-0.66
KEY
+0.2m to +1m
+1m to +2m
+2m to +3m
>3m
-0.2m to +0.2m
-0.2m to -1m
-1m to-2m
-2m – to -3m
>-3m
N
0 0.2 0.4 0.6
km
FELIXSTOWE
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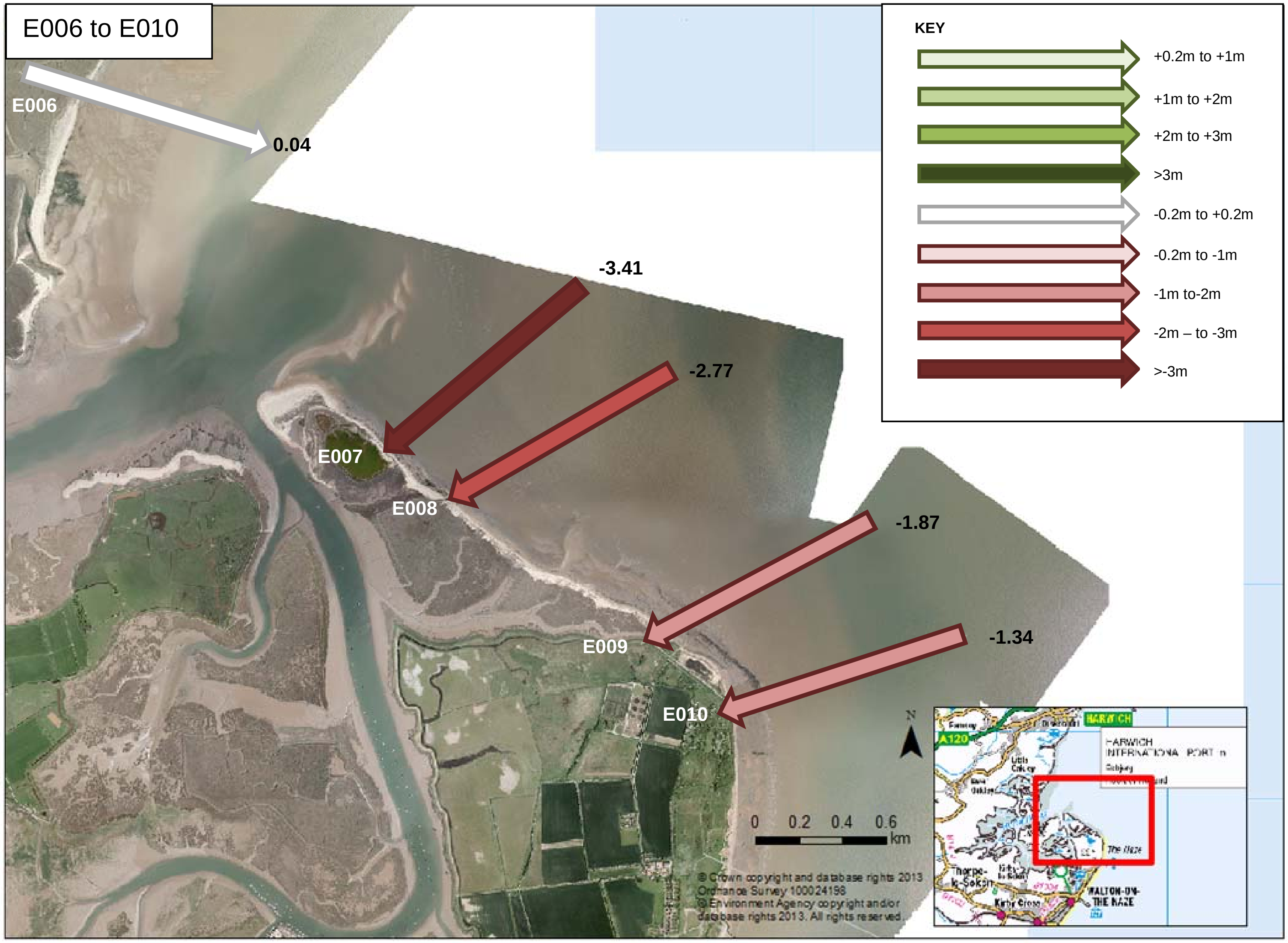
E006 to E010
E006
0.04
-3.41
E007
-2.77
E008
-1.87
E009
-1.34
E010
KEY
+0.2m to +1m
+1m to +2m
+2m to +3m
>3m
-0.2m to +0.2m
-0.2m to -1m
-1m to-2m
-2m – to -3m
>-3m
N
0 0.2 0.4 0.6
km
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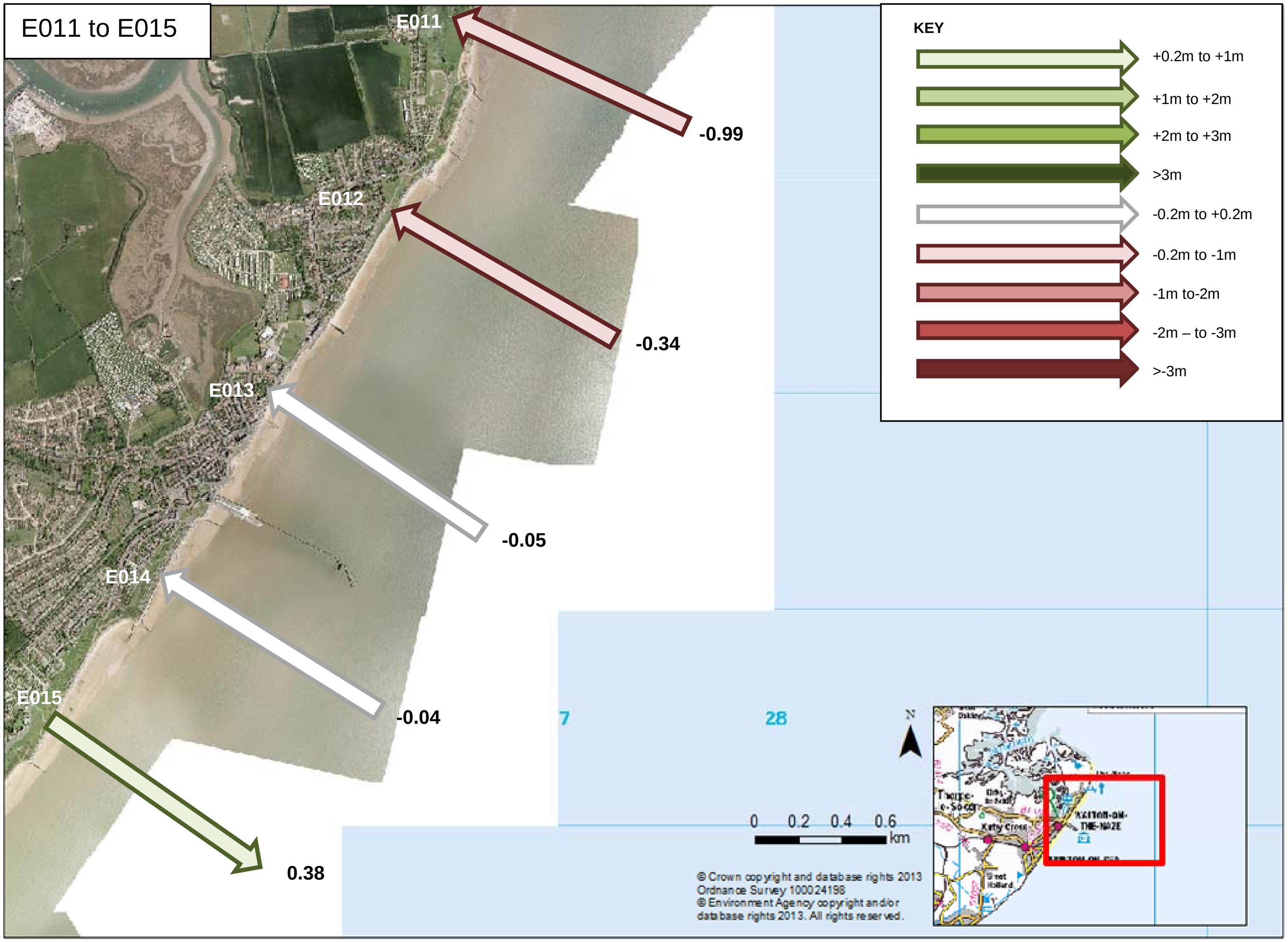
HARWICH
A120
WALTON-ON-THE NAZE


E011 to E015
E011
E012
E013
E014
E015
-0.99
-0.34
-0.05
-0.04
0.38
KEY
+0.2m to +1m
+1m to +2m
+2m to +3m
>3m
-0.2m to +0.2m
-0.2m to -1m
-1m to-2m
-2m – to -3m
>-3m
0 0.2 0.4 0.6 km
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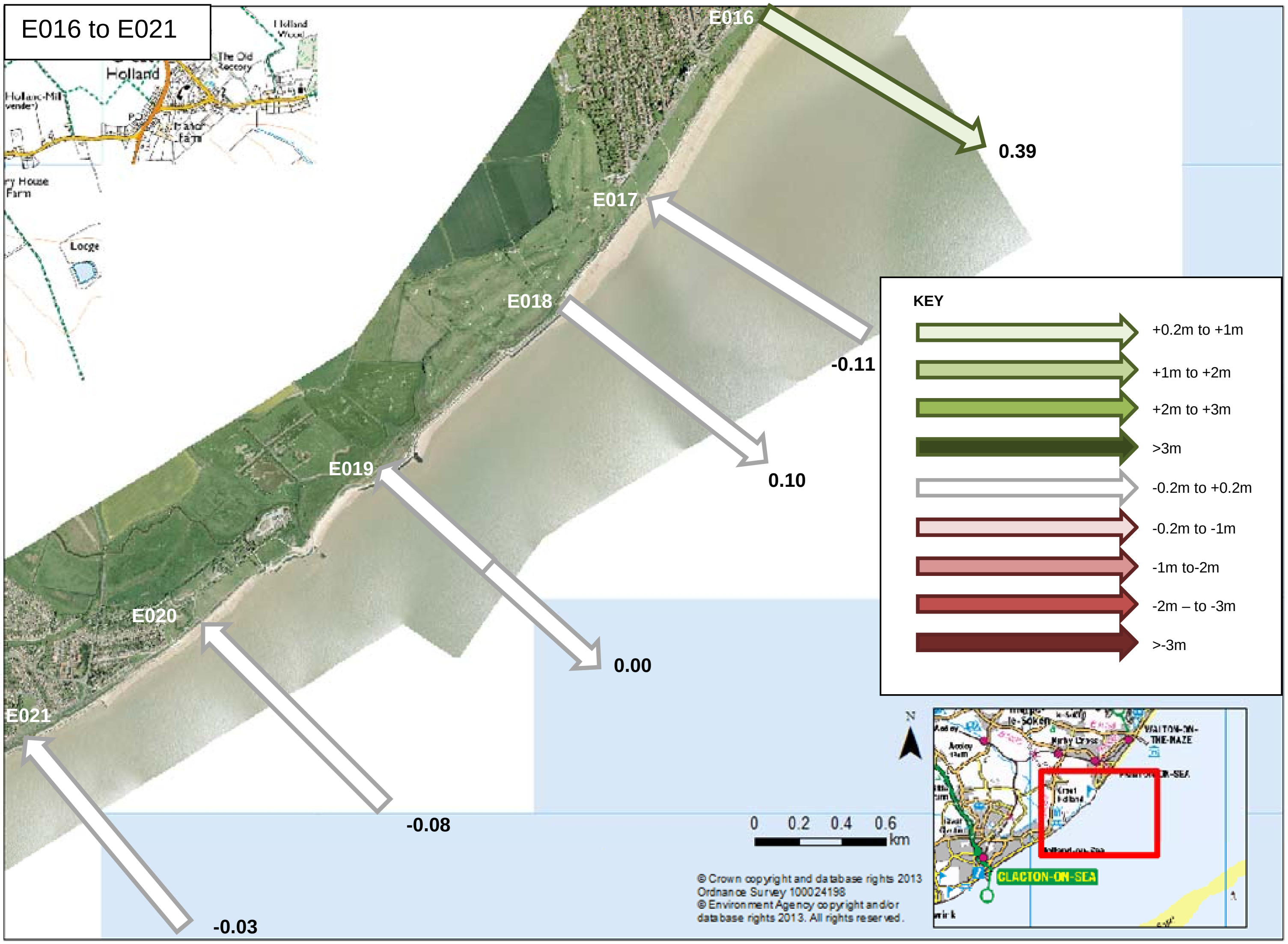
E016 to E021
E016
0.39
E017
-0.11
E018
0.10
E019
0.00
E020
-0.08
E021
-0.03
Holland
The Old Rectory
Lodge
KEY
+0.2m to +1m
+1m to +2m
+2m to +3m
>3m
-0.2m to +0.2m
-0.2m to -1m
-1m to-2m
-2m – to -3m
>-3m
N
0 0.2 0.4 0.6 km
WALTON-ON-THE-NAZE
CLACTON-ON-SEA
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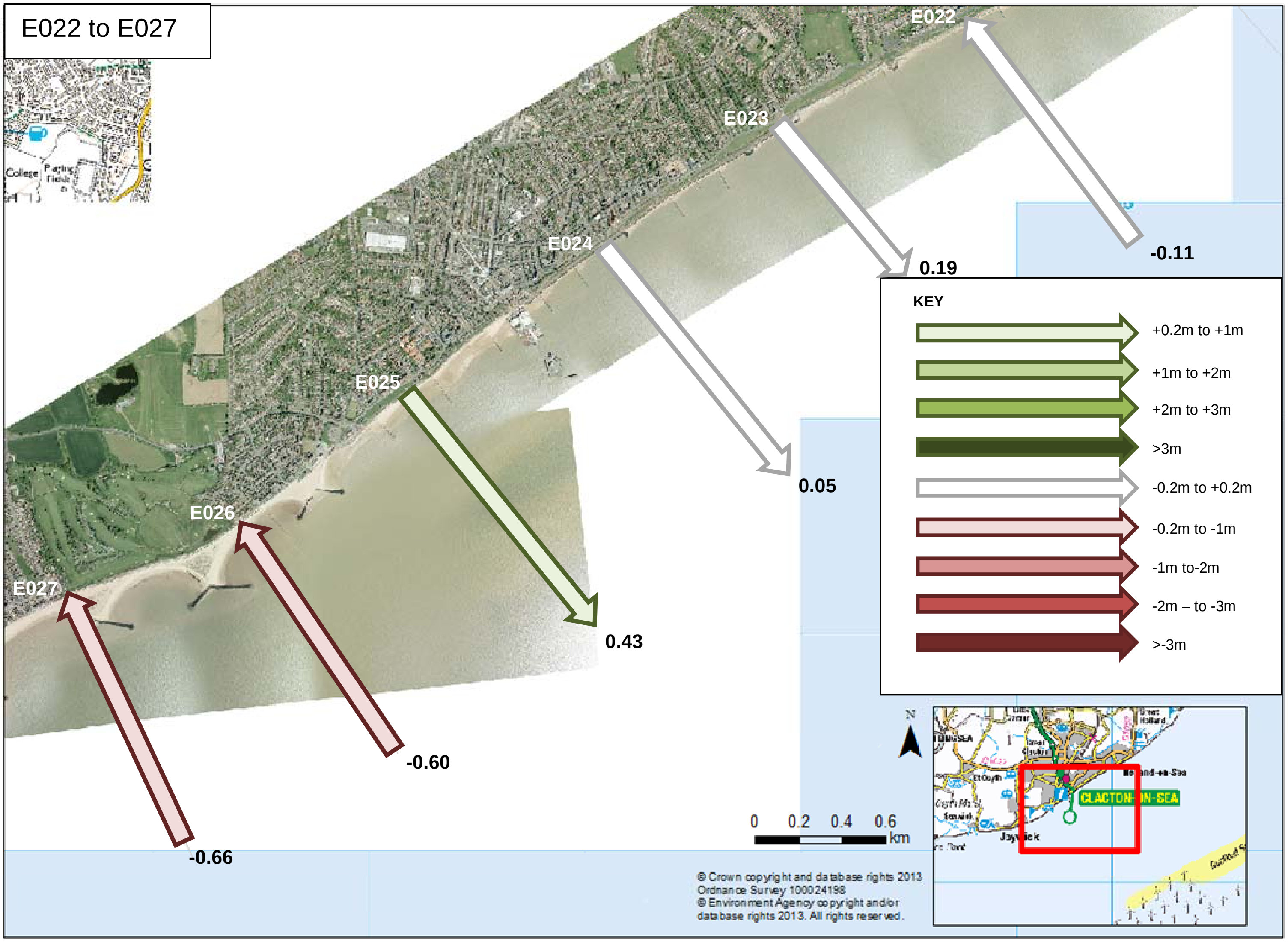
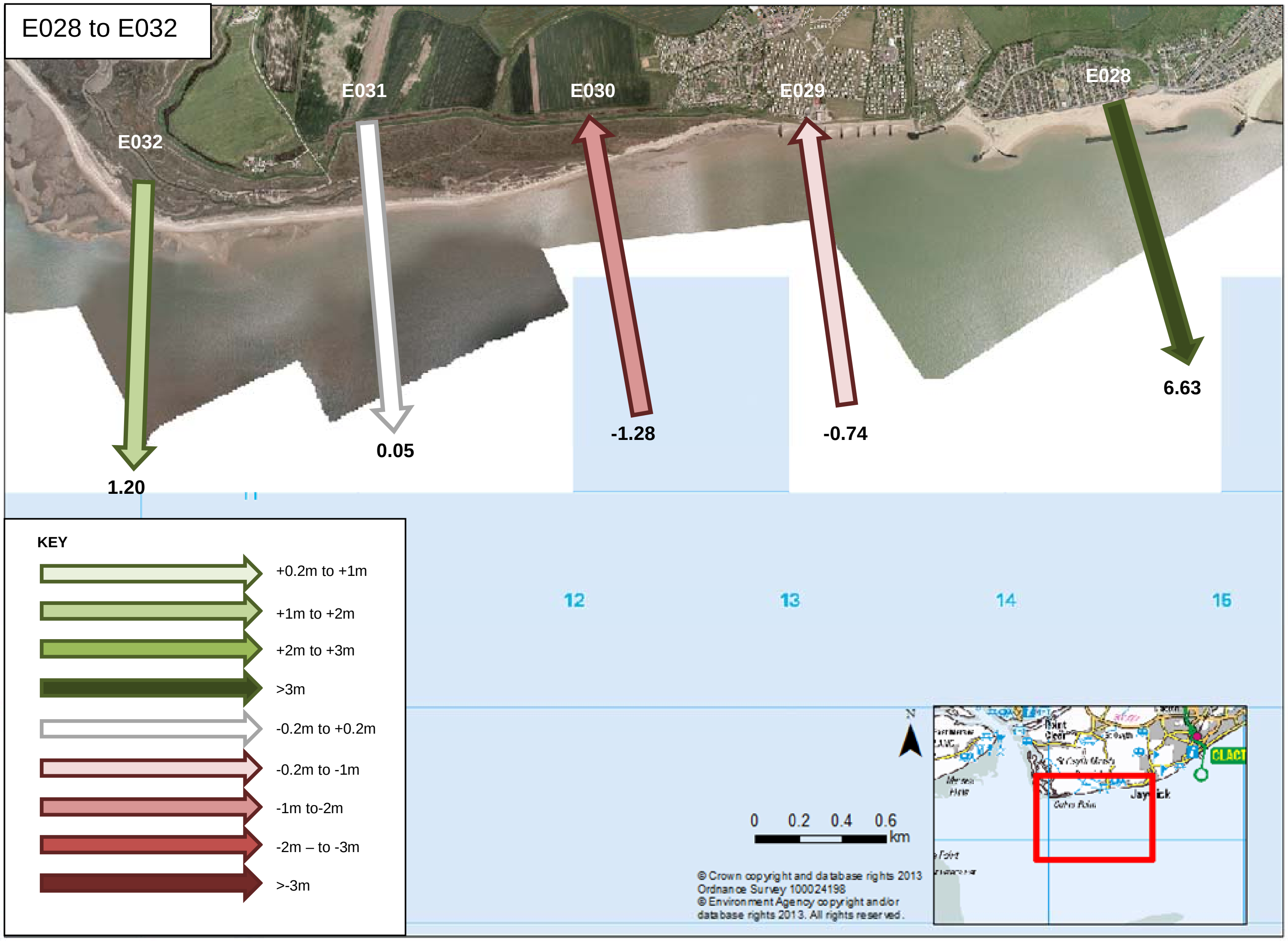

E022 to E027
E022
E023
E024
E025
E026
E027
-0.11
0.19
0.05
0.43
-0.60
-0.66
KEY
+0.2m to +1m
+1m to +2m
+2m to +3m
>3m
-0.2m to +0.2m
-0.2m to -1m
-1m to-2m
-2m – to -3m
>-3m
0 0.2 0.4 0.6 km
CLACTON-ON-SEA
Holland-on-Sea
Jaywick
N


E028 to E032
E032
E031
E030
E029
E028
1.20
0.05
-1.28
-0.74
6.63
12
13
14
15
KEY
+0.2m to +1m
+1m to +2m
+2m to +3m
>3m
-0.2m to +0.2m
-0.2m to -1m
-1m to-2m
-2m – to -3m
>-3m
N
0 0.2 0.4 0.6 km
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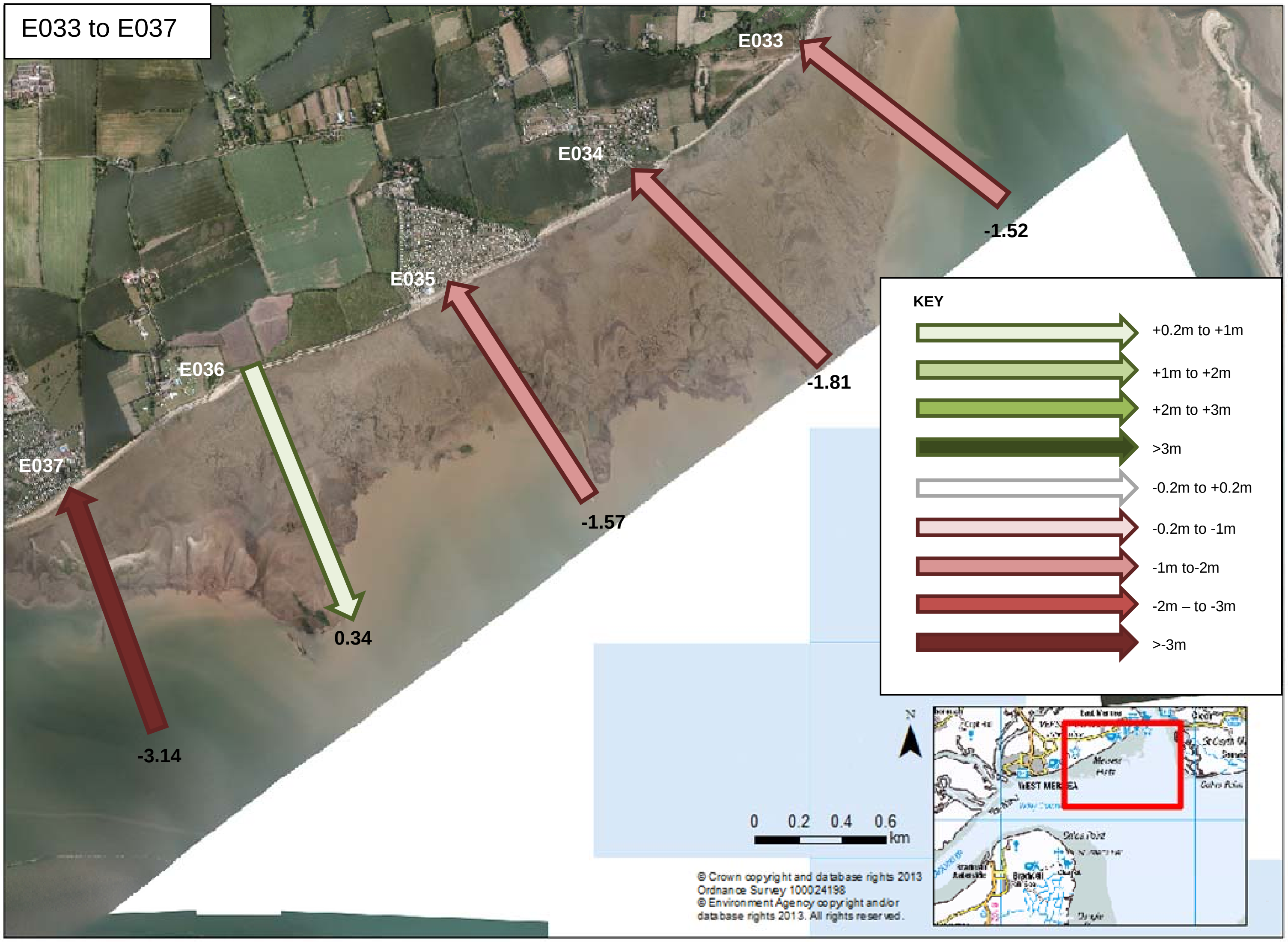
E033 to E037
E033
E034
E035
E036
E037
-1.52
-1.81
-1.57
0.34
-3.14
KEY
+0.2m to +1m
+1m to +2m
+2m to +3m
>3m
-0.2m to +0.2m
-0.2m to -1m
-1m to-2m
-2m – to -3m
>-3m
N
0 0.2 0.4 0.6
km
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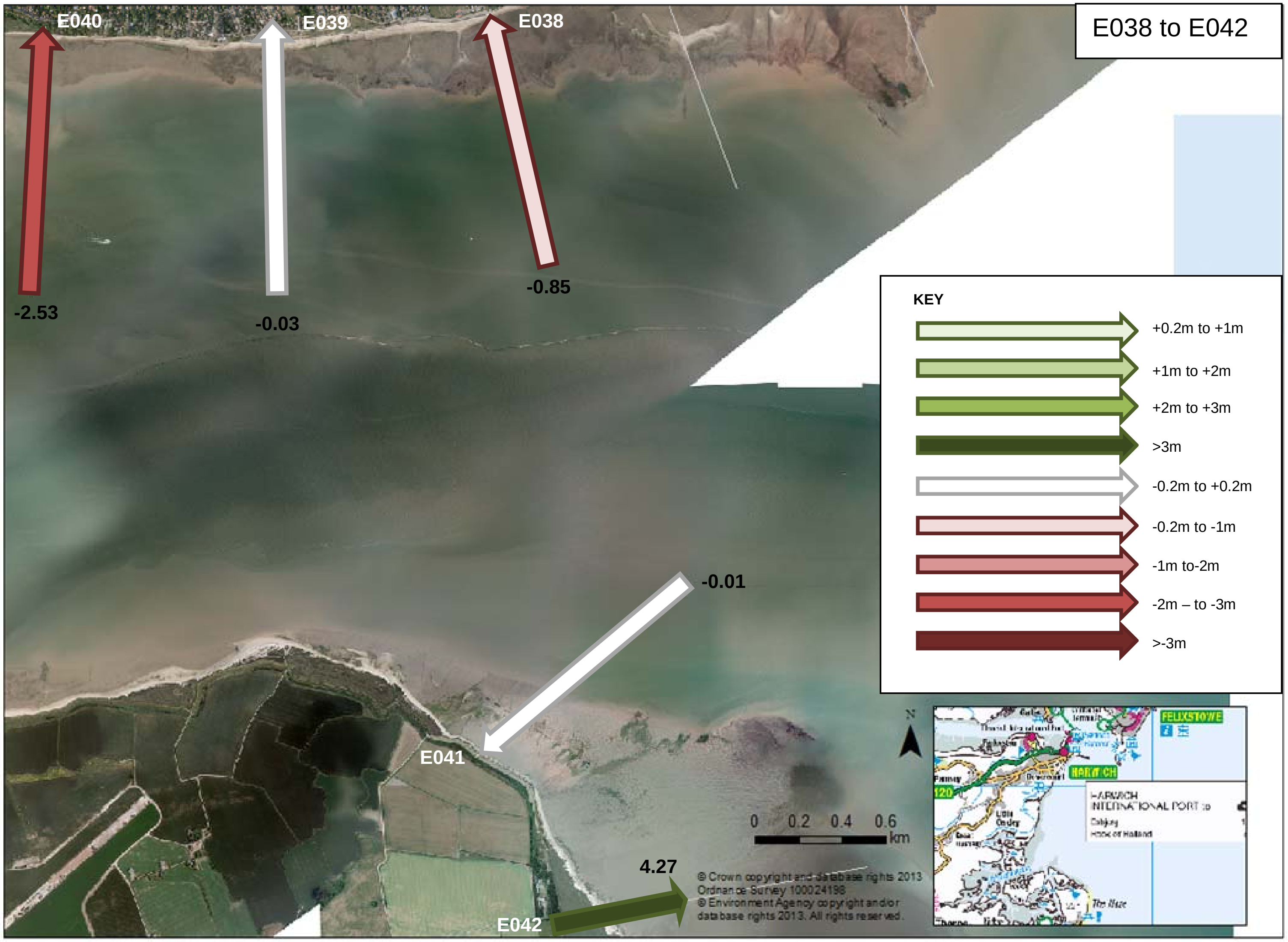
WEST MERSEA


E038 to E042
E040
E039
E038
-2.53
-0.03
-0.85
-0.01
E041
4.27
E042
KEY
+0.2m to +1m
+1m to +2m
+2m to +3m
>3m
-0.2m to +0.2m
-0.2m to -1m
-1m to-2m
-2m – to -3m
>-3m
0 0.2 0.4 0.6
km
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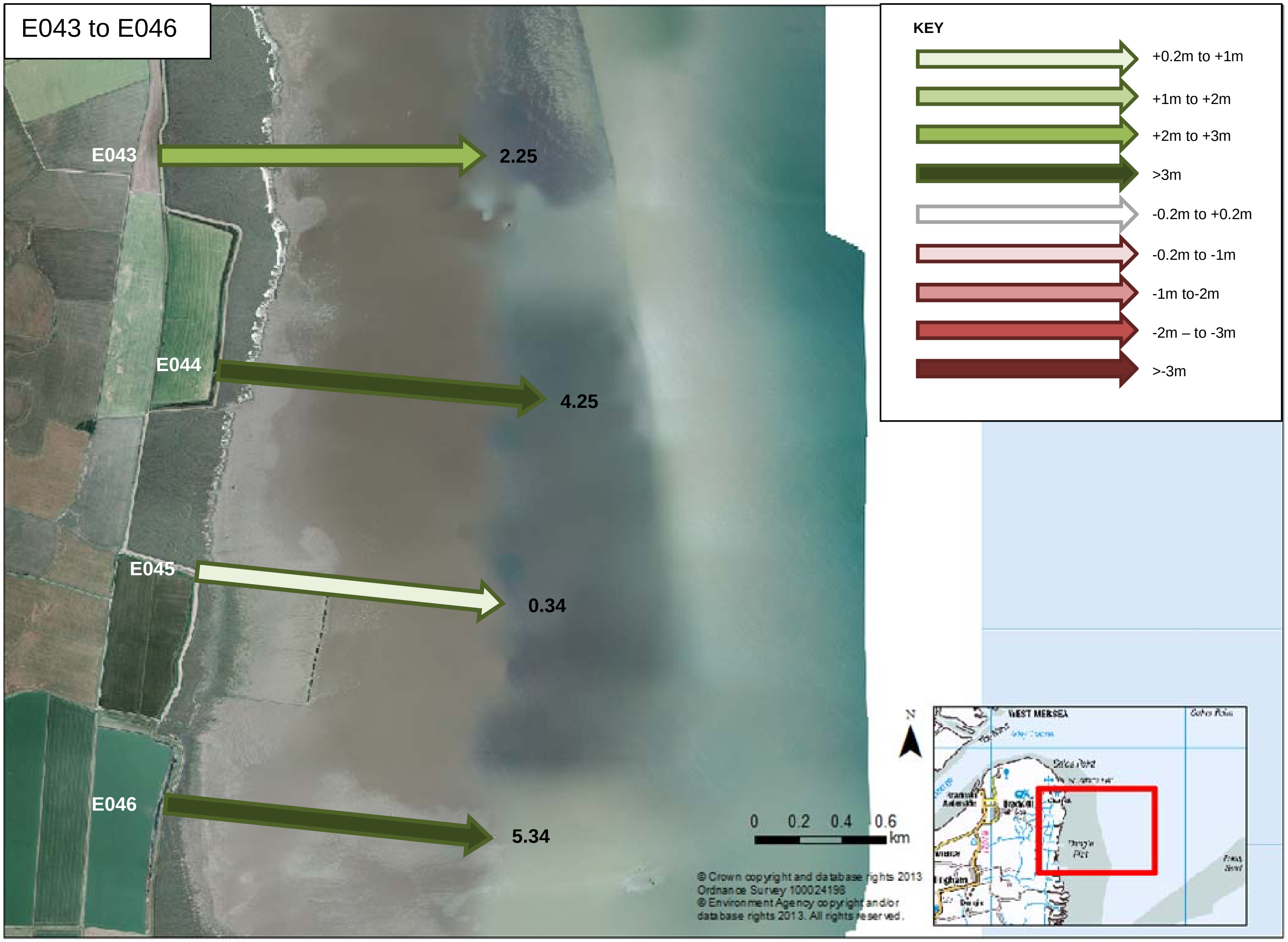
FELIXSTOWE
HARWICH


E043 to E046
KEY
+0.2m to +1m
+1m to +2m
+2m to +3m
>3m
-0.2m to +0.2m
-0.2m to -1m
-1m to-2m
-2m – to -3m
>-3m
E043
2.25
E044
4.25
E045
0.34
E046
5.34
0 0.2 0.4 0.6
km
N
WEST MERSEA
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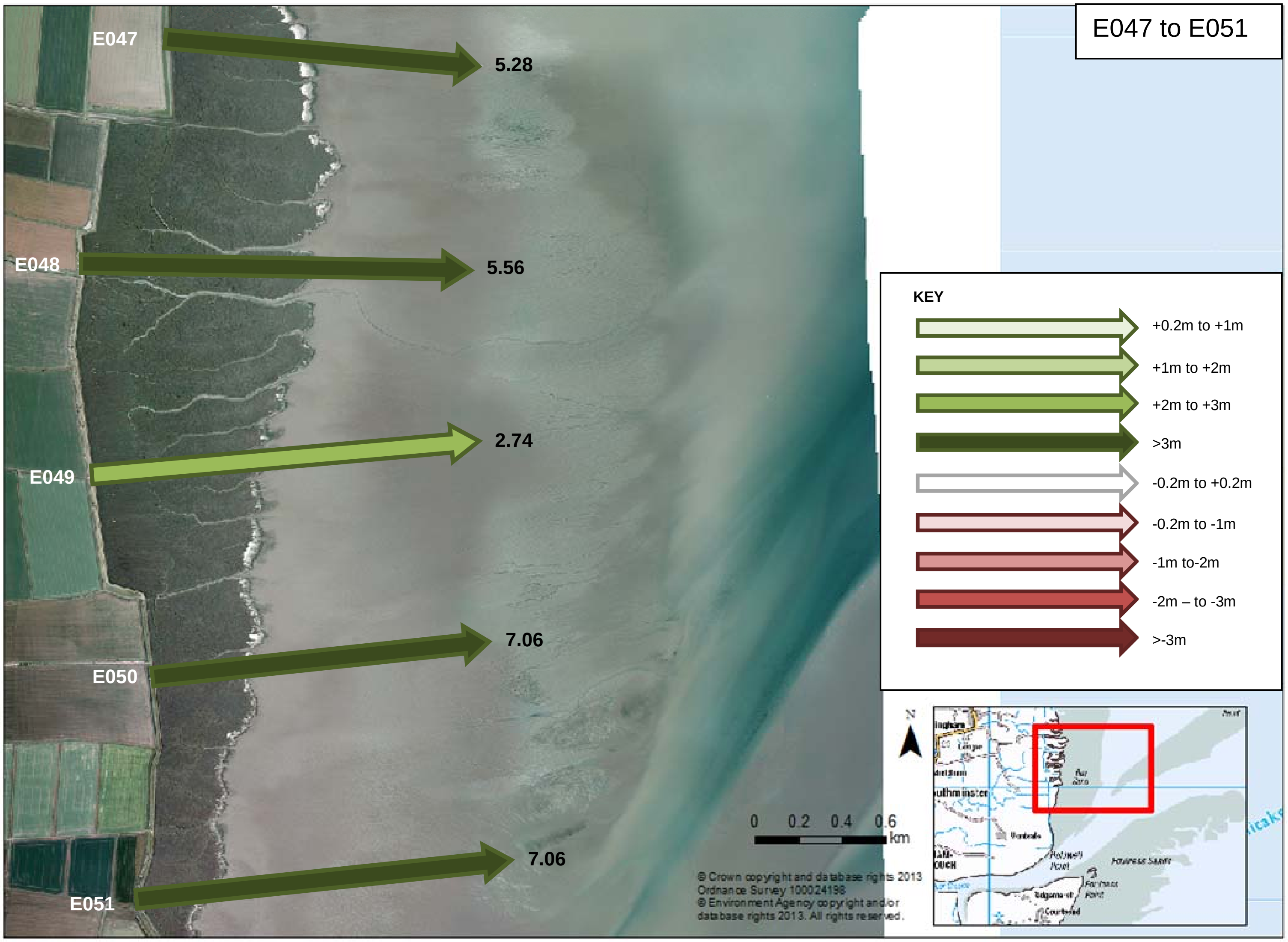

E047 to E051
E047
5.28
E048
5.56
2.74
E049
7.06
E050
7.06
E051
KEY
+0.2m to +1m
+1m to +2m
+2m to +3m
>3m
-0.2m to +0.2m
-0.2m to -1m
-1m to-2m
-2m – to -3m
>-3m
0 0.2 0.4 0.6
km
N
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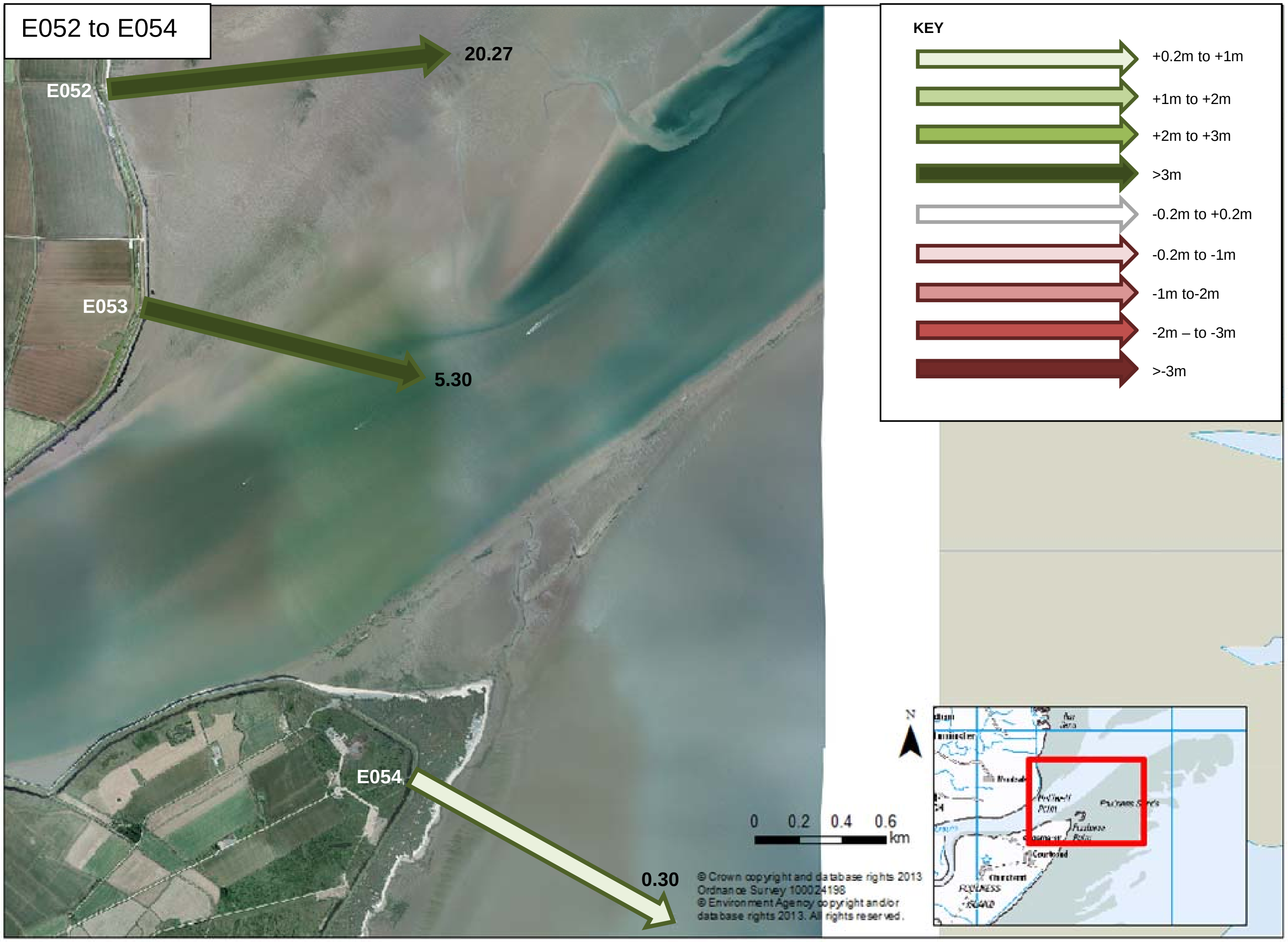

E052 to E054
E052
20.27
E053
5.30
E054
0.30
KEY
+0.2m to +1m
+1m to +2m
+2m to +3m
>3m
-0.2m to +0.2m
-0.2m to -1m
-1m to-2m
-2m – to -3m
>-3m
0 0.2 0.4 0.6
km
N
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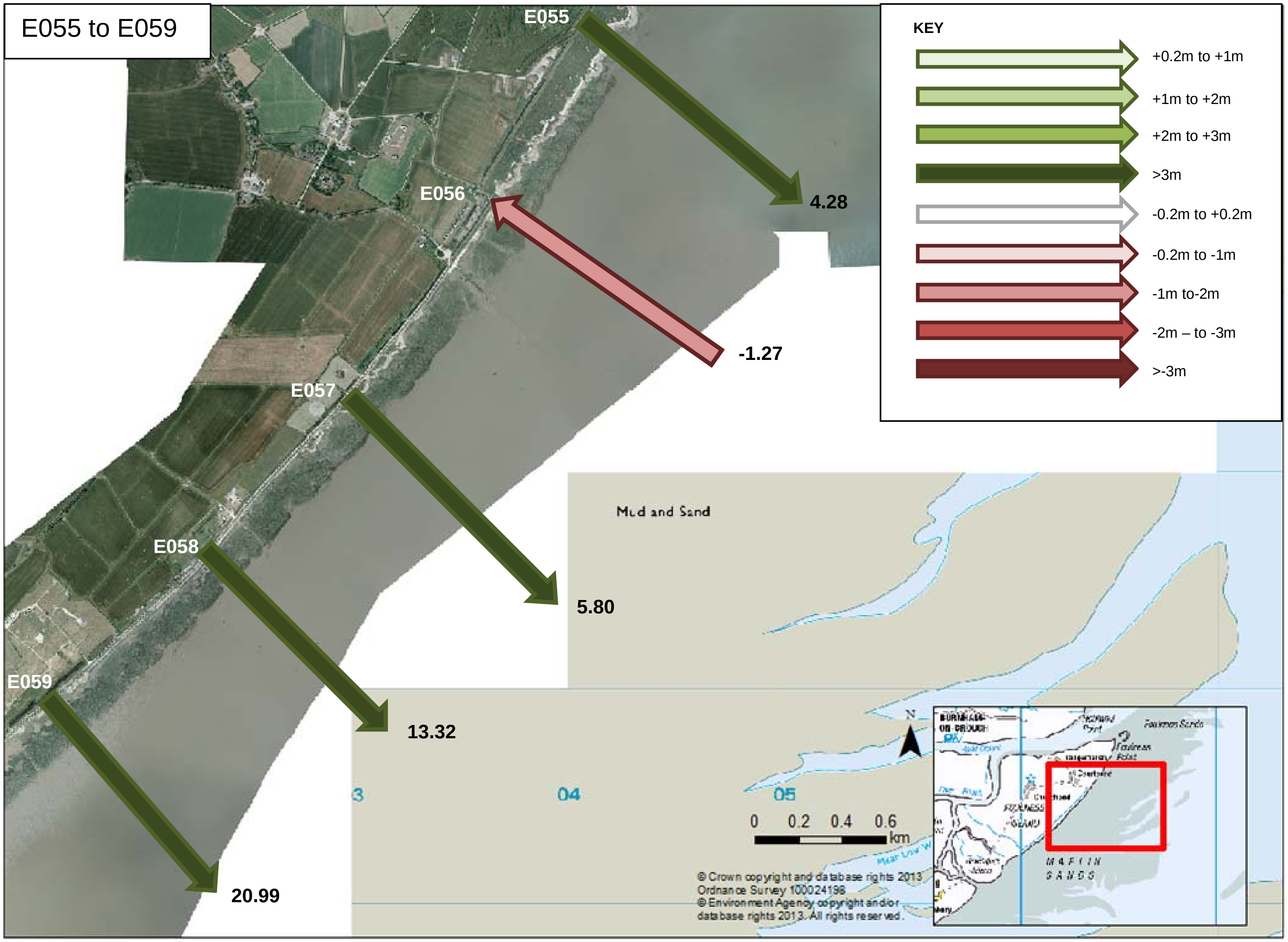
E055 to E059
E055
E056
E057
E058
E059
4.28
-1.27
5.80
13.32
20.99
KEY
+0.2m to +1m
+1m to +2m
+2m to +3m
>3m
-0.2m to +0.2m
-0.2m to -1m
-1m to-2m
-2m – to -3m
>-3m
Mud and Sand
04
05
0 0.2 0.4 0.6
km
N
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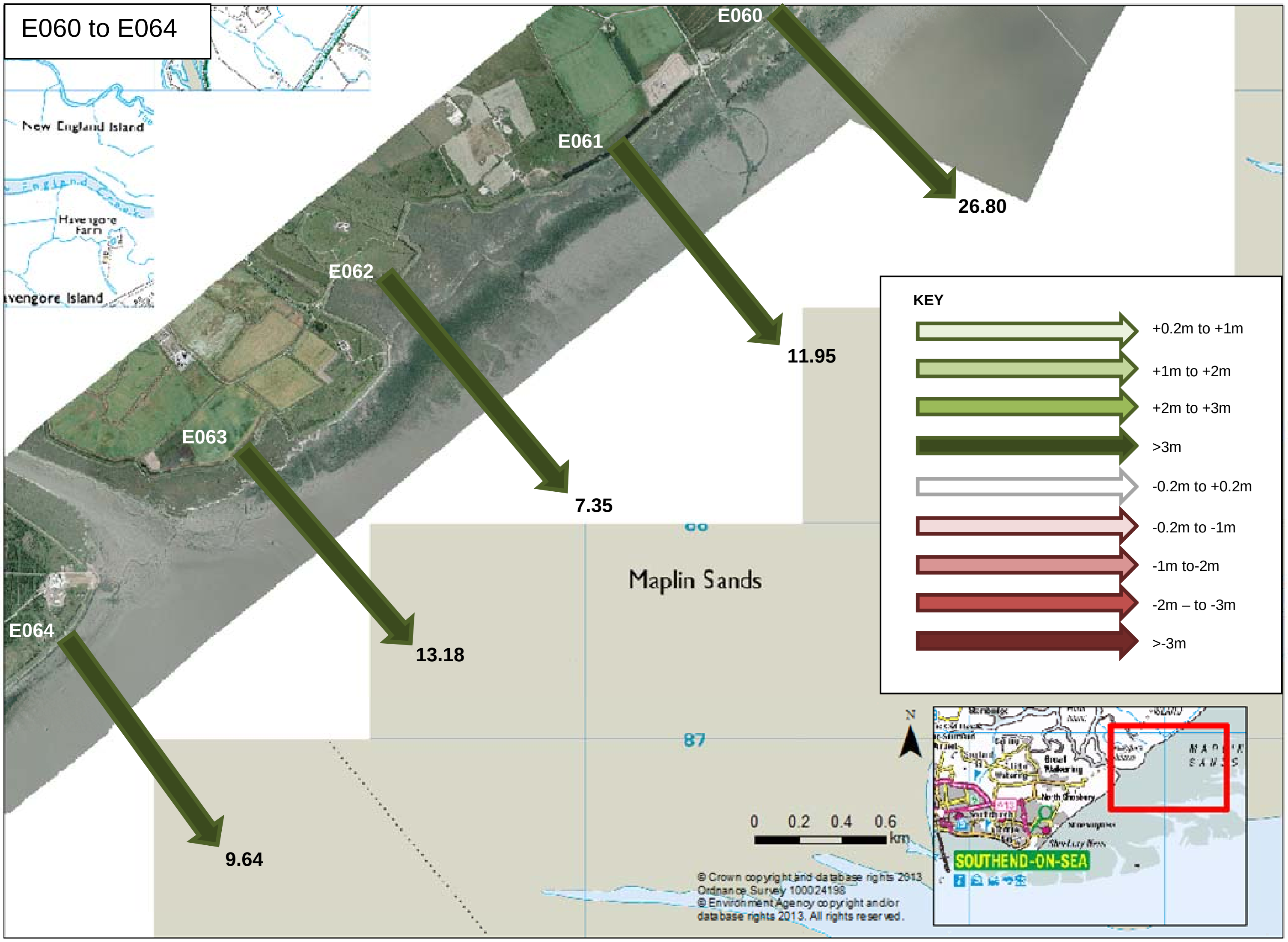

E060 to E064
New England Island
Havengore Farm
Havengore Island
E060
26.80
E061
11.95
E062
7.35
E063
13.18
E064
9.64
Maplin Sands
87
KEY
+0.2m to +1m
+1m to +2m
+2m to +3m
>3m
-0.2m to +0.2m
-0.2m to -1m
-1m to-2m
-2m – to -3m
>-3m
N
0 0.2 0.4 0.6
km
SOUTHEND-ON-SEA
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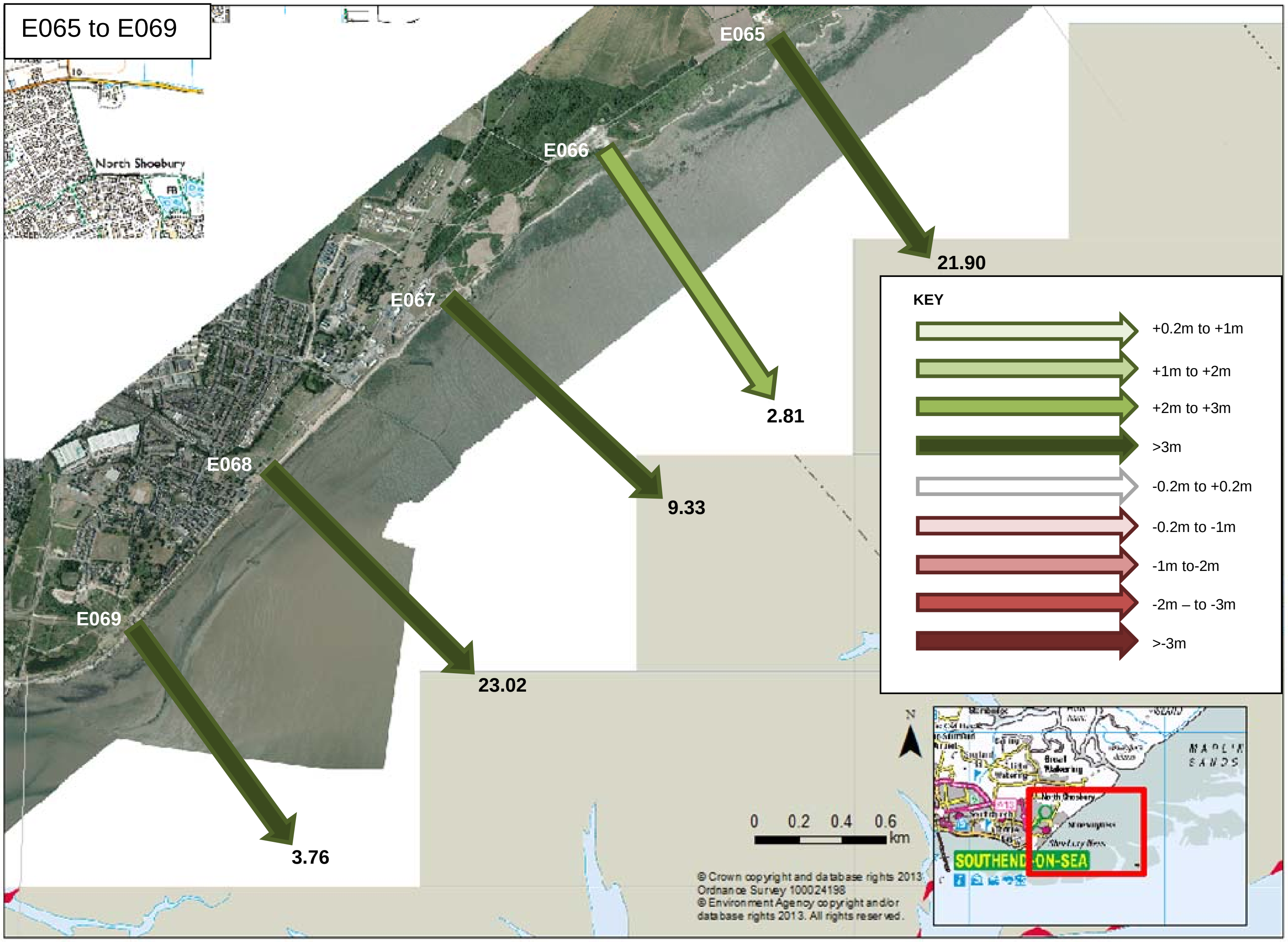

E065 to E069
North Shoebury
E065
21.90
E066
2.81
E067
9.33
E068
23.02
E069
3.76
KEY
+0.2m to +1m
+1m to +2m
+2m to +3m
>3m
-0.2m to +0.2m
-0.2m to -1m
-1m to-2m
-2m – to -3m
>-3m
0 0.2 0.4 0.6
km
N
SOUTHEND-ON-SEA
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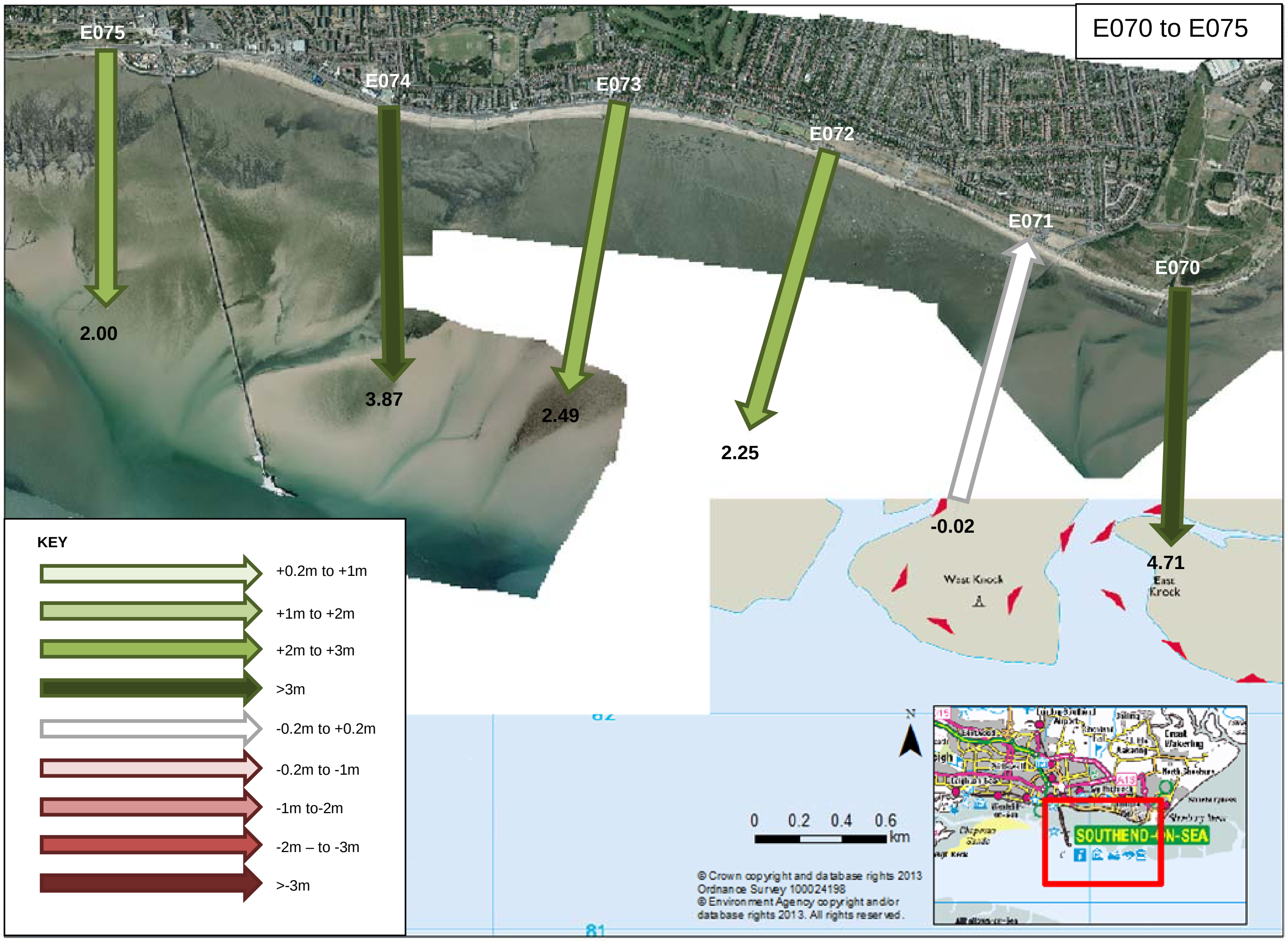

E070 to E075
E075
E074
E073
E072
E071
E070
2.00
3.87
2.49
2.25
-0.02
4.71
West Knock
East Knock
KEY
+0.2m to +1m
+1m to +2m
+2m to +3m
>3m
-0.2m to +0.2m
-0.2m to -1m
-1m to-2m
-2m – to -3m
>-3m
0 0.2 0.4 0.6 km
N
SOUTHEND-ON-SEA
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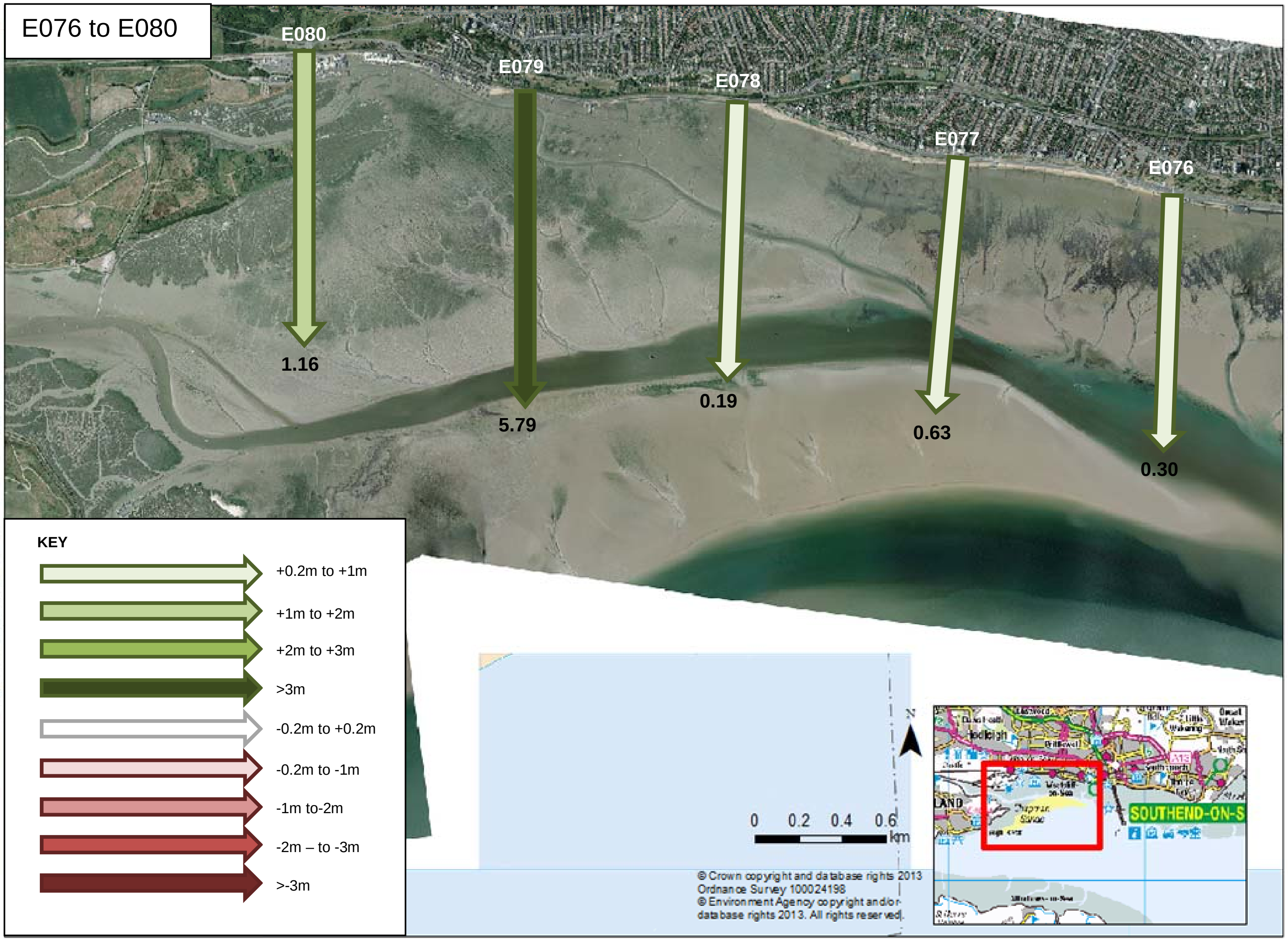

E076 to E080
E080
E079
E078
E077
E076
1.16
5.79
0.19
0.63
0.30
KEY
+0.2m to +1m
+1m to +2m
+2m to +3m
>3m
-0.2m to +0.2m
-0.2m to -1m
-1m to-2m
-2m – to -3m
>-3m
0 0.2 0.4 0.6 km
N
SOUTHEND-ON-S
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4.0 Appendices

4.1 Detailed results

New Name	Old Name	Location	Defence	Metres per year			Mean		Tide levels used	NOTES
				MHWS/ MHWN	MSL	MLWS/ MLWN	m/yr	FCP		
E001	E1D1A	Harwich	sea wall and groyne	-0.01	-0.22	0.40	0.06	1	MHWS & MLWS	
E002	E1D2		recurved sea wall	0.03	0.04	0.11	0.06	1	MHWS & MLWS	
E003	E1D3		concrete revetment	0.00	0.01	-0.69	-0.23	-1	MHWS & MLWS	Sea defence at MHWN and MSL
E004	E1D4		clay embankment	-1.39	-1.20	-1.39	-1.33	-4	MHWS & MLWS	Saltmarsh behind dune may destort trend at MHWN
E005	E1D5		embankment and groyne (shore parallel)	0.00	-0.80	-1.17	-0.66	-1	MHWS & MLWS	Sea defence at MHWN but clear at MHWS
E006	E1D6		none	-0.29	-1.28	1.68	0.04	-2	MHWS & MLWN	Saltmarsh behind dune may destort trend at MHWN Sea defence at MSL
E007	E1C1	Walton, Stone Point	none	-2.15	-2.85	-5.22	-3.41	-5	MHWS & MLWN	
E008	E1C2	Walton-on-the-Naze	clay embankment	-2.08	-3.25	-2.99	-2.77	-4	MHWS & MLWN	
E009	E1C3		clay sea wall with concrete slab revetment and asphalt crest path	-1.68	-1.79	-2.15	-1.87	-4	MHWS & MLWS	
E010	E1C4A		none	-1.79	-1.10	-1.13	-1.34	-4	MHWS & MLWS	
E011	E1C5A		none	-1.20	-1.13	-0.62	-0.99	-5	MHWS & MLWS	
E012	E1C6		concrete recurved sea wall	-0.15	-0.40	-0.47	-0.34	-5	MHWN & MLWN	
E013	E1C7		concrete recurved sea wall	0.04	0.29	-0.47	-0.05	-1	MHWN & MLWS	Sea defence at MHWN
E014	E1B1		concrete recurved sea wall	-0.07	0.04	-0.07	-0.04	0	MHWN & MLWN	Sea defence at MHWN
E015	E1B2	Frinton-on-Sea	concrete recurved sea wall	0.26	0.47	0.40	0.38	5	MHWN & MLWN	Sea defence at MHWS
E016	E1B3		concrete recurved sea wall and stepped revetment	-0.07	0.15	1.10	0.39	1	MHWS & MLWS	
E017	E1B4		concrete recurved sea wall and stepped revetment and groyne	0.01	-0.22	-0.11	-0.11	0	MHWN & MLWN	Sea defence at MHWN
E018	E1B5A		clay seawall and armour rock, stone revetment and concrete crest wall	0.29	0.26	-0.26	0.10	2	MHWN & MLWN	Sea defence at MHWS and MSL
E019	E1B6	Holland-on-Sea	clay seawall, slab revetment and concrete crest wall	0.07	0.15	-0.22	0.00	-1	MHWN & MLWN	Sea defence at MHWS and MSL
E020	E1A1S		piling	-0.02	0.00	-0.22	-0.08	-1	MHWN & MLWN	Sea defence at MHWS
E021	E1A1		concrete sea wall with stepped revetment, rock armour	0.00	0.00	-0.11	-0.03	0	MHWN & MLWN	Sea defence at MHWN and MSL
E022	E1A2		concrete stepped wall and revetment	0.04	-0.07	-0.29	-0.11	-1	MHWN & MLWN	Sea defence at MHWN
E023	E1A3	Clacton-on-Sea	Recurved sea wall, revetment and rock armour	0.22	0.22	0.14	0.19	5	MHWN & MLWN	Sea defence at MHWN and MSL
E024	E1A4		recurved sea wall, toe piling	0.18	0.11	-0.15	0.05	2	MHWN & MLWN	Sea defence at MHWN and MSL
E025	E1A5		concrete sea wall	0.15	0.33	0.80	0.43	6	MHWS & MLWN	
E026	E1A6	Jaywick	clay seawall, concrete crest and essex revetment + beach recharge	-0.52	-0.47	-0.80	-0.60	-4	MHWS & MLWN	Trends from 1999 due to new fishtail groyne
E027	E1A7		clay seawall, concrete crest and essex revetment and fishtail groyne + beach recharge	-0.93	-1.20	0.15	-0.66	-2	MHWS & MLWN	
E028	E1A8		clay sea wall with essex blockwork revetment + beach recharge	7.19	6.24	6.46	6.63	4	MHWS & MLWN	Trends from 1999 due to new fishtail groyne New shore-parallel groyne constructed in 2008

E029	E1A9	Seawick	clay sea wall with essex blockwork revetment	-0.88	-0.80	-0.55	-0.74	-4	MHWS & MLWN	
E030	E1A10		clay tidal sea wall with essex block revetment	-1.57	-1.50	-0.77	-1.28	-4	MHWS & MLWN	
E031	E1A11	Lee-over-Sands	clay tidal sea wall with essex block revetment	0.01	-0.01	0.15	0.05	0	MHWS & MLWS	
E032	E1A12		none	1.28	0.40	1.93	1.20	4	MHWS & MLWN	
E033	E2A1	Mersea Island	clay embankment with essex block revetment	0.15	-1.42	-3.29	-1.52	-1	MHWS & MLWN	Sea defence at MHWN
E034	E2A2		none	-0.51	-4.75	-0.18	-1.81	-6	MHWS & MLWN	
E035	E2A3		clay embankment with revetment	0.04	-0.66	-4.09	-1.57	-1	MHWS & MLWN	
E036	E2A4		clay embankment with essex block revetment	-0.04	-0.69	1.75	0.34	1	MHWS & MLWN	Sea defence at MHWN
E037	E2A5		clay embankment with revetment	0.44	-5.66	-4.20	-3.14	2	MHWS & MLWN	
E038	E2A6		rock armour, revetment	0.11	-2.19	-0.47	-0.85	-1	MHWS & MLWN	
E039	E2A7	West Mersea	none	0.26	-0.02	-0.33	-0.03	2	MHWS & MLWS	
E040	E2A8		none	-0.22	-1.02	-6.35	-2.53	-6	MHWS & MLWN	
E041	E2A15	Bradwell Peninsular	lighter barges and clay seawall with essex block	0.00	-0.22	0.18	-0.01	0	MHWS & MLWN	Sea defence at MHWS and MHWN (Lighter barges)
E042	E3E1	Dengie, St Peters Flat	embankment	-3.58	9.42	6.97	4.27	-2	MHWS & MLWN	
E043	E3E2		clay sea wall, essex block revetment and timber wave break	-0.29	5.62	1.42	2.25	-2	MHWS & MLWN	
E044	E3E3		clay sea wall, essex block revetment and concrete wave break	-1.46	9.34	4.85	4.25	-2	MHWN & MLWN	
E045	E3E4	Dengie Flat	lighter barges, clay seawall, essex block revetment and timber wavebreak	0.29	2.63	-1.90	0.34	2	MHWS & MLWN	Saltmarsh at MHWS and MHWN (Lighter barges)
E046	E3E5		clay sea wall, essex block revetment	0.51	6.90	8.61	5.34	6	MHWN & MLWN	Sea defence at MHWS
E047	E3E6		clay sea wall, essex block revetment and concrete wave break	-1.90	3.25	14.49	5.28	-2	MHWN & MLWN	Saltmarsh at MHWS
E048	E3D1	Dengie, Ray Sand	earth embankment with concrete revetment	-2.77	9.16	10.29	5.56	-2	MHWN & MLWN	Saltmarsh at MHWS and MHWN
E049	E3D2		earth embankment with concrete revetment	-1.75	0.62	9.34	2.74	-2	MHWN & MLWN	Saltmarsh at MHWS
E050	E3D3		clay sea wall, essex block revetment and timber wave break	-1.31	8.36	14.13	7.06	-2	MHWN & MLWN	Saltmarsh at MHWS
E051	E3D4		clay sea wall, essex block revetment and timber wavebreak + old polder site	-0.99	1.17	20.99	7.06	-2	MHWN & MLWN	Saltmarsh at MHWS
E052	E3D5		clay sea wall and essex block revetment, concrete revetment + old polder site	-4.64	-0.15	65.59	20.27	-2	MHWN & MLWN	High and low water a little erratic
E053	E3D6		clay sea wall, essex block and concrete revetment	-0.01	0.40	15.51	5.30	1	MHWN & MLWN	Sea defence at MHWS and MHWN
E054	E3C1	Foulness Island	earth embankment with concrete revetment	-1.57	1.97	0.51	0.30	-2	MHWN & MLWN	
E055	E3C2		earth embankment with concrete revetment	-0.73	1.13	12.45	4.28	-2	MHWS & MLWN	
E056	E3C3		earth embankment with concrete revetment	-0.11	-0.15	-3.54	-1.27	-5	MHWN & MLWN	Saltmarsh at MHWS and MHWN

E057	E3C4		earth embankment with concrete revetment	-0.95	0.40	17.96	5.80	-2	MHWN & MLWN	Rock at MHWS and Saltmarsh at MHWN
E058	E3C5		earth embankment with concrete revetment	0.15	4.96	34.86	13.32	6	MHWN & MLWN	Sea defence at MHWS and rock at NHWN
E059	E3B1		earth embankment with concrete revetment	0.07	9.96	52.93	20.99	1	MHWN & MLWN	Sea defence at MHWS
E060	E3B2		earth embankment with concrete revetment	0.62	8.32	71.47	26.80	5	MHWN & MLWN	Saltmarsh at MHWS
E061	E3B3		earth embankment with concrete revetment	0.91	6.86	28.07	11.95	5	MHWN & MLWN	Saltmarsh at MHWS
E062	E3B4		grassed earth embankment with concrete revetment	2.92	6.72	12.41	7.35	6	MHWN & MLWN	Saltmarsh at MHWS
E063	E3B5		grassed earth embankment	-1.31	7.12	33.73	13.18	-2	MHWN & MLWN	Saltmarsh at MHWS
E064	E3A1	Shoeburyness	embankment with concrete cladding	0.07	5.33	23.51	9.64	1	MHWN & MLWN	Sea defence at MHWS and rock at NHWN
E065	E3A2		embankment with concrete cladding	0.55	10.29	54.86	21.90	6	MHWN & MLWN	Sea defence at MHWS and rock at NHWN
E066	E3A3		grassed earth embankment	-0.44	6.83	2.04	2.81	-2	MHWN & MLWN	Saltmarsh at MHWS
E067	E3A4		concrete sea wall	-0.04	2.41	25.62	9.33	1	MHWN & MLWN	Saltmarsh at MHWS
E068	E3A5		embankment	-0.40	24.56	44.90	23.02	-2	MHWN & MLWN	
E069	E3A6		recurved sea wall	0.11	0.07	11.10	3.76	1	MHWN & MLWN	Sea defence at MHWS and MHWN
E070	E4A1		revetment with concrete crest and groyne	0.00	-0.44	14.56	4.71	1	MHWN & MLWN	Sea defence at MHWS and MHWN
E071	E4A2	Shoebury Common	concrete sea wall	-0.02	-0.11	0.07	-0.02	0	MHWN & MLWN	
E072	E4A3	Southend-on-Sea	sea wall	0.00	-0.04	6.79	2.25	1	MHWS & MLWN	
E073	E4A4		sea wall with stone revetment	1.42	1.39	4.67	2.49	5	MHWN & MLWN	Sea defence at MHWS upto 2002B then sediment
E074	E4A5	Southend-on-Sea	sea wall with stone revetment	1.10	0.29	10.22	3.87	5	MHWS & MLWN	
E075	E4B1	Southend-on-Sea	concrete revetment	0.22	0.47	5.29	2.00	6	MHWS & MLWN	
E076	E4B2		concrete revetment	-0.01	0.07	0.84	0.30	1	MHWS & MLWN	Sea defence at MHWS and MHWN
E077	E4B3		sea wall and groyne enclosure	-0.07	0.03	1.93	0.63	1	MHWN & MLWN	Sea defence at MHWS
E078	E4B4		pitching	0.15	-0.95	1.39	0.19	5	MHWN & MLWN	Sea defence at MHWS
E079	E4B5		pitching and armour	-0.01	11.97	5.40	5.79	1	MHWS & MLWN	Sea defence at MHWS and MHWN (profile crosses MSL amd MLWN a lot hence rates are meaningless)
E080	E4B6		concrete paved earth embankment	0.66	1.97	0.84	1.16	5	MHWN & MLWN	Saltmarsh at MHWS and MHWN

4.2 Essex profiles, new names/old names

Transect ID	Old ID	Type	Monitoring cell	Monitoring cell ID
E001	E1D1A	Essex	Harwich - Hamford Water	HR
E002	E1D2	Essex	Harwich - Hamford Water	HR
E003	E1D3	Essex	Harwich - Hamford Water	HR
E004	E1D4A	Essex	Harwich - Hamford Water	HR
E005	E1D5	Essex	Harwich - Hamford Water	HR
E006	E1D6	Essex	Harwich - Hamford Water	HR
E007	E1C1	Essex	Walton-on-the-Naze	WN
E008	E1C2	Essex	Walton-on-the-Naze	WN
E009	E1C3	Essex	Walton-on-the-Naze	WN
E010	E1C4A	Essex	Walton-on-the-Naze	WN
E011	E1C5A	Essex	Walton-on-the-Naze	WN
E012	E1C6	Essex	Walton-on-the-Naze	WN
E013	E1C7	Essex	Walton-on-the-Naze	WN
E014	E1B1	Essex	Walton-on-the-Naze	WN
E015	E1B2	Essex	Walton-on-the-Naze	WN
E016	E1B3	Essex	Walton-on-the-Naze	WN
E017	E1B4	Essex	Walton-on-the-Naze	WN
E018	E1B5A	Essex	Tendring - Holland	TH
E019	E1B6	Essex	Tendring - Holland	TH
E020	E1A1S	Essex	Tendring - Holland	TH
E021	E1A1	Essex	Tendring - Holland	TH
E022	E1A2	Essex	Tendring - Holland	TH
E023	E1A3	Essex	Tendring - Holland	TH
E024	E1A4	Essex	Tendring - Holland	TH
E025	E1A5	Essex	Tendring - Holland	TH
E026	E1A6	Essex	Clacton - Jaywick	CJ
E027	E1A7	Essex	Clacton - Jaywick	CJ
E028	E1A8	Essex	Clacton - Jaywick	CJ
E029	E1A9	Essex	Seawick	SK
E030	E1A10	Essex	Seawick	SK
E031	E1A11	Essex	Seawick	SK
E032	E1A12	Essex	Seawick	SK
E033	E2A1	Essex	Mersea Island	MI
E034	E2A2	Essex	Mersea Island	MI
E035	E2A3	Essex	Mersea Island	MI
E036	E2A4	Essex	Mersea Island	MI
E037	E2A5	Essex	Mersea Island	MI
E038	E2A6	Essex	Mersea Island	MI
E039	E2A7	Essex	Mersea Island	MI
E040	E2A8	Essex	Mersea Island	MI
E041	E2A15	Essex	Dengie Flats	DF
E042	E3E1	Essex	Dengie Flats	DF
E043	E3E2	Essex	Dengie Flats	DF
E044	E3E3	Essex	Dengie Flats	DF
E045	E3E4	Essex	Dengie Flats	DF
E046	E3E5	Essex	Dengie Flats	DF
E047	E3E6	Essex	Dengie Flats	DF
E048	E3D1	Essex	Dengie Flats	DF
E049	E3D2	Essex	Dengie Flats	DF
E050	E3D3	Essex	Dengie Flats	DF
E051	E3D4	Essex	Dengie Flats	DF

E052	E3D5	Essex	Dengie Flats	DF
E053	E3D6	Essex	Dengie Flats	DF
E054	E3C1	Essex	Maplin Sands	MS
E055	E3C2	Essex	Maplin Sands	MS
E056	E3C3	Essex	Maplin Sands	MS
E057	E3C4	Essex	Maplin Sands	MS
E058	E3C5	Essex	Maplin Sands	MS
E059	E3B1	Essex	Maplin Sands	MS
E060	E3B2	Essex	Maplin Sands	MS
E061	E3B3	Essex	Maplin Sands	MS
E062	E3B4	Essex	Maplin Sands	MS
E063	E3B5	Essex	Maplin Sands	MS
E064	E3A1	Essex	Maplin Sands	MS
E065	E3A2	Essex	Maplin Sands	MS
E066	E3A3	Essex	Maplin Sands	MS
E067	E3A4	Essex	Maplin Sands	MS
E068	E3A5	Essex	Maplin Sands	MS
E069	E3A6	Essex	Maplin Sands	MS
E070	E4A1	Essex	Southend-on-Sea	SE
E071	E4A2	Essex	Southend-on-Sea	SE
E072	E4A3	Essex	Southend-on-Sea	SE
E073	E4A4	Essex	Southend-on-Sea	SE
E074	E4A5	Essex	Southend-on-Sea	SE
E075	E4B1	Essex	Southend-on-Sea	SE
E076	E4B2	Essex	Southend-on-Sea	SE
E077	E4B3	Essex	Southend-on-Sea	SE
E078	E4B4	Essex	Southend-on-Sea	SE
E079	E4B5	Essex	Southend-on-Sea	SE
E080	E4B6	Essex	Southend-on-Sea	SE

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