SeaScapes 2030

Beach Erosion Case Study

Short, Medium, and Long Term
Beach Erosion Analysis

Eastbourne Bandstand

Beach Survey at Eastbourne Bandstand

Eastbourne Bandstand occupies two “beaches”, its semicircular structure built in 1935 that extends into the shingle. A wooden groyne extends seaward from around the mid-section of the curved concrete revetment at the base.

The structure and central groyne provide good reference points to graphically illustrate the rate of erosion for short- medium and long-term time scales.

Real time observations, measurements and photographic records have been conducted to analyses the rate of erosion over the past 18 months.

Both short- and medium-term analysis of beach shingle movements have demonstrated that the rate of increase of erosion has increased significantly since the last major recharge program in 2011.

Historical satellite imagery of the beach, dating back two decades, graphically illustrates the beach sediment load has eroded and been recharged on many occasions since 2004, the completion of the £30 million groyne rebuilding program.

Case Study A- Short Term Beach Erosion

Field Study Eastbourne Bandstand 18th to 19th February 2022

The shingle deposits along the coastal margin between Beachy Head and Cooden Beach are subject to vigorous erosion and longshore drift. The following basic field surveys provides estimates of short-term rates of shingle losses from this beach. Two weeks after the storms the beach was reprofiled mechanically.

Short Term Loss

Short term is defined for periods of 24 hours to 48 hours.

Three named storms; Dudley, Eunice and Franklin passed across the UK between 18th and 25th February 2022. At the height of storm Dudley wind speeds of 80 mph were recorded in conjunction with Spring tides. As the storm was building on 18th February 2022 a basic survey was conducted on the beach that fronts Eastbourne Bandstand. The data collected included photographs and direct measurements of recognisable reference points located on structures such as wooden groynes and the Bandstand edifice.

The survey was conducted as storm Dudley was building, the resultant waves impacted onto the beach at an approximate angle of 45° (Figure 1). This is the prevailing direction and demonstrates the forces responsible for moving the shingle north-eastwards.

Figure 1: *Photograph of the beach fronting Eastbourne Bandstand. Taken on 18th February 2022 as storm Dudley was building during the ebbtide. Waves from a southwest direction impacting on the beach at approximately 45^0. Photo G. Caira.*

Case Study A Short-Term Beach Erosion

Figure 2: *The beach after storm Dudley and initial impact of storm waves. There is a significant sand content in the beach deposit mixed with small round pebbles that has very likely contributed to the apparent acceleration in erosion since 2018. Photo G. Caira.*

Case Study A Short-Term Beach Erosion

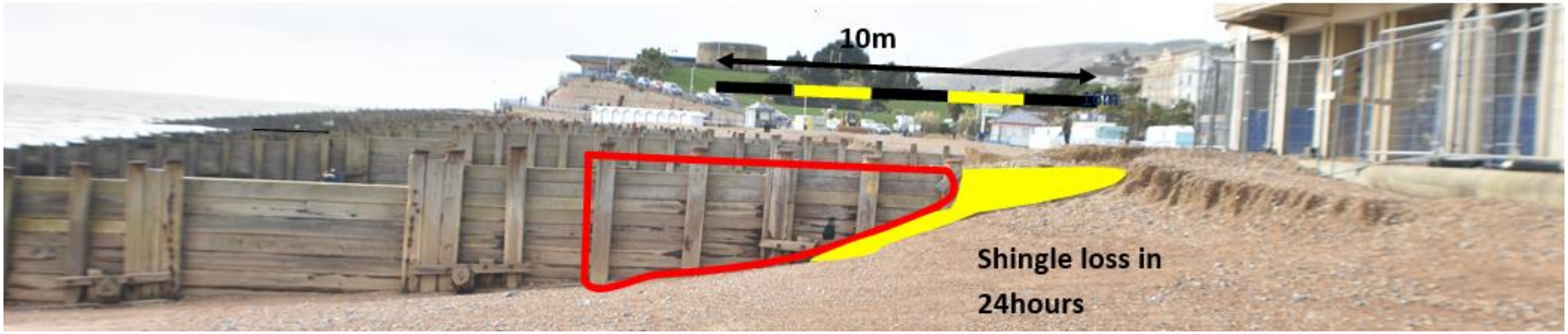

Figure 3: *Beach profile 24 hours later after the height of storm Dudley. The high tide mark has eroded back considerably in the 24-hour period. Photo G. Caira.*

Area of approx yellow triangle, newly exposed groyne	0.7 x 0.5 x 2.2	0.77m^2
Area of approx yellow strip	2.3 x 0.3	0.69m^2
Total loss		1.46 m^3 per m
The beach width is 55m		80.3 m^3
Theer is less errosion on the SE side. Estimate 10% reduction in volume	80.3 x 0.1 = 8 Estimated beach loss in 24hours	72.2m^3

Table 1: *Estimate of Shingle Loss from Bandstand Beach between 18th and 19th February 2022.*

Case Study A Short-Term Beach Erosion

***Figure 4**: The Bandstand beach after reprofiling work undertaken on 1st March 2022. Photo G. Caira.*
There appears to be more sand than shingle in the newly formed beach head. This mix of sand and shingle does not provide much protection and is easily washed away by storm waves.

Case Study A Short-Term Beach Erosion

Case Study B- Medium-Term Beach Erosion

Field Study Eastbourne Bandstand 18th Feb 2022 to 10th July 2023

Medium Term Loss

Medium term is defined for periods 16 months.

The beach that fronts Eastbourne Bandstand was recharged following the erosion caused by Dudley, Eunice and Franklin passing across the UK between 18th and 25th February 2022.

The image below is from May 2022 and the beach head is approximately 20 m further seaward.

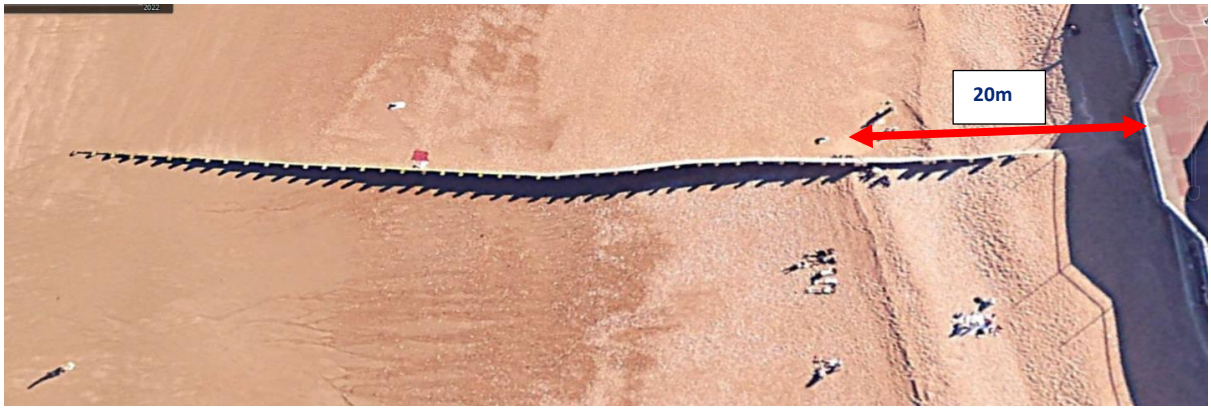

***Figure 1**: Satellite Image showing beach head HW to be within 20 m of the bandstand in May 2022.*

Figure 2: *The Bandstand beach on 22nd Oct 2022. The beach has been recharged following the February storms and then eroded back around 17m during the summer and autumn. Photo G. Caira.*

Case Study B Medium-Term Beach Erosion

Figure 3: *The Bandstand beach on 2nd March 2023. The yellow arrows indicate the distance the shingle sand mix has eroded back another 1.5 m over the winter. Photo G. Caira.*

Figure 4: *The Bandstand beach on 29th June 2023. Using the beach loss model from the survey conducted in February 2022, the beach has been recharged with around 1000 m^3 of unsuitable ballast. Which at previous costs of £15 per m^3 equates to another £16 ,500 on just one of many beaches. Photo G. Caira.*

Reprofiling with heavy machines has compacted the ballast into a hard slope that allows the clasts to easily roll down. Along the water's edge deposits of the grey cobbles have accumulated. Further up the beach the small round pebbles and sand have been easily washed into small ridges by the relatively calm sea.

Case Study B Medium-Term Beach Erosion

Figure 5: *Bandstand beach on 10th July following long Spring tides, between the 4th and 6th July, combined with 1m swell waves impacting from the south west. This relatively benign set of marime conditions has stripped back a significant amount of the newly recharged beach. Photo G. Caira.*

Summary

During the spring of 2022 the beach in front of the Bandstand appears to have been recharged, then over the autumn and winter eroded back by storms and spring tides.
Over the 18-month period between the storms of February 2022 and July 2023 a significant amount of shingle has been lost from the beach.
The recharge and reprofiling of the beach were conducted during the late spring of 2023, and extended the beach head around 20 meters seawards.
The beach is 55 m wide, so around 1100 m^3 ballast at a cost of £15 per m^3 equates to £16,500
In early July 2023, during particularly long spring tides in conjunction with a 1m SW swell the ballast was eroded back 2m, equating to 110m^3 across the beach.

Case Study C Long-Term Beach Erosion

Historical Satellite Image Analysis for period December 2004 and July 2022

The third broad brush analysis of beach erosion attempts to quantify the amount of shingle loss over the 19 years since the beach was at its maximum extent during this period . This has been achieved by using the wooden groynes and Bandstand structure that enclose the beach as a reference. Since December 2004 when the first arial photographs of the beach became available the subject beach has eroded, been recharged and recycled on an number of occasions. This is costly to both the tax payer and environment. After storm events this mix of sand and shingle renders the beaches unsafe due to a rare geological phenomenon known as “cliffing”.

During the following 19 years, the snap shots through time, represented by the coloured limits, demostrates the dynamic nature of the beach erosion and signifcant changes to the shingle deposit between December 2004 and July 2023. Fugure 1.

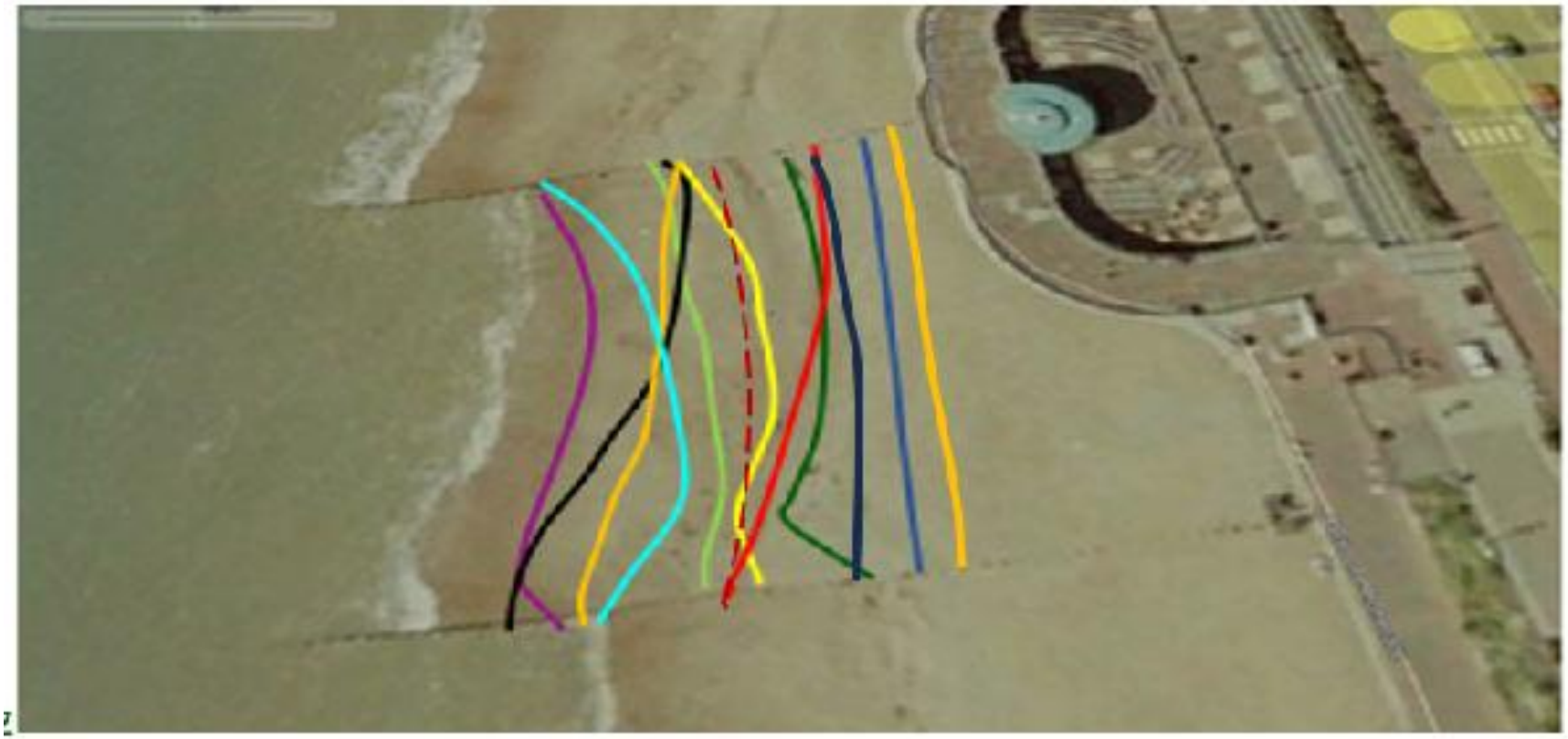

Figure 1: The time snap shots from historical Google Earth image archives. The coloured lines above represent the extennt of shingle that is level with the top of enclosing groynes. Each colour repesents the time the arial photo was taken and are referenced in the table below.

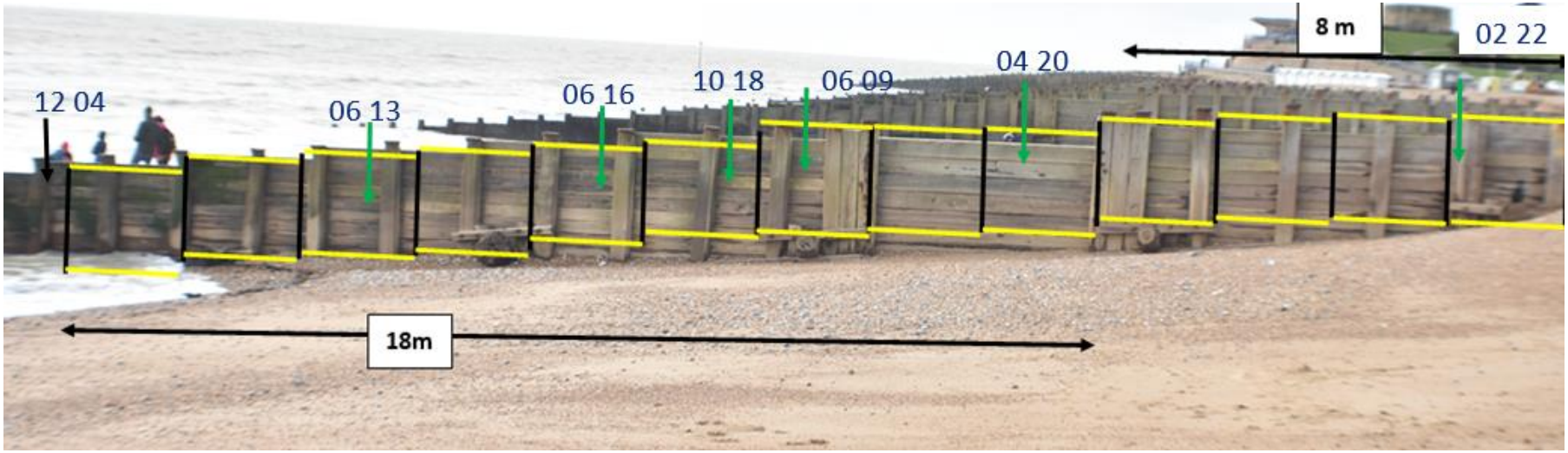

Figure 2: *Beach erosion model. The volume of shingle loss has been estimated from the exposed groyne that was completely covered by shingle in 2004. The high tide limits for different dates during the following 18 years are indicated with green arrows.*

Figure 3: *Northeastern side of the beach. The beach gently slopes up from the SW to NE laterally across the beach. The red lines follow the approximate trend of the deposit against the opposite groyne. Taken on 1st March 2022 after the three named storms had eroded and reprofiled the beach.*

	2004 limit considered full recharge	
		Model loss per m regress: 40.45 m^3
	2005Estimated 2m regress	-80.90 m^3
	2009Estimate 12m regress	- 485.4 m^3
	2013 Estimate 8m recharge	+ 323.6 m^3
	2016 Estimate 4m regress	-161.8 m^3
	2018 Estimate 2m regress	-80.90 m^3
	2020 Estimate 6m regress	-242.7 m^3
	2021 Estimate 2m regress	-80.90 m^3
	2022 Estimate 6m regress	- 242.7 m^3
	2023 Estimate 8m regress	-323.6 m^3
	2023 post recharge 20m	+809 m^3
	Total Sediment Budget	1875.5 m^3
	Annual average over 23 years	81.54 m^3

Table 1: *Estimated Sediment Budget for Bandstand East Beach.*

If the erosion can be asumed constant for all 139 neaches between Holywell and Langley Point the total annual loss is 81.54 x 139 = 11,334m^3 per anum overall average. This appears to be 50% of the figure estimated delow. Either there is more loss from some of the other beaches or the method employed is not accurate enough.

The published recharge of the beach between the Wish Tower and Soveriegn Harbour is 200,000m^3 in 2011[5] If this can be assumed lost since deposition then

the average conforms with the other estimates of annual beach loss of 20,000m^3.

This compares with the published anual bugget of 20,000m^3 loss for the Pevensey levels. And The SCOPAC[6] area Seaford Head to Cuckmere Haven calculated using LITPACK at 25k m^3 per annum.