### Report Log

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<th>This Unit Bexhill (MU26)</th>
<th>East direction Bulverhythe (MU25)</th>
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Executive Summary

Shingle beaches provide a vital element of the flood and coastal erosion defences along the Bexhill frontage. The monitoring and management of this asset is therefore crucial to the successful and sustainable delivery of flood and coastal erosion protection.

The condition and performance of different beach sections are currently monitored through the Strategic Regional Coastal Monitoring Programme. This report evaluates changes along the coastline over the period June 2006 to July 2007 and makes comparisons to previous surveys conducted since the outset of the project in 2003. The key findings are listed below;

- A net gain of 27,405m$^3$ was observed along the entire Bexhill frontage over the last year (June 2006 to July 2007)
- In total, the Bexhill frontage has now gained 40,103m$^3$ (+10,026m$^3$/year) over the last four years since the monitoring project began (2003-2007). This is in direct contrast to the loss rate of -5,000m$^3$/year predicted in the Cooden-Cliff End Strategy Plan (2002).
- The frontage by the De La Warr Pavilion (section four) remains the most erosive area with loses of 13,647m$^3$ over the last year.
- Section two Veness Gap to West Parade continues to show an increasing trend of accretion, with net gains raised to 20,107m$^3$ over the reporting period, almost four times that of the previous period.
- Beach crest levels are on the whole reasonably healthy well clear of ‘action’ trigger levels defined in the Cooden – Cliff End Strategy Plan (2002). The one exception to this is the beach in front of Channel View West, this has a combination of low crest height and reduced crest width.
- Five storms exceeded the storm threshold of a 3m significant wave height ($H_s$) at the Pevensey wave buoy. All but one storm with a $H_s$ over three metres occurred in December/January 2006-2007, with an additional event in March.
- A Post Storm Survey was conducted on the 9th December. The survey followed two weeks of stormy weather and had an almost universal effect on profile configuration. Losses were observed along the crest and upper beach, however losses were regained over the period leading up to the summer.

It is important to recognise the inconsistency in short-term trends. As with many coastal areas a lot of annual variability is expected, thus drawing conclusions with increased confidence will become possible as more data is collected, with regards annual losses, net sediment drift and erosion/accretion trends in section sub-units.
1.0 Introduction

As part of the strategic regional coastal monitoring project the beach has been surveyed three times a year since the summer of 2003 with land based GPS techniques. These comprise biannual profile surveys and an annual beach plan survey, full details of which can be found in the explanatory notes (Annex A). In addition to this bathymetric surveys of the adjacent seabed were conducted in 2003 and 2006. The location of the frontage is shown in Figure 1.1-1, this includes the location of tide and wave gauges in the southeast region.

This report covers the changes in beach topography between the 2006 summer beach management plan survey and the most recent 2007 survey. A previous report (BMP34, 2006) covers the observed changes between the 2005 and 2006 summer beach management plan surveys.

Bexhill frontage is managed by Rother District Council who maintain a ‘hold the line’ policy in order to protect the rail/road infrastructure and settlements.

Note management unit boundaries were modified in 2007; MU26 (BMP51 2007) replaces MU5 and the western half of MU6 (BMP34 2006).
1.1 Management Unit 26: Bexhill

Management Unit 26 consist of 5km of beach from Cooden to the point where the railway meets the frontage east of Galley Hill.

Bexhill-on-Sea is protected by a variety of defence structures. The whole frontage consists of a shingle beach maintained by a series of timber groynes. At the western end (Cooden) the shingle ridge is wide and backed by a grassy embankment. Moving eastwards, towards Veness Gap, the shingle ridge reduces in width and is backed by a promenade with a splash wall. Further eastwards the topography of the coastal fringe rises and then starts to descend into an area known as ‘West Parade’. In this region, the shingle is retained by a series of timber groynes and is backed by a vertical concrete wall and promenade, which protects Western Bexhill. A large number of residential properties exist at the back of this promenade.

West Parade has a history of flooding due to wave overtopping of the existing coastal defences; consequently the area is more sensitive to changes in beach levels. Beyond this point towards De La Warr, the coastline is relatively straight and protects the old town of Bexhill. The existing defences consist of a near vertical blockwork wall with promenade fronted by a shingle beach and timber groynes.

At De La Warr, the western section of the Management Unit, the frontage forms a slight headland with most properties set back a considerable distance inland, these are unlikely to be affected by overtopping or flooding. From this point east the coastline becomes more jagged and is defended by a series of timber groynes and a shingle beach backed by a vertical wall and promenade.

At Sutton Place the coastline begins to rise to form the sedimentary rock slopes at Galley Hill. A shingle beach in combination with a series of timber groynes defends this frontage. To the rear of the beach the slopes are protected by a concrete wall.
2.0 Surveys

All topographic and bathymetric surveys are referenced to a Global Positioning System (GPS) control grid, established for this programme, and conducted according to the current Environment Agency’s National Specification, summarised in the Explanatory Notes (Annex A).

2.1 Topographic

The schedule of completed surveys since the start of the Regional Monitoring Programme is given in Table 2.1-1. Note management unit boundaries were modified in 2007; MU26 replaces MU5 and the Western half of MU6.


<table>
<thead>
<tr>
<th>Profile</th>
<th>Beach Plan</th>
<th>Post-storm</th>
<th>Bathymetric</th>
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<td>25/03/2004</td>
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<td></td>
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<td>01/09/2004</td>
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<tr>
<td>16/11/2004</td>
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<td></td>
</tr>
<tr>
<td>20/04/2005</td>
<td></td>
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</tr>
<tr>
<td>20/06/2005</td>
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<td>06/05/2006 (MU6)</td>
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<tr>
<td>06/06/2007</td>
<td></td>
<td>02/07/2007</td>
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</tr>
<tr>
<td>31/10/2007</td>
<td></td>
<td></td>
<td></td>
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2.2 Bathymetric

A schedule of surveys since the start of the Regional Monitoring Programme is given in Table 2.2-1. Contour Maps of the latest survey are available upon request.

<table>
<thead>
<tr>
<th>Date</th>
<th>Line Spacing</th>
<th>Distance Offshore</th>
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<tr>
<td>06/05/2006 (MU6)</td>
<td>50m</td>
<td>1,000m</td>
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3.0 Analysis

3.1 Difference Models

Now that the 2007 beach management plan data set has been compiled, it is possible to overlay the results of the survey with the previous years data (2006). This enables comparative volumetric analysis to be undertaken to determine change over a given period. Through the use of three dimensional ground models and the ortho-rectified aerial photographs it is possible to create a visual interpretation of the volumetric change that has occurred during each analysis period.

Plate 1. shows the difference models generated from the summer 2007 survey minus the Summer 2006 survey, with negative values (red) representing erosion that has occurred during that past period and positive values (black) accretion, note that 0.25m difference in elevation is considered as “no change”. Whilst these figures show an overall change in beach volume within each discrete ‘survey cell’, it should be recognised that the data is based on the beach management survey which is undertaken annually. It is therefore only a snapshot in time and the particular dynamics of each frontage need to be considered. This will ensure that the information shown in the difference models represents the net change rather than capturing a particular extreme variation caused by a large event.

3.2 Profile Evolution

To ensure that the results from the difference models are representative of net change rather than a particular event that may have been captured by the survey, the beach profiles have been cross referenced with the profile-only surveys carried out on a biannual basis. This then gives an indication of the beach variability over three time steps in each individual year. Profiles also provide important information about the change in beach shape/gradient that is not always apparent from difference models.

Section 3.3 contains a narrative summarising the changes that have taken place over the last year, as part of this exercise hypotheses regarding the processes driving these changes are made. This has been carried out for a number of locations along the frontage, with survey sections organised into groups that have undergone similar erosion and deposition patterns. Where appropriate profile plots have been included to illustrate any significant change.

A Cross-sectional area (CSA) has been calculated for all beach profiles. This is calculated as the area of profile above a Master Profile. In general, the lower boundary of the Master Profile is the transition between the beach material and the foreshore. The landward boundary is the seawall or, where a hard structure is not present, the landward extent of the stable part of the beach. The Master Profile is held constant for a given profile line and therefore the changes in CSA through time can be derived.
3.3 Management Unit 26

The management unit is split into 45 survey cells, typically bounded by groyne structures, depicted in Figure 3.3-1, Figure 3.3-2, and Figure 3.3-3. To aid purposeful analysis these survey cells have been grouped into sections reflecting changes in beach configuration and/or the presence of terminal structures. Analysis sections used in previous MU 5 & 6 reports are retained for consistency. Detailed analysis for each section is provided on the following pages.

Table 3.3-1 provides a summary of volume change within each survey cell during the period between the 2006 and 2007 summer surveys.

<table>
<thead>
<tr>
<th>Section</th>
<th>Cells</th>
<th>Survey Area</th>
<th>Error Estimate*</th>
<th>Erosion/Accretion (2006 to 2007)</th>
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<tr>
<td>1</td>
<td>1-8</td>
<td>90,185m³</td>
<td>± 271m³</td>
<td>1,036m³</td>
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<tr>
<td>2</td>
<td>9-14</td>
<td>50,626m³</td>
<td>± 152m³</td>
<td>-2,756m³</td>
</tr>
<tr>
<td>3</td>
<td>15-20</td>
<td>54,112m³</td>
<td>± 162m³</td>
<td>389m³</td>
</tr>
<tr>
<td>4</td>
<td>21-25</td>
<td>58,085m³</td>
<td>± 174m³</td>
<td>-1,855m³</td>
</tr>
<tr>
<td>5</td>
<td>26-34</td>
<td>50,513m³</td>
<td>± 152m³</td>
<td>3,706m³</td>
</tr>
<tr>
<td>6</td>
<td>35-45</td>
<td>64,760m³</td>
<td>± 194m³</td>
<td>-9,522m³</td>
</tr>
<tr>
<td>Total</td>
<td>1-95</td>
<td>368,281m³</td>
<td>-</td>
<td>-9,002m³</td>
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</table>

* Error estimates are calculated as the survey area multiplied by a ± 30mm error margin, although unlikely the error of combined surveys can be up to double this figure
Figure 3.3-1: Management Unit 26 Beach analysis sections (West)
Figure 3.3-2: Management Unit 26 Beach analysis sections (Centre)
Figure 3.3-3: Management Unit 26 Beach analysis sections (East)
3.3.1 Section 1: Cells 1-8

This section covers the 1.5km from Cooden to Veness Gap, the area has a number of timber groynes at 40-60m intervals. Several of these groynes are covered by shingle and at present provide little benefit in arresting sediment transport. The net gain over the last year (2006/07) was 6,771m³ compared to 2,740m³ over the 2005/06 period. In contrast to the previous reporting period gains are found to the western end of the analysis section fed by losses across the eastern end.

The principle erosion event took place between 27th September and 9th December 2006 due to a storm event. During this period a large volume was excavated from the toe and the eastern end of the analysis section shows the autumn ridge was removed (shown in red). The excavation is prominent across most of analysis section one, however it moves beyond the survey cells so is not wholly included in the difference calculation, which would otherwise show greater net losses.

Much of the material, including that extracted seaward of the difference calculation areas, appears to have moved within the analysis section accreting across the western profiles where the coast changes orientation. The accretion has been fairly uniform with a tendency to build up the seaward height and width of the berm.

The profiles show this analysis section to be seasonally dynamic, however the net loss of material does not appear to be significant in terms of the integrity of the beach.

Figure 3.3-4: Profile 4c01667 (Cell 1) indicates a loss of sediment during winter 2006.
3.3.2 Section 2: Cells 9-14

Comprising 750m of groined beach extending from Veness Gap to West Parade, this area gained 20,107m³ in the year 2006/07. The pattern of accretion begins in the western end of the previous section opposite Winceby Close (cell 7), and runs through to section three opposite Polegrove Recreation Ground (cell 16). The gains are spread across berm, face, and toe, with the largest area of accretion being the berm, thus resulting in increased crest height, and occasionally width.

After initial losses of some 8,000m³ in the first year (2003-2004), annual net gains have been steadily increasing with the current year showing a 3.5 fold increase over the previous reporting period.

Figure 3.3-5: Profile 4c01624 (Cell 12) show gains to the beach crest at the end of winter 2006/07.
3.3.3 Section 3: Cells 15-20

The central part of *West Parade* exhibited a net gain in beach volume of 10,800m$^3$ between 2006 and 2007. The source of accreted material is likely to be littoral transport and the landward movement of near shore materials.

As in 3.3.1 Section 1 there are losses beyond the difference calculation limits, in this case opposite *Brockley Road* (cell 18), this material may well have been transported to the upper beach.

![Figure 3.3-6: Profile 4c01603 (Cell 18) show gains to the upper beach and the foreshore beyond the ~70m difference calculation limit.](image)
3.3.4 Section 4: Cells 21-25

Comprising 780m of groyned beach in front of the De La Warr Pavilion, in the year 2006/07 this area lost 13,647m³, mainly from the upper beach. This analysis section has shown a degree of volatility since monitoring began in 2003 (see Table 3.4-1), the latest figures represent the highest loss recorded annual loss, although it is of a similar magnitude to that witnessed in the 2003/04 period. The loss to the berm (5m+) is thought to be a result of the particularly stormy 2006/7 winter rather than a general erosion trend.

Figure 3.3-7: Profile 4c01578 (Cell 24) show loss of upper beach and berm width.
3.3.5 Section 5: Cells 26-34

Extending from *De Le Ware* to *Sutton Place* this area has shown a reversal of a three-year trend of net loss, in gaining 13,310m³ over the 2006-2007 reporting period.

The otherwise destructive principle winter storm proved to be a major constructive event on this section of coastline; this is most likely contributed to by the change in orientation of the coast. The material accreted across the face and seaward of the toe, the area beyond the toe proved more transient in nature and was removed before the autumn profiles.

Groynes were uncovered during the previous reporting period (2005-2006) and aided the retention of material; this effect appears to remain active.

There are areas beyond the calculation polygons that could provide a source for a proportion of the material accreting on the upper beach, although the majority is thought to have been transported from section 5 given the closely matching volume change figures in Table 3.4-1.

![Figure 3.3-8: Profile 4c1560 (Cell 30) shows a stable berm with gains across the beach face with erosion beyond the beach toe.](image-url)
3.3.6 Section 6: Cells 35-45

The area from Sutton Place through to the Bulverhythe scheme continues to lose material in much the same pattern as the previous reporting period, namely the upper beach and beach crest. The beach crest has generally been reduced in width and in some case height.

Considering the near balanced erosion and accretion volumes of sections 4 and 5 respectively and the dominant west to east drift, it is fair to assume most of the material lost in section 6 has moved into the Bulverhythe frontage.

This section has not seen net gains since 2003-2004 where the entire section gained material totalling 16,000m³, the sections has experienced a net loss of 6,132m³ over the last four years.

Figure 3.3-9: Profile 4c01537 (Cell 40)
3.4 Long Term Summary

There has been a gain of over 27,000m³ across the management unit during the 2006-2007 reporting period. This shows a significant increase in beach volume in comparison to pervious years; in the last reporting period there was a loss of 6,428 while in the first two years there was a 19,126m³ increase.

Looking at the net volume changes since monitoring began sections one, two, and three have a trend of accretion, while sections four, five and six have been subject to material loss. The current reporting period sees section five returning its first net gain after several years showing decreasing magnitudes of loss, it is likely that without exceptional incidence, that the 2008 summer survey will show further gains. As the first three sections approach equilibrium it can be expected that increasing levels of material will become available to the latter sections through littoral transport.

The active management of Pevensey Bay to the east provides a reasonably uninterrupted supply for east-west littoral transport along this stretch of coast; this would suggest that that accretion is not supply limited. The relatively high levels of accretion in this particular management unit could be a result of greater volumes of material subject to littoral transport during the exceptionally stormy 2006-2007 winter (see 5.0 Storm events).

The results and error estimates are summarised in Table 3.4-1.

Table 3.4-1: Beach Volume Change Summary (2003 - 2007)

<table>
<thead>
<tr>
<th>Area</th>
<th>Volume Change (m³)</th>
</tr>
</thead>
<tbody>
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<td>9-14</td>
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<td>15-20</td>
</tr>
<tr>
<td>4</td>
<td>21-25</td>
</tr>
<tr>
<td>5</td>
<td>26-34</td>
</tr>
<tr>
<td>6</td>
<td>35-45</td>
</tr>
<tr>
<td>Total</td>
<td>1-95</td>
</tr>
</tbody>
</table>
4.0 Wave Climate

This was the "stormiest" year since measurements began in July 2003, including nearly twice as many storms as the previous reporting year. Mid-November to early January was a particularly rough period. Storm wave approach was consistently from the southwest. Storm surges (at Newhaven) were larger than observed during storms in all previous years, reaching ~0.9m during the largest storm, and occurring within 2 hours of High Water.

A detailed analysis of the wave climate for July 2006 to June 2007 is given in Annex D.
5.0 Storm events

There were six storm events during the reporting period that exceeded the storm threshold of 3m. These occurred on 3rd December 2006, 7th December 2006, 30th December 2006, 11th January 2007, 18th January 2007 and 20th March 2007. The largest recorded significant wave height (Hs) was 4.23m and occurred during the 18 January 2007 storm. As a result, a post storm survey was carried out on the 9th December 2006 (Figure 3.4-1).

Based on beach profiles from the reporting period, the 3rd December 2006 storm event was the most destructive. The storm was generated by the passage of a well-developed frontal system. Although wave direction was predominantly from the southwest, there was less evidence of the storm being preceded by long period swell waves than has been observed on other occasions. Profiles taken a day after the significant wave height had dropped below 1m show the removal of a ridge that had built up in the 4th quarter of the last reporting period. The ridge is generally found at approximately 4-5m OD (Figure 3.4-2), which when taking into account increased wave height in shallow water is the same zone where storm waves were likely to be active.

Despite the volume loss the frontage shows a rapid build-up of material in the subsequence period up to the Spring Profiles 2007.
Figure 3.4-2: Profile 4c01658 (Cell 3) shows upper beach face loss during the 3rd December 2006 storm event (red), with subsequent gains (green) in the period leading up to the summer surveys.
6.0 Performance Overview

6.1 Critical Beach Conditions

The Cooden to Cliff End Strategy Plan (2002) sets out proposed beach crest levels, for illustrative purposes these are presented in Figure 6.1-1. Current beach crest levels at the seawall are also shown, these were derived from the June 2007 profiles, for means of comparison. Trigger levels have also been extracted from the strategy plan comprising an ‘action’ (yellow) and ‘emergency’ (red) level for each section.

The first half of Section One has seen losses in relation to the 2005/2006 crest heights, however levels remain above designed height.

The second half of Section One (profile 4c01656), the whole of section two, and the first four profiles of section three were up to a metre below design levels in the last reporting period. The majority of profiles have seen a gain in crest height; despite this increase most profiles are still on average 0.5m below the design profiles.

The remainder of Section Three from profile 4c01612 is on or above design levels; there have been some gains but overall little relative change.

The beach crest in the second half of Section Four from profile 4c01582 has seen a large drop on last year’s levels (0.5m+). At Channel View West (profile 4c01580) the crest is 0.5m above the Action Level this section should be closely monitored through subsequent survey periods.

Although below design levels the first half of Section Five has remained stable, while losses in the second have not reduced crest levels below design.

The first part of section six shows little change and is on or above design levels. Starting with profile 4c01544 the second part of Section Six falls below design levels, however with a few exceptions crest height has increased on last year.

Overall 57% of profiles have seen a crest level gain in comparison to the last reporting period. There has been on average a 120mm loss of beach crest across Management Unit 26, this has been skewed slightly by the large drop in crest levels in section four, without these the loss across the MU26 averages at 8mm.

During the last reporting period profile 4c01622 was the lowest crest height of the entire frontage (4.9m), although this has now gained 0.6m, in line with it neighbouring profiles it still remains below the design level.

Despite comparable beach crest levels to those proposed in the strategy plan along much of the coast, it should be kept in mind that there is a need for a functional crest width to absorb the impact of erosive events. Narrow crest widths are particularly significant where they coincide with low crest height notably at various profiles within Sections Four, Five, and Six.
Figure 6.1-1 Comparison of current and proposed beach crest levels and crest widths
7.0 Coastal works

7.1 Recycling

No records of recycling activities have been received, and it is presumed none have taken place. Bexhill does not lend itself to regular beach recycling operations due to the lack of a suitable borrow area; there are no large terminal structures, or areas that demonstrate consistent long-term accretion.

7.2 Replenishment

Although there have been no replenishment schemes along the Bexhill frontage the area is influenced by the Bulverhythe coastal defence scheme to the east, and the heavily managed section to the west, namely Pevensey Bay. Given the predominant sediment drift is from west to east, the Bexhill area is unlikely to benefit from the replenishment along the Bulverhythe frontage. Despite this, the management activities throughout the Pevensey Scheme have a profound influence on the sediment budget in Bexhill, dictating to a large extent the amount of sediment that is available to naturally enter the frontage from the east.
8.0 Conclusion

Bexhill coastline has gained 27,405m³ in the last year (2006-2007), with the exception of the 2005-2006 reporting period, Bexhill has seen increasing net import of material since reporting began in 2003, the total net gain now stands at 40,103m³.

Active management schemes to the East and West, Pevensey Bay and Bulverhythe respectively, may be keeping artificially high levels of material in transport. This may increase the potential for the Bexhill frontage to maintain and accrete material.

The lowest crest levels are in Section Four, specifically profiles 4c01580, 4c01581, and 4c01582, to compound this there has also been berm width losses of five metres. The profiles of this section should be tracked through future monitoring reports to identify and assess any signs of degradation or recovery.

There were five storm events during the reporting period that exceeded the storm threshold of 3m. Based on beach profiles from the reporting period, the 3rd December 2006 storm event was the most destructive. Generally the frontage has fully recovered from this event, the temporal resolution of the survey schedule is not sufficient to pinpoint the exact period or event that enabled this recovery.

It is important to recognise the inconsistency in short-term trends. As with many coastal areas a lot of annual variability is expected, thus drawing conclusions with increased confidence will become possible as more data is collected, with regards annual losses, net sediment drift and erosion/accretion trends in section sub-units.

Scheduled future monitoring includes profile surveys in Autumn 2007 and Spring 2008, in addition storm surveys may be carried out if any event is deemed to have significantly affected the frontage. An interim report will be issued on completion of the spring profile survey, with the next BMP report scheduled for after completion of the Summer 2008 beach plan survey. All historic monitoring data is available on the website (www.channelcoast.org), future surveys will be obtainable after satisfying the projects quality assurance procedures.
Profile Location Diagrams