BEACH MANAGEMENT PLAN REPORT

St Mary’s Bay

2006

BMP 40

March 2007
Beach Management Plan Site Report 2005&2006
MU 18: St Mary’s bay

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Annex A

Explanatory Notes
1. **Summary of method of conducting topographic and hydrographic surveys (based on the Environment Agency’s National Specification Sections XII and XIII)**

Topographic cross-shore (profile) measurements are made at the intercept of the beach and a hard structure, at all changes of beach slope, at changes in surface sediment and at maximum defined intervals (every 5 metres). Each measurement is feature-coded with the type of surface material. Profiles are 100-500m apart, depending on management status. The seaward limit to be achieved is Mean Low Water Springs or 50 metres from the beach toe.

Topographic spot height (baseline) surveys are carried out annually at Beach Management Plan sites. Profiles are measured at 50m intervals, with the addition of spot heights at the toe of hard structures, the beach surface surrounding structures, all beach ridge crests, all other changes in slope and sediment changes, plus contour lines at a maximum spacing of 5m. All measurements are feature-coded with sediment type. Sufficient data points must be measured to generate a reliable Digital Terrain Model.

Hydrographic surveys are conducted with a single beam echo-sounder, with the position fixing requirement relaxed to DGPS. Soundings are taken along cross-shore profile lines 50m apart and extend 1km offshore. A minimum of 4 shore parallel tie lines are required (including one near the landward and seaward boundaries). The landward limit varies slightly across the region, due to the variation in tidal range, but in general is landward of Mean Sea Level, thus providing overlap with the topographic surveys. Tidal control may be by RTK GPS or by correction from tide gauges which are tied to the survey control network.

2. **Change in Cross-sectional Area (CSA)**

The annual change in cross-sectional area is calculated as the difference in CSA between two surveys, expressed as a percentage change compared to the earlier CSA.

\[
\frac{CSA_1 - CSA_2}{CSA_2} \times 100 \quad \text{Eqn (1)}
\]

where CSA\(_1\) = most recent springtime survey and CSA\(_2\) = spring survey previous year. Therefore an annual change of –14% represents erosion during the last year of 14% of the area of last year’s survey.

3. **Method of derivation of Digital Terrain and difference models**

The Digital Ground Model is created by interpolating the points of a topographic baseline survey collected by using RTK GPS system. The interpolation method used to create the SECG DGMs is specified as Triangulation with smoothing and is applied in MapInfo Vertical Mapper to create a 1 metre resolution grid.
Triangulation is a process of grid generation that is usually applied to data that requires no regional averaging, such as elevation readings. The surface created by triangulation passes through all of the original data points while generating some degree of "overshoot" above local high values and "undershoot" below local low values. Elevation is an example of point values that are best "surfaced" with a technique that predicts some degree of over- and under-estimation. In modeling a topographic surface from scattered elevation readings, it is not reasonable to assume that data points were collected at the absolute top or bottom of each local rise or depression in the land surface.

Triangulation involves a process whereby all the original data points are connected in space by a network of triangular faces, drawn as equilaterally as possible. This network of triangular faces is referred to as a Triangular Irregular Network (TIN). Points are connected based on the nearest neighbour relationship (the Delaunay criterion) which states that a circumcircle drawn around any triangle will not enclose the vertices of any other triangle.

To visualise the resulting grid, the same colour scheme is applied, thus enabling comparison between grids of different geographic origin. The colour bands cover a elevation range between -4 to +12 metres OD with elevations lying between -2 and + 5 metres OD are shown in 0.5 metres intervals, the remaining elevation bands shown in 1 metre intervals.

All difference models are created by using a grid calculator within the GIS system. For example the difference model of two baseline surveys is created by subtracting the earlier baseline grid from the most recent baseline grid:

\[ \text{Grid}_1 - \text{Grid}_2 \]  

where \( \text{Grid}_1 \) = most recent baseline grid and \( \text{Grid}_2 \) = previous baseline grid. Therefore an annual change of -14m\(^2\) represents erosion during the last year of 14m\(^2\), whilst positive values represent accretion over the period.
Annex B

Digital Terrain Models
Annex C

*Difference Models*
Annex D

Folkestone Wave Buoy

Folkestone WaveRider Buoy - July 2005 to June 2006

Location
OS: 619711E  132538N
WGS84: Latitude: 51°03.5335'N  Longitude: 01°08.2988'E

Water Depth
12.7m CD

Instrument Type
Datawell Directional WaveRider Buoy Mk III

Data Quality

<table>
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<tr>
<th>C1(%)</th>
<th>Sample interval</th>
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<td>96</td>
<td>30 minutes</td>
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Storm Analysis

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<tr>
<th>Date/Time</th>
<th>H_s</th>
<th>T_p</th>
<th>T_z</th>
<th>Dir.</th>
<th>Water level elevation* (OD)</th>
<th>Tidal stage</th>
<th>Tidal range (m)</th>
<th>Tidal surge* (m)</th>
<th>Max. surge* (m)</th>
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<tbody>
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<td>3.15</td>
<td>7.7</td>
<td>5.8</td>
<td>167</td>
<td>-0.56</td>
<td>HW +4</td>
<td>4.9</td>
<td>-0.36</td>
<td>-0.57</td>
</tr>
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<td>7.1</td>
<td>5.5</td>
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<td>HW -3</td>
<td>5.4</td>
<td>0.14</td>
<td>0.58</td>
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</table>

Table F1  Highest events during the reporting period, July 2005 to June 2006

A storm is defined using the Peaks-over-Threshold method (Figure A1). Each storm is then examined in detail, and covers the period 16 hours either side of the storm peak, so as to include both the build-up and decay of the storm. This is the procedure recommended by the CIRIA Beach Management Manual since it covers the build-up and decay typical of a mid-latitudes depression.

At present, the threshold for an individual site is derived empirically, since the measurements span only 2 years and, therefore, errs on the low side. Once the record length exceeds 5 years, a more realistic value of the Threshold can be derived, so as to identify 3 or 4 storms in an average year. The threshold used for Folkestone is 2.5m.

Figure F1  Storm definition

Figure A2 shows the monthly time series of H_s, with the threshold shown in red. The occurrence of storm waves in the current reporting period is also compared with similar storm waves in previous years in Figure A3. Subsequent figures show a time series of the wave conditions for each of the events listed in Table A1, together with the tidal conditions at the nearest tide gauge. Each graph is centred around the highest H_s of the individual event.

* Tidal information is obtained from the nearest recording tide gauge (the National Network gauge at Dover). The tidal surge shown is the residual at the time of the highest H_s. The maximum tidal surge is the largest positive surge during the storm event.
Figure F2  Monthly time series of $H_s$ at Folkestone. Storm threshold, shown in red, is 2.5m.
Figure F3 Incidence of storms during (a) reporting period and (b) since deployment
Figure F4 Highest event of reporting period

This storm shows follows the typical pattern of rise and decay of waves associated with the passage of a mid-latitudes depression system; in this case a complex low pressure system with several occluded fronts. The storm was accompanied by an 8 hour negative surge which was at its maximum around the storm peak. The surge cannot be accounted for by the atmospheric conditions and, as was observed the wind direction was southerly (203°) until 18:30 at which point it veered sharply to (WSW) 250°.
Figure F5  Surface pressure chart for 30 December 2005 at 0000Z
The second event represented a peak during a 30 hour period of sustained high waves. The waves were locally-generated from the south, by a deep low pressure system off south-west Ireland (central pressure 964mb) and were of constant period throughout. Again, a negative surge was present through the whole period of the storm, which cannot be accounted for by meteorological conditions.
Summary

This reporting period experienced stormier conditions than the previous period, where no storms exceeded the threshold of 2.5m. The storms were characterised by predominantly southerly waves. Negative tidal surges were again a feature.

Acknowledgements

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