South West Regional Coastal Monitoring Programme

Annual Survey Report
Dawlish Warren to Start Point
2018

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Cover Photograph: Blackpool Sands 2018

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Summary

This report contains the changes to the beaches and wave conditions that have been measured and recorded by the South West Regional Coastal Monitoring Programme for Dawlish Warren to Start Point. The data set that is analysed is from 2017 and 2007 when the data was first collected by the Programme.

Since 2017, the majority of the survey units have experienced erosion. There has been an overall trend for erosion between Dawlish Warren (6bSU16-3) and Teignmouth (6bSU18-1). In particular, following the beach recharge which was carried out as part of the Dawlish Warren Beach Management Scheme, Dawlish Warren (6bSU16-3) has experienced high level erosion. Across Torbay from Oddicombe Beach (6bSU20-1) and Broadsands (6bSU21-8), there has been a mixture of low level erosion and accretion across each of the survey units, with the majority of profiles experiencing no significant change. The overall trend for Start Bay over the past year has been for erosion, with Blackpool Sands (6bSU25-2), Slapton Sands (6bSU26-1) and Beesands (6bSU26-2) each showing areas of erosion. Slapton Sands has (6bSU26-1) experienced erosion in the northern and central areas of the beach. Hallsands (6bSU26-3) is the only survey unit in Start Bay that has shown a trend for accretion.

Since 2007, the overall trend is opposite to that of the short term epoch, with accretion dominant throughout most sub-cells. Between Dawlish Warren (6bSU16-3) and The Teign Estuary (6bSU18-2) there has been a mixture of erosion and accretion throughout the survey units. Dawlish Warren (6bSU16-3) which historically has shown erosional trends, now shows both high levels of erosion and accretion, which can be attributed to the beach recharge that took place in 2017. Teignmouth (6bSU18-1) shows a balance of erosion and accretion throughout the survey unit. The general trend for Torbay from Oddicombe Beach (6bSU20-1) to BroadSands (6bSU21-8) is for accretion, with the exception of Meadfoot (6bSU21-2) which shows an overall trend for erosion. Finally, all the survey units in Start Bay have experienced an overall trend of high level erosion, with the only exception being Blackpool Sands (6bSU25-2) which has experienced high level accretion.

The Dawlish Waverider Buoy recorded 4 storms that exceeded the 3.14m storm threshold between February and June 2017. The waves were recorded approaching predominately from the south. The Tor Bay Waverider Buoy recorded 3 storms that exceeded the 2.37m storm threshold between February and May 2017. The waves were recorded approaching predominantly from the east south east. Finally, the Start Bay Waverider Buoy recorded 3 storms that exceeded the 3.37m storm threshold between February and May 2017. The waves were recorded approaching predominantly from the south.
South West Regional Coastal Monitoring Programme

Annual Survey Report 2018 – Dawlish Warren to Start Point

Introduction

Analysis presented in this report provides an overview of beach changes and wave and tidal measurements since the commencement of the South West Regional Coastal Monitoring Programme. The first beach surveys took place during the spring of 2007 and changes are reported until spring 2018.

Data are presented at the following levels:

- **Process Cell**
  - Process cell summary of percentage and actual profile change from Spring 2017 to Spring 2018.
  - Process cell summary of percentage and actual profile change from Baseline 2007 to Spring 2018.

- **Survey Unit**
  - Detailed beach profile change from Spring 2017 to Spring 2018.
  - Detailed beach profile change from Baseline 2007 to Spring 2018.
  - Topographic difference model change from Repeat Baseline 2017 to Repeat Baseline 2018 (where available).
  - Topographic difference model change from Baseline 2007 to Repeat Baseline 2018 (where available).
  - Change in position of Mean High Water contour (where available).
  - Beach sediment distribution (where available).
  - Time series of beach profile graphs*.
  - Trend analysis of beach cross-sectional area*.

The process cell summary maps provide an at-a-glance summary of the changes during the past year and over the longer term. It is recommended that the user should use the maps to identify areas of interest and then examine the individual profile plots and trends. Colour-coded lines highlight areas of maximum change and identify profiles which might need closer examination.

Lines are colour-coded based on actual change; percentage change is displayed in brackets following the profile name on each line. Please note that lines on the map have been extended for clarity and therefore may not represent the actual distance surveyed.

Difference models have been produced where there are at least two baseline surveys to compare. Where available, the most recent LiDAR data has been used to extract the level of Mean High Water (MHW) for each survey unit, and where possible, sediment distribution maps are produced from the latest topographic baseline survey information.

It must be appreciated that the accuracies of each measurement system must be taken into account when drawing conclusions, particularly from the difference models. In the case of topographic difference models from RTK GPS surveys, the accuracy of each data point is
±0.03m and therefore differences of ±0.06m can generally be considered as "real", whilst smaller changes may be an artefact of the measuring system, and are considered to be "No Change". Difference plots show changes >±0.25m, which should be indicative of areas of genuinely measurable change. Smaller changes may also be present but these are filtered from the analysis to provide clarity. This report displays difference models only where detailed analysis suggests that the changes are real but, nevertheless, the user should approach the results as indicative, unless reinforced overtime or with other information.

Where LiDAR has provided the source data sets, the modelling is less precise. Each LiDAR cell value has a plan position representative of a 1m² grid. It is not reasonable to expect to observe changes with positional accuracy of better than 1-2m therefore. Profiles of steep slopes may suggest that the changes “bounce” back and forth. This is an artefact of the accuracy of the source data. LiDAR is particularly ineffective at identifying sharp edges or steep slopes e.g. cliffs, seawalls. Despite these limitations in accuracy the changes shown indicate an overview of profile change, but to a lower precision than the RTK data. The location of the regularly surveyed profiles superimposed on the difference plots indicates how representative these profiles might be of overall changes.

It must be emphasised that this is only the eighth report of a series and that changes identified are indicative only of relatively short-term trends.
## Dawlish Directional Waverider Buoy

### Location

- **OS**: 299750 E  76540 N
- **WGS84**
  - *Latitude*: 50° 34.80’ N
  - *Longitude*: 03° 25.04’ W

### Instrument type
- Datawell Directional Waverider Mk III

### Water depth
- ~11 m CD

### Buoy in situ off Dawlish beach. Photo courtesy of Fugro GB Marine Limited

### Location of buoy (Google mapping, image ©2016 TerraMetrics)

### Data Quality

<table>
<thead>
<tr>
<th>Recovery rate (%)</th>
<th>Sample interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>96</td>
<td>30 minutes</td>
</tr>
</tbody>
</table>

### Monthly Averages - 2017

*All times are GMT*

<table>
<thead>
<tr>
<th>Month</th>
<th>$H_s$ (m)</th>
<th>$T_p$ (s)</th>
<th>$T_z$ (s)</th>
<th>Dir. (°)</th>
<th>SST (°C)</th>
<th>Bimodal seas (%)</th>
<th>No. of days</th>
</tr>
</thead>
<tbody>
<tr>
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<td>0.57</td>
<td>6.6</td>
<td>3.7</td>
<td>169</td>
<td>9.0</td>
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<tr>
<td>February</td>
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<td>8.2</td>
<td>4.1</td>
<td>162</td>
<td>8.5</td>
<td>2</td>
<td>28</td>
</tr>
<tr>
<td>March</td>
<td>0.62</td>
<td>7.7</td>
<td>3.9</td>
<td>164</td>
<td>9.8</td>
<td>0</td>
<td>31</td>
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<tr>
<td>April</td>
<td>0.29</td>
<td>4.4</td>
<td>3.3</td>
<td>162</td>
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<td>0</td>
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<tr>
<td>May</td>
<td>0.51</td>
<td>5.7</td>
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<td>149</td>
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<td>0</td>
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<tr>
<td>June</td>
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<td>October</td>
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<td>3.6</td>
<td>168</td>
<td>15.4</td>
<td>1</td>
<td>31</td>
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<tr>
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<td>3.7</td>
<td>172</td>
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<tr>
<td>December</td>
<td>0.50</td>
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<td>3.8</td>
<td>174</td>
<td>10.6</td>
<td>0</td>
<td>31</td>
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</table>

### Monthly Averages - All Years (December 2010 – December 2016)

<table>
<thead>
<tr>
<th>Month</th>
<th>$H_s$ (m)</th>
<th>$T_p$ (s)</th>
<th>$T_z$ (s)</th>
<th>Dir. (°)</th>
<th>SST (°C)</th>
<th>Bimodal seas (%)</th>
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<tbody>
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<td>4.0</td>
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<td>9.6</td>
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<td>4.0</td>
<td>162</td>
<td>8.5</td>
<td>2</td>
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<tr>
<td>March</td>
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<td>3.8</td>
<td>154</td>
<td>8.7</td>
<td>1</td>
</tr>
<tr>
<td>April</td>
<td>0.53</td>
<td>7.1</td>
<td>3.7</td>
<td>159</td>
<td>10.2</td>
<td>1</td>
</tr>
<tr>
<td>May</td>
<td>0.42</td>
<td>5.7</td>
<td>3.3</td>
<td>166</td>
<td>12.1</td>
<td>0</td>
</tr>
<tr>
<td>June</td>
<td>0.42</td>
<td>5.4</td>
<td>3.4</td>
<td>162</td>
<td>14.4</td>
<td>0</td>
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<tr>
<td>July</td>
<td>0.34</td>
<td>5.1</td>
<td>3.3</td>
<td>168</td>
<td>16.5</td>
<td>0</td>
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<tr>
<td>August</td>
<td>0.40</td>
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<td>3.4</td>
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<tr>
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<td>3.7</td>
<td>156</td>
<td>15.3</td>
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<tr>
<td>November</td>
<td>0.70</td>
<td>6.8</td>
<td>3.9</td>
<td>160</td>
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<td>0</td>
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<tr>
<td>December</td>
<td>0.70</td>
<td>7.8</td>
<td>3.9</td>
<td>167</td>
<td>10.6</td>
<td>3</td>
</tr>
</tbody>
</table>
Storm Analysis

<table>
<thead>
<tr>
<th>Date/Time</th>
<th>Hs (m)</th>
<th>Tp (s)</th>
<th>Tz (s)</th>
<th>Dir. (°)</th>
<th>Water level elevation* (OD)</th>
<th>Tidal stage (hours re. HW)</th>
<th>Tidal range (m)</th>
<th>Tidal surge (m)</th>
<th>Max. surge (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>03-Feb-2017 16:00</td>
<td>3.39</td>
<td>8.3</td>
<td>6.3</td>
<td>156</td>
<td>-0.51</td>
<td>HW +5</td>
<td>3.05</td>
<td>0.54</td>
<td>0.63</td>
</tr>
<tr>
<td>02-Feb-2017 10:30</td>
<td>3.12</td>
<td>7.1</td>
<td>5.6</td>
<td>169</td>
<td>2.32</td>
<td>HW</td>
<td>3.15</td>
<td>0.45</td>
<td>0.59</td>
</tr>
<tr>
<td>13-Feb-2017 21:30</td>
<td>2.57</td>
<td>8.3</td>
<td>5.3</td>
<td>118</td>
<td>1.92</td>
<td>HW +1</td>
<td>3.65</td>
<td>0.05</td>
<td>0.19</td>
</tr>
<tr>
<td>05-Jun-2017 18:30</td>
<td>2.56</td>
<td>6.7</td>
<td>5.1</td>
<td>170</td>
<td>0.96</td>
<td>HW +2</td>
<td>2.27</td>
<td>0.54</td>
<td>0.56</td>
</tr>
</tbody>
</table>

* Tidal information is obtained from the WaveRadar REX in Exmouth Marina. The surge shown is the residual at the time of the highest Hs. The maximum tidal surge is the largest surge during the storm event.

Annual Statistics

<table>
<thead>
<tr>
<th>Year</th>
<th>Annual Hs exceedance** (m)</th>
<th>Annual Maximum Hs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.05%</td>
<td>0.5%</td>
</tr>
<tr>
<td>2011</td>
<td>2.78</td>
<td>2.21</td>
</tr>
<tr>
<td>2012</td>
<td>3.74</td>
<td>2.33</td>
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<tr>
<td>2013</td>
<td>2.97</td>
<td>2.37</td>
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<td>2014</td>
<td>3.96</td>
<td>2.93</td>
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<td>2015</td>
<td>3.02</td>
<td>2.21</td>
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<tr>
<td>2016</td>
<td>3.76</td>
<td>2.59</td>
</tr>
<tr>
<td>2017</td>
<td>3.08</td>
<td>2.19</td>
</tr>
</tbody>
</table>

** i.e. 5% of the Hs values measured in 2011 exceeded 1.31 m

* Note that waves were breaking at the buoy for several hours during this storm; where breaking waves were clearly present in the measured time series, the parameters have been omitted. Accordingly, there may have been short periods where measured significant wave heights exceeded this value.
Significant wave height return periods

Return periods for significant wave height can be calculated since the buoy has been deployed for more than 5 years. The return periods are based on 0.5 hourly records and are calculated for periods up to 10 times the record length using a peaks-over-threshold method and Weibull distribution.

<table>
<thead>
<tr>
<th>Observation period</th>
<th>December 2010 to June 2017</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return period (years)</td>
<td>Significant wave height (m)</td>
<td></td>
</tr>
<tr>
<td>0.25</td>
<td>3.14</td>
<td>No depth limitation</td>
</tr>
<tr>
<td>1</td>
<td>3.88</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>4.19</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>4.55</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>4.80</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>5.03</td>
<td>Depth-limited at MLWS</td>
</tr>
<tr>
<td>50</td>
<td>5.32</td>
<td></td>
</tr>
</tbody>
</table>

Distribution plots

The distribution of wave parameters are shown in the accompanying graphs of:

- Annual time series of $H_s$ (red line is 3.14 m storm alert threshold)
- Incidence of storm waves for 2017. Storm events are defined using the Peaks-over-Threshold method. The highest $H_s$ of each storm event is shown
- Wave height exceedance each year since deployment
- Percentage of occurrence of $H_s$, $T_p$, $T_z$ and Direction for 2017
- Wave rose (percentage of occurrence of direction vs. $H_s$) for all measured data
- Joint distribution of all parameters for all measured data, given as percentage of occurrence

General

The wave buoy at Dawlish, owned by Teignbridge District Council, was deployed on 07 December 2010, at which time the magnetic declination at the site was 2.7° west, changing by 0.15° east per year.

Acknowledgements

Tidal predictions were supplied by Fugro GB Marine Limited.
# Tor Bay Directional Waverider Buoy

**Location**  
- OS: 292283 E, 60410 N  
- WGS84:  
  - Latitude: 50° 26.02' N  
  - Longitude: 03° 31.08' W  

**Instrument type**  
- Datawell Directional Waverider Mk III

**Water depth**  
- ~11m CD

**Buoy in situ in Tor Bay. Photo courtesy of Fugro GB Marine Limited**

**Location of buoy (Google mapping, image ©2016 TerraMetrics)**

## Data Quality

<table>
<thead>
<tr>
<th>Recovery rate (%)</th>
<th>Sample interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>30 minutes</td>
</tr>
</tbody>
</table>

## Monthly Averages - 2017

*All times are GMT*

<table>
<thead>
<tr>
<th>Month</th>
<th>$H_s$ (m)</th>
<th>$T_p$ (s)</th>
<th>$T_z$ (s)</th>
<th>Dir. (°)</th>
<th>SST (°C)</th>
<th>Bimodal seas (%)</th>
<th>No. of days</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>0.46</td>
<td>6.3</td>
<td>3.6</td>
<td>130</td>
<td>9.6</td>
<td>0</td>
<td>31</td>
</tr>
<tr>
<td>February</td>
<td>0.64</td>
<td>7.6</td>
<td>3.8</td>
<td>130</td>
<td>8.9</td>
<td>0</td>
<td>28</td>
</tr>
<tr>
<td>March</td>
<td>0.48</td>
<td>6.5</td>
<td>3.5</td>
<td>148</td>
<td>9.8</td>
<td>0</td>
<td>31</td>
</tr>
<tr>
<td>April</td>
<td>0.26</td>
<td>5.7</td>
<td>3.3</td>
<td>130</td>
<td>11.2</td>
<td>0</td>
<td>30</td>
</tr>
<tr>
<td>May</td>
<td>0.46</td>
<td>5.5</td>
<td>3.5</td>
<td>119</td>
<td>12.9</td>
<td>0</td>
<td>31</td>
</tr>
<tr>
<td>June</td>
<td>0.25</td>
<td>5.3</td>
<td>3.1</td>
<td>153</td>
<td>15.3</td>
<td>0</td>
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<tr>
<td>July</td>
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<td>3.2</td>
<td>153</td>
<td>16.8</td>
<td>0</td>
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<tr>
<td>August</td>
<td>0.23</td>
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<td>3.2</td>
<td>148</td>
<td>16.9</td>
<td>0</td>
<td>31</td>
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<tr>
<td>September</td>
<td>0.30</td>
<td>5.1</td>
<td>3.2</td>
<td>154</td>
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<tr>
<td>October</td>
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<tr>
<td>November</td>
<td>0.26</td>
<td>5.5</td>
<td>3.3</td>
<td>161</td>
<td>13.5</td>
<td>0</td>
<td>30</td>
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<tr>
<td>December</td>
<td>0.33</td>
<td>6.5</td>
<td>3.6</td>
<td>152</td>
<td>11.2</td>
<td>0</td>
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</table>

## Monthly Averages - All Years (June 2008 – December 2016)

<table>
<thead>
<tr>
<th>Month</th>
<th>$H_s$ (m)</th>
<th>$T_p$ (s)</th>
<th>$T_z$ (s)</th>
<th>Dir. (°)</th>
<th>SST (°C)</th>
<th>Bimodal seas (%)</th>
<th>No. of days</th>
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</thead>
<tbody>
<tr>
<td>January</td>
<td>0.55</td>
<td>6.8</td>
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<tr>
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<td>0.25</td>
<td>4.8</td>
<td>3.1</td>
<td>147</td>
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<td>August</td>
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<td>October</td>
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<td>129</td>
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Storm Analysis

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<th>Date/Time</th>
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<th>Tp (s)</th>
<th>Tr (s)</th>
<th>Dir. (°)</th>
<th>Water level elevation* (OD)</th>
<th>Tidal stage (hours re. HW)</th>
<th>Tidal range (m)</th>
<th>Tidal surge (m)</th>
<th>Max. surge (m)</th>
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<tr>
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* Tidal information is obtained from the WaveRadar REX in Exmouth Marina. The surge shown is the residual at the time of the highest Hs. The maximum tidal surge is the largest surge during the storm event.

Annual Statistics

<table>
<thead>
<tr>
<th>Year</th>
<th>Annual Hs exceedance** (m)</th>
<th>Annual Maximum Hs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.05%</td>
<td>0.5%</td>
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<tr>
<td>2008</td>
<td></td>
<td>2.20</td>
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<tr>
<td>2009</td>
<td>2.56</td>
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<td>2010</td>
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<td>2011</td>
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<td>1.84</td>
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<td>1.88</td>
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<td>2016</td>
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</tr>
<tr>
<td>2017</td>
<td>3.02</td>
<td>2.17</td>
</tr>
</tbody>
</table>

** i.e. 5% of the Hs values measured in 2008 exceeded 1.22 m

Significant wave height return periods

Return periods for significant wave height can be calculated since the buoy has been deployed for more than 5 years. The return periods are based on 0.5 hourly records and are calculated for periods up to 10 times the record length using a peaks-over-threshold method and Weibull distribution.

<table>
<thead>
<tr>
<th>Observation period</th>
<th>July 2008 to June 2017</th>
<th>Comments</th>
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<tbody>
<tr>
<td>Return period (years)</td>
<td>Significant wave height (m)</td>
<td>Depth-limited at MLWS</td>
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<td>0.25</td>
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<td>No depth limitation</td>
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<td>10</td>
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<tr>
<td>50</td>
<td>4.63</td>
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</tbody>
</table>
Distribution plots

The distribution of wave parameters are shown in the accompanying graphs of:

- Annual time series of $H_s$ (red line is 2.37 m storm threshold)
- Incidence of storm waves for 2017. Storm events are defined using the Peaks-over-Threshold method. The highest $H_s$ of each storm event is shown
- Wave height exceedance each year since deployment
- Percentage of occurrence of $H_s$, $T_p$, $T_z$ and Direction for 2017
- Wave rose (percentage of occurrence of direction vs. $H_s$) for all measured data
- Joint distribution of all parameters for all measured data, given as percentage of occurrence

General

The buoy, owned by Teignbridge District Council, was first deployed on 4 July 2008, at which time the magnetic declination at the site was $3.0^\circ$ west, changing by $0.15^\circ$ east per year.

Acknowledgements

The DWR shore station is kindly hosted by Tor Bay Harbourmaster. The tide gauge is kindly hosted by Exmouth Marina.

Tidal predictions were supplied by Fugro GB Marine Limited.
Tor Bay - Significant Wave Height (Hs) during 2017

Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

Day in month
Start Bay Directional Waverider Buoy

Location

<table>
<thead>
<tr>
<th>OS</th>
<th>284951 E 44837 N</th>
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</thead>
<tbody>
<tr>
<td>WGS84</td>
<td>Latitude: 50° 17.53’ N Longitude: 03° 36.99’ W</td>
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</table>

Instrument type

Datawell Directional Waverider Mk III

Water depth ~10m CD

Buoy in situ in Start Bay. Photo courtesy of Fugro GB Marine Limited

Location of buoy (Google mapping, image ©2016 Getmapping plc)

Data Quality

<table>
<thead>
<tr>
<th>Recovery rate (%)</th>
<th>Sample interval</th>
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<tbody>
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</table>

Monthly Averages - 2017

<table>
<thead>
<tr>
<th>Month</th>
<th>Hs (m)</th>
<th>Tp (s)</th>
<th>Ts (s)</th>
<th>Dir. (°)</th>
<th>SST (°C)</th>
<th>Bimodal seas (%)</th>
<th>No. of days</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>0.71</td>
<td>8.6</td>
<td>4.5</td>
<td>159</td>
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<td>9.9</td>
<td>5.0</td>
<td>162</td>
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<td>167</td>
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<td>152</td>
<td>11.0</td>
<td>0</td>
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<td>0.65</td>
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<tr>
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<td>157</td>
<td>16.1</td>
<td>0</td>
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<tr>
<td>August</td>
<td>0.40</td>
<td>6.6</td>
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<tr>
<td>November</td>
<td>0.49</td>
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<td>4.5</td>
<td>169</td>
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<td>December</td>
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<td>5.0</td>
<td>170</td>
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<td>31</td>
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Monthly Averages - All Years (April 2007 – December 2016)

<table>
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<th>Month</th>
<th>Hs (m)</th>
<th>Tp (s)</th>
<th>Ts (s)</th>
<th>Dir. (°)</th>
<th>SST (°C)</th>
<th>Bimodal seas (%)</th>
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<tr>
<td>June</td>
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<td>4.1</td>
<td>157</td>
<td>13.8</td>
<td>1</td>
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<tr>
<td>July</td>
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<td>7.0</td>
<td>3.9</td>
<td>162</td>
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<td>August</td>
<td>0.48</td>
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<td>October</td>
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<td>4.9</td>
<td>163</td>
<td>11.2</td>
<td>9</td>
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All times are GMT
**Storm Analysis**

<table>
<thead>
<tr>
<th>Date/Time</th>
<th>$H_s$ (m)</th>
<th>$T_p$ (s)</th>
<th>$T_z$ (s)</th>
<th>Dir. (°)</th>
<th>Water level elevation* (OD)</th>
<th>Tidal stage (hours re. HW)</th>
<th>Tidal range (m)</th>
<th>Tidal surge* (m)</th>
<th>Max. surge* (m)</th>
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</thead>
<tbody>
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<td>3.38</td>
<td>7.7</td>
<td>5.9</td>
<td>94</td>
<td>0.91</td>
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<td>2.81</td>
<td>0.03</td>
<td>0.16</td>
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</tbody>
</table>

* Tidal information is obtained from the National Network gauge at Devonport and/or estimated from the predicted tide levels (Admiralty Total Tide). The surge shown is the residual at the time of the highest $H_s$. The maximum tidal surge is the largest surge during the storm event.

**Annual Statistics**

<table>
<thead>
<tr>
<th>Year</th>
<th>Annual $H_s$ exceedance** (m)</th>
<th>Annual Maximum $H_s$</th>
</tr>
</thead>
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<tr>
<td></td>
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</tr>
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</tr>
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<td>16-Jan-2010 05:30</td>
</tr>
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<td>2011</td>
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<td>24-Oct-2011 15:30</td>
</tr>
<tr>
<td>2012</td>
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<td>30-Apr-2012 03:00</td>
</tr>
<tr>
<td>2013</td>
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<td>3.19 2.66 2.36 1.99 1.54 1.18</td>
<td>13-Feb-2017 04:30</td>
</tr>
</tbody>
</table>

** i.e. 5 % of the $H_s$ values measured in 2007 exceeded 1.43 m

*Note that waves were breaking at the buoy for several hours during this storm; where breaking waves were clearly present in the measured time series, the parameters have been omitted. Accordingly, there may have been short periods where measured significant wave heights exceeded this value.
Significant wave height return periods

Return periods for significant wave height can be calculated since the buoy has been deployed for more than 5 years. The return periods are based on 0.5 hourly records and are calculated for periods up to 10 times the record length using a peaks-over-threshold method and Weibull distribution.

<table>
<thead>
<tr>
<th>Observation period</th>
<th>April 2007 to December 2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return period (years)</td>
<td>Significant wave height (m)</td>
</tr>
<tr>
<td>0.25</td>
<td>3.35</td>
</tr>
<tr>
<td>1</td>
<td>3.94</td>
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<td>2</td>
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<td>50</td>
<td>5.00</td>
</tr>
<tr>
<td>100</td>
<td>5.15</td>
</tr>
</tbody>
</table>

Distribution plots

The distribution of wave parameters are shown in the accompanying graphs of:

- Annual time series of $H_s$ (red line is 3.37 m storm alert threshold)
- Incidence of storm waves for 2017. Storm events are defined using the Peaks-over-Threshold method. The highest $H_s$ of each storm event is shown
- Wave height exceedance each year since deployment
- Percentage of occurrence of $H_s$, $T_p$, $T_z$ and Direction for 2017
- Wave rose (percentage of occurrence of direction vs. $H_s$) for all measured data
- Joint distribution of all parameters for all measured data, given as percentage of occurrence

General

The buoy, owned by Teignbridge District Council, was first deployed on 5 April 2007, at which time the magnetic declination at the site was 3.2° west, changing by 0.15° east per year.

Acknowledgements

Tidal data at Devonport were provided by the British Oceanographic Data Centre from the UK national tide gauge network, owned and operated by the Environment Agency.
Start Bay 2007 to 2017 - Joint distribution (% of occurrence)

Annual Wave Report 2017

Start Bay
Exmouth Marina Tide Gauge

**Location**

OS: 299384E 80710N

WGS84: *Latitude:* 50° 37.04269’ N  *Longitude:* 03° 25.41521’ W

Exmouth Marina

**Instrument**

Rosemount WaveRadar REX

**Benchmarks**

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TGBM = 4.214 m above Ordnance Datum Newlyn</td>
<td>Top of S/S horizontal frame</td>
</tr>
<tr>
<td>TGZ = 4.265 m above Ordnance Datum Newlyn</td>
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</tr>
<tr>
<td>TGZ = 6.095 m above Chart Datum</td>
<td></td>
</tr>
<tr>
<td>TGZ = 0.051 m above TGBM</td>
<td></td>
</tr>
</tbody>
</table>

**Datum**

All data are to Ordnance Datum Newlyn. The height of Chart Datum relative to Ordnance Datum at Exmouth Dock is -1.83 m (Admiralty Tide Tables, Supplementary Table III).

**Survey information**

The site was surveyed on 18 February 2016, using an 8 hour occupation. ETRS89 co-ordinates were transformed to OSGB co-ordinates using OSTN02/OSGM02. The elevation of the TGBM using OSTN15/OSGM15 transformation is 4.240 m OD. The data are recorded and archived using the OSTN02/OSGM02 TGBM. The site was re-surveyed on 08 November 2017 when the datum results were within ±2.5mm of the earlier survey. No adjustments were made to the measured data.

**Site characteristics**

The gauge is sited within a sheltered corner of Exmouth Marina. Some seiching within the Marina may occur. Spring tidal range is approx. 3.8 m.

**Data quality**

<table>
<thead>
<tr>
<th>Recovery rate (%)</th>
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<tr>
<td>98</td>
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</table>
Service history

The radar was first deployed on 24 September 2015 and is serviced at 9-monthly intervals. No recalibration of the instrument is required.

Measurements

Residuals and Elevations (OD and CD) for the whole year are shown in Figures 1 to 3 respectively.

Statistics

All times GMT

<table>
<thead>
<tr>
<th>Month</th>
<th>Extreme maxima</th>
<th></th>
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<th>Extreme minima</th>
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<td>Elevation (OD)</td>
<td>Date/Time</td>
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<tr>
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<table>
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<th>Month</th>
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<th>Surge minima</th>
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<tr>
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<td>Date/Time</td>
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<tr>
<td>November</td>
<td>0.74</td>
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<td>18-Dec-2018 10:10</td>
<td>-0.42</td>
<td>29-Dec-2018 17:50</td>
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</table>
### Annual Tide Report 2018

**Exmouth Marina**

<table>
<thead>
<tr>
<th>Month</th>
<th>No. of days</th>
<th>Elevation (OD)</th>
</tr>
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<tbody>
<tr>
<td>January</td>
<td>31</td>
<td>0.309</td>
</tr>
<tr>
<td>February</td>
<td>28</td>
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<td>March</td>
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<td>0.412</td>
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<tr>
<td>December</td>
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<td>0.357</td>
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</table>

**Highest values in 2018**

<table>
<thead>
<tr>
<th>Elevation (OD) (Surge component)</th>
<th>Date/Time</th>
<th>Value (m)</th>
<th>Date/Time</th>
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<tbody>
<tr>
<td>2.77 (0.41)</td>
<td>03-Mar-2018 07:30</td>
<td>0.75</td>
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<td>09-Nov-2018 19:20</td>
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<td>0.72</td>
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<tr>
<td>2.62 (0.32)</td>
<td>05-Jan-2018 08:40</td>
<td>0.71</td>
<td>14-Mar-2018 16:30</td>
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<tr>
<td>2.58 (0.33)</td>
<td>05-Mar-2018 08:50</td>
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<td>18-Dec-2018 10:10</td>
</tr>
<tr>
<td>2.57 (0.39)</td>
<td>02-Apr-2018 07:40</td>
<td>0.68</td>
<td>03-Mar-2018 02:30</td>
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<td>2.56 (0.27)</td>
<td>02-Mar-2018 07:10</td>
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<tr>
<td>2.54 (0.38)</td>
<td>04-Mar-2018 20:40</td>
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<tr>
<td>2.54 (0.41)</td>
<td>12-Oct-2018 08:20</td>
<td>0.63</td>
<td>15-Mar-2018 04:50</td>
</tr>
</tbody>
</table>
General

The time series of 10 minute tidal elevations for one year is quality-checked in accordance with ESEAS guidelines, flagged and archived. The archived time series is continuous and monotonic, with missing data given as 9999. The missing data shown are days where the entire 24 hours of data are missing.

Monthly extreme maxima/minima are the maximum and minimum water levels from all measured data for that month. Monthly surge maxima/minima (residuals) are calculated in a similar manner from the time series of residuals. Residuals are derived as the measured tidal elevation minus the predicted tidal elevation.

The monthly Mean Level is calculated as the average of all readings for the given month. The annual $Z_0$ is the value of Mean Sea Level derived by the harmonic analysis of the year's data. These values should not be used for any purpose without consideration of the recovery rate.

Acknowledgements

Tidal predictions were produced by Fugro GB Marine Limited. The REX is installed at Exmouth Marina by kind permission of the Marina owners.
Figure 1: Exmouth Marina residuals for 2018
Figure 2: Exmouth Marina tidal elevations for 2018 relative to Ordnance Datum
Figure 3: Exmouth Marina tidal elevations for 2018 relative to Chart Datum
### Topographic Survey Record

The table below gives the target and completion dates for topographic surveys between spring 2017 and the repeat baseline surveys of 2018.

<table>
<thead>
<tr>
<th>Survey Unit</th>
<th>Topographic Survey Type</th>
<th>Spring Interim</th>
<th>Post–Storm</th>
<th>Baseline</th>
<th>Autumn Interim</th>
<th>Spring Interim</th>
<th>Post–Storm</th>
<th>Repeat Baseline</th>
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<tr>
<td></td>
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<td>Target</td>
<td>Completion</td>
<td>Target</td>
<td>Completion</td>
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<td>6bSU17</td>
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<td>31/03/2018</td>
<td>21/03/2018</td>
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<td>31/03/2018</td>
<td>06/03/2018</td>
<td>31/08/2018</td>
</tr>
</tbody>
</table>

**Key**
- **Green**: Completed on time and accepted
- **Red**: Overdue
- **Yellow**: Surveyed but not submitted / Accepted
- **White**: Will not be surveyed

For the most recent survey schedules for each survey unit please see [http://southwest.coastalmonitoring.org/latest-updates/survey-schedule/](http://southwest.coastalmonitoring.org/latest-updates/survey-schedule/)
Topographic Survey Report

Profile Data

Analysis has been conducted for those sites where a minimum of three surveys have been recorded. In general, changes are measured relative to the Mean Low Water Springs (MLWS) level. In cases where none of these levels can be reached the master profile is placed at the most appropriate level for the survey unit in question.

A full time series of plotted beach profiles is shown superimposed on and relative to a Master Profile for each profile location. The Master Profile provides the basis for calculation of beach cross-section area changes. Where possible, identical depth boundaries have been used for all profiles within a survey unit. However, even where this has not been possible, direct comparisons can be made for the beach cross sectional area at one profile over time, since the master profile is constant for each profile (Figure 1). In some instances, raising the lower depth of the Master Profile may reduce the overall cross sectional area of the profile. This may cause small changes in the beach profile to have a large impact on the percentage change. This effect has been taken into account in the analysis of change to beach profiles. The trend in cross-sectional area (CSA) is presented as a graph for each profile (Figure 2).

Figure 1: Example Master Profile with CSA Calculated from the Surveyed GPS Profile
Baseline Data

As part of the Monitoring Programme specification, each survey unit receives a full topographic baseline survey once every five years. In addition, highly managed sites, or those with a beach management plan, receive an annual baseline survey. Baseline surveys include a full profile survey at 50m intervals and continuous spot height data collected at approximately 1m intervals across the whole beach to the level of MLWS. This continuous data also includes a feature code for each spot height data point recorded, indicating the surface sediment type.

Where there are at least two baseline surveys for a survey unit, a topographic difference model is produced based on the spot height elevations. The raw spot height data is processed into a grid model and successive models are subtracted from one another to produce a difference model for the survey unit. The spot height data from each survey can be used to derive Mean High Water (MHW) and Mean Low Water (MLW) contours along each survey unit. In some cases, where there is no topographic baseline data collected, the information described above may be derived from LiDAR data.

Process Cell

The Beach Change Summary maps contain an at-a-glance condition of the whole area between Dawlish Warren and Start Point, with the lines representing the average accretion, no change or erosion for each survey unit where there is topographic data.
Survey Unit

Topographic changes within each survey unit are summarised on six maps where applicable:

- Beach change map (Spring to Spring).
- Beach change map (Baseline to Spring).
- Topographic difference model map (2007 Baseline to 2018 Repeat Baseline).
- Topographic difference model map (2017 Repeat Baseline to 2018 Repeat Baseline).
- Mean High Water line.
- Sediment distribution maps.

Beach change maps show the location of each beach profile, superimposed on an aerial photograph (note that the line may be extended for clarity). Where possible, the annual change in cross-sectional area has been calculated from Spring 2017 to Spring 2018 and from Baseline 2007 to Spring 2018.

Survey Schedules

Spring interim surveys are conducted between January and March each year. Baseline and repeat baseline surveys are carried out between April and August. A minimum of 8 weeks must elapse between successive surveys. The dates of individual surveys are given in the topographic survey record and with the analysis for each survey unit.
EXPLANATORY NOTES

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.

\[
\frac{\text{CSA}_1 - \text{CSA}_2}{\text{CSA}_2} \times 100 \quad \text{eqn(1)}
\]

Where \(\text{CSA}_1\) = most recent springtime survey and \(\text{CSA}_2\) = 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.

Net Sediment Volume Calculation

This is the volume change in m\(^3\) across each individual survey unit over time. The initial volumes are derived from the Digital Terrain Models (DTM) made for consecutive baseline topographic surveys. Both models are clipped to cover the same area, and a volume above the MLWS plane is calculated for each DTM. The net sediment change is calculated as

\[
\text{Vol}_1 - \text{Vol}_2 \quad \text{eqn(2)}
\]

Where \(\text{Vol}_1\) = most recent DTM model volume and \(\text{Vol}_2\) = earlier DTM model volume. Therefore a net change of \(-19,730\text{ m}^3\) represents erosion since the earlier survey.
Actual Change in Cross-sectional Area (Spring 2017 to Spring 2018)

Survey Unit Boundary

Accretion
No Change
Erosion

Survey Units:
- 6bSU25-2
- 6bSU26-1
- 6bSU26-2
- 6bSU21-2
- 6bSU21-4
- 6bSU21-6
- 6bSU20-1
- 6bSU18-1
- 6bSU18-2
- 6bSU17
- 6bSU16-3

Legend:
- > 30 m
- 15 - 30 m
- 5 - 15 m
- < 5 m

0 4 8 km
Actual Change in Cross-sectional Area (Baseline 2007 to Spring 2018)

- **Survey Unit Boundary**
- **Accretion**: < 5 m
- **No Change**: 5 - 15 m
- **Erosion**: > 15 m

Survey Units: 6bSU16-3, 6bSU26-2, 6bSU25-2, 6bSU21-2, 6bSU21-6, 6bSU21-5, 6bSU20-1, 6bSU18-2, 6bSU18-1, 6bSU17, 6bSU16-3, 6bSU21-8, 6bSU21-7, 6bSU21-4, 6bSU21-3, 6bSU21-1, 6bSU26-1, 6bSU26-2, 6bSU26-3, 6bSU26-4, 6bSU26-5, 6bSU26-6, 6bSU26-7, 6bSU26-8, 6bSU25-2, 6bSU26-1, 6bSU26-2, 6bSU26-3.
<table>
<thead>
<tr>
<th>Survey Type</th>
<th>Dates Surveyed</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring-Spring</td>
<td>08/10/2017-18/03/2018</td>
<td>Over the past year, the dominant trend has been of erosion for the majority of the spit system. Most profiles have experienced erosion and the rest of the profiles have experienced low level accretion. Profiles 6b00007, 6b00009 and 6b00011 located at the distal end have experienced high level erosion with each of the profiles losing more than 80m² of material. Recession of the dune toe can be seen of up to ±70m on profile 6b00009. Profiles 6b00017 to 6b00024 have lost the greatest amount of material at the top of the beach with cut back of the dunes on some profiles. Profiles 6b00026 to 6b00038 have eroded (with the exception of profile 6b00030) and have experienced draw down of material from the upper beach down towards the bottom of the profile. Profiles 6b00042 and 6b00046A have both experienced erosion with material being lost from the top of the profiles with a lowering of ±70cm in front of the seawall on profile 6b00046A. Profiles 6b00051 and 6b00056 both experienced low level accretion.</td>
</tr>
<tr>
<td>Baseline-Spring</td>
<td>17/04/2007-18/03/2018</td>
<td>Since 2007, the long term trend of erosion is present from the neck to the distal end. Accretion is seen at the central and proximal sections of the spit system. Since the beach recharge in 2017, profiles 6b00007 to 6b00019 have experienced high level erosion with each of the profiles losing more than 100m² of material and the dunes have experienced a large recession of the dune face up to ±130m. Profiles 6b00021 to 6b00046A have all experienced accretion, with each profile gaining more than 16m² of material. However, it is important to note that the dunes on the majority of the profiles have experienced recession since 2007.</td>
</tr>
<tr>
<td>Spring-Spring</td>
<td>08/10/2017-15/06/2018</td>
<td>Over the last year, erosion has dominated the survey unit. The majority of erosion has occurred at the top of the beach and on the dune frontage along the spit. Areas where erosion is highest, are located on the dune frontage at the distal end of the spit, the dunes southwards of the neck and the beach in groyne bay 1. There are small areas of accretion observed on different spots across the spit, with the largest areas of the accretion occurring towards the lower sections of the beach, on the central section of the spit. Net sediment balance above MLWS: -129,707 m³ Net Sediment Change: -6%</td>
</tr>
<tr>
<td>Baseline-Spring</td>
<td>17/04/2007-15/06/2018</td>
<td>Since 2007, there has been high level erosion across the majority of the distal end and the south east facing dune frontage with a drop of &gt;3m in elevation widely. The highest levels of accretion have occurred at the very distal end of the spit. Other large areas of accretion are identified on the lower section of the beach towards the proximal end of the spit and on the back of the neck. This is primarily due to the beach nourishment that took place in 2017. Net sediment balance above MLWS: -308,746 m³ Net Sediment Change: -16%</td>
</tr>
</tbody>
</table>
**Profile Cross-Sectional Area**

<table>
<thead>
<tr>
<th>Profile</th>
<th>Spring to Spring</th>
<th>Baseline to Spring</th>
<th>Master Profile</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>October 2017 to Mar 2018</td>
<td>April 2007 to Mar 2018</td>
<td>Level (m)</td>
</tr>
<tr>
<td></td>
<td>CSA Diff (m²)</td>
<td>% Change</td>
<td>CSA Diff (m²)</td>
</tr>
<tr>
<td>6b00002</td>
<td>1.14</td>
<td>0</td>
<td>5.83</td>
</tr>
<tr>
<td>6b00005</td>
<td>0.75</td>
<td>0</td>
<td>28.62</td>
</tr>
<tr>
<td>6b00007</td>
<td>-106.49</td>
<td>-20</td>
<td>-253.70</td>
</tr>
<tr>
<td>6b00009</td>
<td>-118.46</td>
<td>-11</td>
<td>-387.98</td>
</tr>
<tr>
<td>6b00011</td>
<td>-80.78</td>
<td>-9</td>
<td>-506.35</td>
</tr>
<tr>
<td>6b00014</td>
<td>4.18</td>
<td>1</td>
<td>-611.09</td>
</tr>
<tr>
<td>6b00017</td>
<td>-53.91</td>
<td>-7</td>
<td>-362.01</td>
</tr>
<tr>
<td>6b00019</td>
<td>-28.35</td>
<td>-4</td>
<td>116.80</td>
</tr>
<tr>
<td>6b00021</td>
<td>-62.53</td>
<td>-8</td>
<td>27.81</td>
</tr>
<tr>
<td>6b00024</td>
<td>-67.97</td>
<td>-8</td>
<td>416.08</td>
</tr>
<tr>
<td>6b00026</td>
<td>-26.23</td>
<td>-3</td>
<td>362.83</td>
</tr>
<tr>
<td>6b00027</td>
<td>-20.59</td>
<td>-4</td>
<td>36.61</td>
</tr>
<tr>
<td>6b00029</td>
<td>-13.80</td>
<td>-3</td>
<td>53.91</td>
</tr>
<tr>
<td>6b00030</td>
<td>30.30</td>
<td>8</td>
<td>19.27</td>
</tr>
<tr>
<td>6b00031</td>
<td>-12.75</td>
<td>-3</td>
<td>30.55</td>
</tr>
<tr>
<td>6b00032</td>
<td>3.43</td>
<td>1</td>
<td>44.12</td>
</tr>
<tr>
<td>6b00034</td>
<td>4.72</td>
<td>1</td>
<td>85.85</td>
</tr>
<tr>
<td>6b00038</td>
<td>4.66</td>
<td>1</td>
<td>37.53</td>
</tr>
<tr>
<td>6b00042</td>
<td>-59.22</td>
<td>-15</td>
<td>80.83</td>
</tr>
<tr>
<td>6b00046A</td>
<td>-27.50</td>
<td>-15</td>
<td>17.15</td>
</tr>
<tr>
<td>6b00051</td>
<td>5.10</td>
<td>16</td>
<td>-1.32</td>
</tr>
<tr>
<td>6b00056</td>
<td>9.47</td>
<td>55</td>
<td>-2.53</td>
</tr>
</tbody>
</table>

*Please note as part of the Dawlish Warren Beach Management Scheme, 250,000m³ of sand was dredged from Pole Sands and deposited onto the beach in June 2017. This is the reason for the large area of accretion along the majority of the spit and caution should be used when performing analysis on this data.*
Actual Change in Cross-sectional Area (Spring 2017 to Spring 2018)

Survey Unit Boundary

Accretion
No Change
Erosion

Aerial Photography from 2017

± Actual Change in Cross-sectional Area

Survey Unit Boundary

No Change
Accretion
Erosion

> 30 m²
15 - 30 m²
5 - 15 m²
< 5 m²
15 - 30 m²
> 30 m²

Aerial Photography from 2017

0 150 300 m
Actual Change in Cross-sectional Area (Spring 2017 to Spring 2018)

Survey Unit Boundary

Aerial Photography from 2017

Accretion
No Change
Erosion

> 30 m²
15 - 30 m²
5 - 15 m²
< 5 m²
5 - 15 m²
15 - 30 m²
> 30 m²
< 5 m²

6bSU16-3 Dawlish Warren - Beach Change (2 of 2)

SDADCA G - South Devon
Actual Change in Cross-sectional Area (Baseline 2007 to Spring 2018)

Survey Unit Boundary

Aerial Photography from 2017
Actual Change in Cross-sectional Area (Baseline 2007 to Spring 2018)

Survey Unit Boundary

Aerial Photography from 2017

Accretion
No Change
Erosion

<table>
<thead>
<tr>
<th>Baseline 2007 to Spring 2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 m^2</td>
</tr>
<tr>
<td>15-30 m^2</td>
</tr>
<tr>
<td>5-15 m^2</td>
</tr>
<tr>
<td>5-15 m^2</td>
</tr>
<tr>
<td>&gt; 30 m</td>
</tr>
<tr>
<td>&lt; 5 m</td>
</tr>
<tr>
<td>15-30 m^2</td>
</tr>
<tr>
<td>&gt; 30 m</td>
</tr>
</tbody>
</table>

6bSU16-3 Dawlish Warren - Beach Change (2 of 2)
Change in Elevation (m) Between October 2017 and June 2018

Model Extent

Change in Elevation (m)

-3 -2.5 -2 -1.5 -1 -0.5 -0.25 0 0.25 0.5 1 1.5 2 2.5 3

EROSION
NO CHANGE
ACCRETION

Aerial Photography from 2017

0 150 300 m
Aerial Photography from 2017

Change in Elevation (m) Between October 2017 and June 2018

Model Extent

-3 ≥ 3
2.5 - 3
2 - 2.5
1.5 - 2
1 - 1.5
0.5 - 1
0.25 - 0.5
-0.25 - 0.25
-0.5 - -0.25
-1 - -0.5
-1.5 - -1
-2 - -1.5
-2.5 - -2
-3 - -2.5

ACCRETION
NO CHANGE
EROSION
Change in Elevation (m) Between April 2007 and October 2018

*2007 and 2018 baseline data is from LiDAR

Model Extent

Change in Elevation (m)

-3 - 2.5
-2 - 2.5
-1.5 - 2.5
-1 - 2.5
-0.5 - 2.5
0.25 - 2.5
0.5 - 2.5
1 - 2.5
1.5 - 2.5
2 - 2.5
2.5 - 2.5
3 - 2.5

EROSION
NO CHANGE
ACCRETION

Aerial Photography from 2017
Change in Elevation (m) Between April 2007 and October 2018

Model Extent

Erosion
No Change
Accretion

*2007 and 2018 baseline data is from LiDAR

Aerial Photography from 2017
### Spring-Spring

<table>
<thead>
<tr>
<th>Survey Type</th>
<th>Dates Surveyed</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring-Spring</td>
<td>28/06/2017 - 21/03/2018</td>
<td>Over the past year, the overall trend has been dominated by erosion with the majority of profiles experiencing a loss of material. Profile 6b00094 has seen the greatest change losing 47% of its cross-sectional area across the entire profile length. Profiles 6b00066, 6b00090 and 6b00119 have all accreted.</td>
</tr>
</tbody>
</table>

### Baseline-Spring

<table>
<thead>
<tr>
<th>Survey Type</th>
<th>Dates Surveyed</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline-Spring</td>
<td>19/04/2007 - 21/03/2018</td>
<td>Since 2007, the overall trend is for erosion, with the majority of profiles losing material. Profile 6b00098 has experienced the most erosion, with a decrease of 34 m² in cross-sectional area. Profiles 6b00113 to 6b00119 have experienced low level erosion, equating to no significant change. Profiles 6b00074 to 6b0082 have accreted across the majority of their profile lengths.</td>
</tr>
</tbody>
</table>

### Comments

Please note the high percentage change in cross-sectional area observed along 6b00090 is due to the short length of the profile and does not equate to the large amount of actual material change.

### Profile Cross-Sectional Area

<table>
<thead>
<tr>
<th>Profile</th>
<th>Spring to Spring</th>
<th>Baseline to Spring</th>
<th>Master Profile Level (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>June 2017 to Mar 2018</td>
<td>April 2007 to Mar 2018</td>
<td>Level (m)</td>
</tr>
<tr>
<td>CSA Diff (m²)</td>
<td>% Change</td>
<td>CSA Diff (m²)</td>
<td>% Change</td>
</tr>
<tr>
<td>-----------</td>
<td>---------</td>
<td>-------------</td>
<td>---------</td>
</tr>
<tr>
<td>6b00066</td>
<td>11.89</td>
<td>-30.00</td>
<td>-17</td>
</tr>
<tr>
<td>6b00070</td>
<td>-2.63</td>
<td>-13.98</td>
<td>-11</td>
</tr>
<tr>
<td>6b00074</td>
<td>-10.55</td>
<td>5.70</td>
<td>5</td>
</tr>
<tr>
<td>6b00078</td>
<td>-14.91</td>
<td>23.21</td>
<td>40</td>
</tr>
<tr>
<td>6b00082</td>
<td>-7.87</td>
<td>13.21</td>
<td>41</td>
</tr>
<tr>
<td>6b00086</td>
<td>-8.91</td>
<td>4.99</td>
<td>46</td>
</tr>
<tr>
<td>6b00090</td>
<td>5.72</td>
<td>-1.19</td>
<td>-11</td>
</tr>
<tr>
<td>6b00094</td>
<td>-25.10</td>
<td>-13.32</td>
<td>-32</td>
</tr>
<tr>
<td>6b00098</td>
<td>-22.40</td>
<td>-34.33</td>
<td>-43</td>
</tr>
<tr>
<td>6b00102</td>
<td>-9.40</td>
<td>-11.29</td>
<td>-14</td>
</tr>
<tr>
<td>6b00107</td>
<td>-8.49</td>
<td>-14.32</td>
<td>-13</td>
</tr>
<tr>
<td>6b00111</td>
<td>-12.37</td>
<td>-24.00</td>
<td>-39</td>
</tr>
<tr>
<td>6b00113</td>
<td>0.53</td>
<td>-0.09</td>
<td>0</td>
</tr>
<tr>
<td>6b00116</td>
<td>-15.76</td>
<td>-1.74</td>
<td>-1</td>
</tr>
<tr>
<td>6b00119</td>
<td>21.20</td>
<td>-3.04</td>
<td>-3</td>
</tr>
</tbody>
</table>
Actual Change in Cross-sectional Area (Spring 2017 to Spring 2018)

<table>
<thead>
<tr>
<th>Survey Unit Boundary</th>
<th>Change in Cross-sectional Area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6b00084 (-47%)</td>
</tr>
<tr>
<td></td>
<td>6b00090 (103%)</td>
</tr>
<tr>
<td></td>
<td>6b00082 (-36%)</td>
</tr>
<tr>
<td></td>
<td>6b00078 (-15%)</td>
</tr>
<tr>
<td></td>
<td>6b00074 (-8%)</td>
</tr>
<tr>
<td></td>
<td>6b00070 (-22%)</td>
</tr>
<tr>
<td></td>
<td>6b00066 (8%)</td>
</tr>
</tbody>
</table>

S D A D C A G  -  S o u t h  D e v o n

Aerial Photography from 2017

Survey Unit Boundary

Accretion

No Change

Erosion

6bSU17 Dawlish - Beach Change (1 of 2)
Actual Change in Cross-sectional Area (Baseline 2007 to Spring 2018)

Survey Unit Boundary

Accretion
No Change
Erosion

Aerial Photography from 2017

Survey Unit Boundary

6bSU17 Dawlish - Beach Change (1 of 2)

SDADCAG - South Devon
Actual Change in Cross-sectional Area (Baseline 2007 to Spring 2018)

Survey Unit Boundary

Accretion
No Change
Erosion

Aerial Photography from 2017

0 150 300 m

6bSU17 Dawlish - Beach Change (2 of 2)

SDADCAG - South Devon
### Survey Unit

<table>
<thead>
<tr>
<th>Survey Unit</th>
<th>6bSU18-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local Name</td>
<td>Teignmouth</td>
</tr>
</tbody>
</table>

#### Survey Type

<table>
<thead>
<tr>
<th>Survey Type</th>
<th>Dates Surveyed</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring-Spring</td>
<td>24/09/2017 - 20/03/2018</td>
<td>Since 2017, there has been a mixture of erosion and accretion across the survey unit. The greatest change has occurred on profile 6b00216 which has lost 42m² of material, equating to a 16% decrease in cross-sectional area. The losses on this profile have occurred at the foot of the sea wall, however there have been gains towards the bottom of the profile also. Profiles 6b00183 and 6b00209 have both experienced high level accretion, each gaining more than 30m² of material.</td>
</tr>
<tr>
<td>Baseline-Spring</td>
<td>16/05/2007 - 20/03/2018</td>
<td>Similar to the short term analysis, a mixture of erosion and accretion has occurred throughout the survey unit. Profile 6b00216 has experienced the most change, increasing its cross-sectional area by 63%, mostly towards the bottom of the profile. Profile 6b00183 has also shown high level accretion, gaining 57m² of material across the entire profile length.</td>
</tr>
</tbody>
</table>

#### Comments

Since 2017, there has been a mixture of erosion and accretion across the survey unit. The greatest change has occurred on profile 6b00216 which has lost 42m² of material, equating to a 16% decrease in cross-sectional area. The losses on this profile have occurred at the foot of the sea wall, however there have been gains towards the bottom of the profile also. Profiles 6b00183 and 6b00209 have both experienced high level accretion, each gaining more than 30m² of material.

Since 2017, there has been a mixture of erosion and accretion across the survey unit. The greatest change has occurred on profile 6b00216 which has lost 42m² of material, equating to a 16% decrease in cross-sectional area. The losses on this profile have occurred at the foot of the sea wall, however there have been gains towards the bottom of the profile also. Profiles 6b00183 and 6b00209 have both experienced high level accretion, each gaining more than 30m² of material.

### Profile Cross-Sectional Area

<table>
<thead>
<tr>
<th>Profile</th>
<th>Spring to Spring</th>
<th>Baseline to Spring</th>
<th>Master Profile Level (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CSA Diff (m²)</td>
<td>% Change</td>
<td>CSA Diff (m²)</td>
</tr>
<tr>
<td></td>
<td>Sep 2017 to Mar 2018</td>
<td>Baseline to Spring</td>
<td></td>
</tr>
<tr>
<td>6b00153</td>
<td>-4.97</td>
<td>-9</td>
<td>8.62</td>
</tr>
<tr>
<td>6b00157</td>
<td>-24.62</td>
<td>-24</td>
<td>-8.19</td>
</tr>
<tr>
<td>6b00161</td>
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<td>10.07</td>
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<td>6b00165</td>
<td>3.14</td>
<td>6</td>
<td>17.91</td>
</tr>
<tr>
<td>6b00169</td>
<td>7.03</td>
<td>22</td>
<td>17.07</td>
</tr>
<tr>
<td>6b00172</td>
<td>-1.39</td>
<td>-7</td>
<td>-15.15</td>
</tr>
<tr>
<td>6b00179</td>
<td>-21.27</td>
<td>-30</td>
<td>-3.12</td>
</tr>
<tr>
<td>6b00183</td>
<td>37.20</td>
<td>37</td>
<td>57.03</td>
</tr>
<tr>
<td>6b00187</td>
<td>-1.76</td>
<td>-5</td>
<td>3.74</td>
</tr>
<tr>
<td>6b00191</td>
<td>-21.87</td>
<td>-26</td>
<td>-28.46</td>
</tr>
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<td>6b00198</td>
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<td>-8.13</td>
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<td>6b00204</td>
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<td>9</td>
<td>-21.28</td>
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<td>6b00209</td>
<td>30.78</td>
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<td>-56.09</td>
</tr>
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<td>6b00212</td>
<td>23.40</td>
<td>96</td>
<td>-25.59</td>
</tr>
<tr>
<td>6b00216</td>
<td>-41.81</td>
<td>-16</td>
<td>83.05</td>
</tr>
<tr>
<td>6b00219</td>
<td>12.10</td>
<td>2</td>
<td>28.29</td>
</tr>
</tbody>
</table>
Actual Change in Cross-sectional Area (Spring 2017 to Spring 2018)

Survey Unit Boundary

Aerial Photography from 2017
Actual Change in Cross-sectional Area (Spring 2017 to Spring 2018)

Survey Unit Boundary

- Accretion
- No Change
- Erosion

Aerial Photography from 2017

Survey Unit Boundary

No Change
Accretion
Erosion

> 30 m²
15 - 30 m²
5 - 15 m²
< 5 m²
5 - 15 m²
15 - 30 m²
> 30 m²
< 5 m²
**Actual Change in Cross-sectional Area (Spring 2017 to Spring 2018)**

Survey Unit Boundary

- **Accretion**: > 30 m²
- **No Change**: 15 - 30 m²
- **Erosion**: 5 - 15 m²

Aerial Photography from 2017

**6bSU18-1 Teignmouth - Beach Change (3 of 3)**

SDADCAG - South Devon
Actual Change in Cross-sectional Area (Baseline 2007 to Spring 2018)

- **Survey Unit Boundary**

- **Accretion**
  - > 30 m²
  - 15 - 30 m²
  - 5 - 15 m²

- **No Change**
  - 5 - 15 m²

- **Erosion**
  - > 30 m²
  - < 5 m²

Aerial Photography from 2017
Actual Change in Cross-sectional Area (Baseline 2007 to Spring 2018)

<table>
<thead>
<tr>
<th>Survey Unit Boundary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accretion</td>
</tr>
<tr>
<td>No Change</td>
</tr>
<tr>
<td>Erosion</td>
</tr>
</tbody>
</table>

Aerial Photography from 2017

Survey Unit Boundary

6bSU18-1 Teignmouth - Beach Change (3 of 3)

SDADCAG - South Devon
## Survey Unit

### 6bSU18-2

### Local Name

Teign Estuary

---

<table>
<thead>
<tr>
<th>Survey Type</th>
<th>Dates Surveyed</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring-Spring Beach Change</td>
<td>09/10/2017 - 20/03/2018</td>
<td>Over the past year, the survey unit has remained fairly stable with the majority of profiles experiencing no significant change. Profile 6b00221 has experienced the most change with 18m² of accretion occurring on the beach face towards the seaward end and at the bottom of the profile towards the estuary. Profile 6b00258 has shown erosion losing 10m² of material across the majority of the profile length.</td>
</tr>
<tr>
<td>Baseline-Spring Beach change</td>
<td>26/10/2007 - 20/03/2018</td>
<td>Since 2007, the trend is very similar to that of the year on year analysis with the survey unit remaining relatively stable. Profile 6b00221 has experienced high level accretion gaining 40m² of material, equating to a 37% increase in cross-sectional area. However please note that this profile is highly dynamic due to the presence of the estuary mouth.</td>
</tr>
</tbody>
</table>

---

| Profile | Profile Cross-Sectional Area | | |
|---------|------------------------------|---|---|---|
|         | **Spring to Spring** | **Baseline to Spring** | **Master Profile Level (m)** |
|         | CSA Diff (m²) | % Change | CSA Diff (m²) | % Change | | |
| 6b00221 | 17.65 | 13 | 40.40 | 37 | -1.67 |
| 6b00224 | -0.67 | -1 | -5.65 | -6 | -1.67 |
| 6b00228 | -0.48 | -1 | 3.76 | 7 | -1.67 |
| 6b00247 | 0.50 | 0 | 10.11 | 8 | -1.67 |
| 6b00249 | 0.31 | 0 | -3.99 | -3 | -1.67 |
| 6b00252 | 0.84 | 2 | 0.31 | 1 | -1.67 |
| 6b00254 | 0.50 | 0 | 9.53 | 8 | -1.67 |
| 6b00256 | 6.77 | 4 | 14.92 | 9 | -1.67 |
| 6b00258 | -10.39 | -14 | -1.46 | -2 | -1.67 |
| 6b00263 | 0.57 | 1 | -3.37 | -5 | -1.67 |
Actual Change in Cross-sectional Area (Baseline 2007 to Spring 2018)

Survey Unit Boundary

- No Change
- Accretion
- Erosion

Aerial Photography from 2017

SDADCAG - South Devon
Survey Unit | 6bSU20-1
--- | ---
Local Name | Oddicombe Beach

<table>
<thead>
<tr>
<th>Survey Type</th>
<th>Dates Surveyed</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring-Spring</td>
<td>28/06/2017 - 03/02/2018</td>
<td>Over the last year, the overall trend for the survey unit has been for erosion. Profiles 6b00396 to 6b00399 have all experienced more than a 4.5m² decrease in cross-sectional area. The material has been drawn down from the top of the beach and some material has accreted towards the bottom. Profiles 6b00399 and 6b00409 have remained relatively stable.</td>
</tr>
<tr>
<td>Baseline-Spring</td>
<td>20/04/2007 - 03/02/2018</td>
<td>Since 2007, the majority of profiles in the survey unit have experienced accretion. The largest change is observed on profile 6b00396 with an increase of 12m² in cross-sectional area, mainly accreting at the bottom of the profile. Profile 6b00399 has experienced erosion losing 9m² of material, with material being lost at the top and mid sections of the beach and some accretion down towards the bottom of the profile.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Profile</th>
<th>Spring to Spring</th>
<th>Baseline to Spring</th>
<th>Master Profile Level (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Jun 2017 to Feb 2018</td>
<td>Apr 2007 to Feb 2018</td>
<td></td>
</tr>
<tr>
<td>CSA Diff (m²)</td>
<td>% Change</td>
<td>CSA Diff (m²)</td>
<td>% Change</td>
</tr>
<tr>
<td>6b00396</td>
<td>-5.04</td>
<td>-4</td>
<td>12.36</td>
</tr>
<tr>
<td>6b00397</td>
<td>-5.63</td>
<td>-6</td>
<td>3.59</td>
</tr>
<tr>
<td>6b00399</td>
<td>-4.56</td>
<td>-6</td>
<td>-8.85</td>
</tr>
<tr>
<td>6b00409</td>
<td>-0.78</td>
<td>-1</td>
<td>2.06</td>
</tr>
</tbody>
</table>
Actual Change in Cross-sectional Area (Baseline 2007 to Spring 2018)

Survey Unit Boundary

- **6b00396** (11%)
- **6b00397** (4%)
- **6b00399** (-11%)
- **6b00409** (2%)
### Survey Unit
6bSU21-2

### Local Name
Meadfoot

**Survey Type** | **Dates Surveyed** | **Observations**
--- | --- | ---
Spring-Spring | Beach Change 28/07/2017 - 03/02/2018 | Over the last year, there has been a mixture of erosion and accretion across the survey unit. Profile 6b00524 has seen the greatest change, losing 20% of its cross-sectional area, equating to a loss of 17m² of material across the majority of the profile length. Profiles 6b00520A and 6b00527 have both gained a small amount of material at the top of the profiles. Profile 6b00529 has remained fairly stable over the last year.

Baseline-Spring | Beach change 26/10/2007 - 03/02/2018 | The long term trend for this survey unit shows a different signal to that of the year on year analysis, with erosion dominating. Profiles 6b00524, 6b00527 and 6b00529 have all experienced erosion across their entire profile lengths, with each seeing a >20% decrease in cross-sectional area. Profile 6b00520A has experienced significant accretion, with a 36% increase in cross-sectional area.

---

#### Profile Cross-Sectional Area

<table>
<thead>
<tr>
<th>Profile</th>
<th>Spring to Spring</th>
<th>Baseline to Spring</th>
<th>Master Profile</th>
<th>Level (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>July 2017 to Feb 2018</td>
<td>Oct 2007 to Feb 2018</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CSA Diff (m²)</td>
<td>% Change</td>
<td>CSA Diff (m²)</td>
<td>% Change</td>
<td></td>
</tr>
<tr>
<td>6b00520A</td>
<td>12.29</td>
<td>15</td>
<td>24.48</td>
<td>36</td>
</tr>
<tr>
<td>6b00524</td>
<td>-16.80</td>
<td>-20</td>
<td>-19.45</td>
<td>-22</td>
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<tr>
<td>6b00527</td>
<td>7.18</td>
<td>22</td>
<td>-13.54</td>
<td>-26</td>
</tr>
<tr>
<td>6b00529</td>
<td>-3.99</td>
<td>-6</td>
<td>-15.30</td>
<td>-20</td>
</tr>
</tbody>
</table>
Actual Change in Cross-sectional Area (Baseline 2007 to Spring 2018)

Survey Unit Boundary

Aerial Photography from 2017

No Change

Erosion

Accretion
### Survey Unit

**6bSU21-4**

### Local Name

**Torquay and Livermead**

---

<table>
<thead>
<tr>
<th>Survey Type</th>
<th>Dates Surveyed</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring-Spring</td>
<td>27/07/2017 - 04/02/2018</td>
<td>Since 2017, the survey unit has remained relatively stable with no significant change occurring on the profiles. Profile 6b00574 has experienced the most change, with low level accretion at the top of the profile, resulting in a 6% increase in cross-sectional area.</td>
</tr>
<tr>
<td>Baseline-Spring</td>
<td>15/05/2007 - 04/02/2018</td>
<td>Over the long term, the majority of profiles in the survey unit have experienced accretion, with the exception of 6b00570 which has experienced very low level erosion. Profile 6b00570 has experienced the most accretion, showing a 15m² increase in cross-sectional area.</td>
</tr>
</tbody>
</table>

### Comments

The high percentage change in cross-sectional area observed along 6b00578 is due to the short length of the profile and does not equate to a large amount of actual material change.

---

### Profile Cross-Sectional Area

<table>
<thead>
<tr>
<th>Profile</th>
<th>Spring to Spring - Jul 2017 to Feb 2018</th>
<th>Baseline to Spring - May 2007 to Feb 2018</th>
<th>Master Profile Level (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CSA Diff (m²)</td>
<td>% Change</td>
<td>CSA Diff (m²)</td>
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<tr>
<td>6b00570</td>
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<tr>
<td>6b00574</td>
<td>5.85</td>
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<td>15.84</td>
</tr>
<tr>
<td>6b00578</td>
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<td>10.10</td>
</tr>
<tr>
<td>6b00585</td>
<td>2.81</td>
<td>1</td>
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</tr>
<tr>
<td>6b00592</td>
<td>2.79</td>
<td>7</td>
<td>5.25</td>
</tr>
<tr>
<td>6b00595</td>
<td>-2.87</td>
<td>-5</td>
<td>2.42</td>
</tr>
</tbody>
</table>
Since 2017, the survey unit has remained relatively stable. All profiles with the exception of profile 6b00628 have experienced accretion. The changes have been relatively small across all profiles, with the maximum amount of accretion occurring on profile 6b00614 which has gained 7m² of material, equating to a 6% change in cross-sectional area.

Compared to the year on year analysis, the long term trend has more of a mixed signal of erosion and accretion. The majority of profiles have accreted, with the largest change occurring on profile 6b00652, which has gained 18m² of material across the majority of the profile length. Profiles 6b00632 and 6b00636 have experienced no significant change. Profiles 6b00644 and 6b00648 have both shown low level erosion, losing 7m² and 14m² of material respectively.

### Profile Cross-Sectional Area

<table>
<thead>
<tr>
<th>Profile</th>
<th>Spring to Spring</th>
<th>Baseline to Spring</th>
<th>Master Profile Level (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CSA Diff (m²)</td>
<td>% Change</td>
<td>CSA Diff (m²)</td>
</tr>
<tr>
<td>6b00614</td>
<td>6.78</td>
<td>6</td>
<td>14.75</td>
</tr>
<tr>
<td>6b00624</td>
<td>5.77</td>
<td>5</td>
<td>16.34</td>
</tr>
<tr>
<td>6b00628</td>
<td>-1.32</td>
<td>-1</td>
<td>7.38</td>
</tr>
<tr>
<td>6b00632</td>
<td>1.83</td>
<td>1</td>
<td>0.90</td>
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<tr>
<td>6b00636</td>
<td>1.13</td>
<td>1</td>
<td>-3.61</td>
</tr>
<tr>
<td>6b00640</td>
<td>3.17</td>
<td>1</td>
<td>5.51</td>
</tr>
<tr>
<td>6b00644</td>
<td>5.62</td>
<td>3</td>
<td>-7.29</td>
</tr>
<tr>
<td>6b00648</td>
<td>3.62</td>
<td>3</td>
<td>-13.45</td>
</tr>
<tr>
<td>6b00652</td>
<td>2.52</td>
<td>1</td>
<td>18.12</td>
</tr>
</tbody>
</table>
Actual Change in Cross-sectional Area
(Spring 2017 to Spring 2018)

Survey Unit Boundary

- Erosion > 30 m
- Erosion 15 - 30 m
- Erosion 5 - 15 m
- Accretion 5 - 15 m
- Accretion 15 - 30 m
- No Change > 30 m
- No Change < 5 m
- No Change 5 - 15 m
- No Change 15 - 30 m
- No Change > 30 m

Aerial Photography from 2017
Actual Change in Cross-sectional Area (Baseline 2007 to Spring 2018)

Survey Unit Boundary

- Accretion
- No Change
- Erosion

6bSU21-5 Paignton - Beach Change

SDADCAG - South Devon
### Survey Unit

**Survey Unit**: 6bSU21-6

**Local Name**: Goodrington Sands

---

<table>
<thead>
<tr>
<th>Survey Type</th>
<th>Dates Surveyed</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring-Spring</td>
<td>29/04/2017 - 03/02/2018</td>
<td>Over the last year, there has been a mixture of erosion and accretion across the survey unit and most profiles have remained fairly stable. Profiles 6b00673 and 6b00687 have experienced very little change, resulting in a 0% change in cross-sectional area. Profiles 6b00676 to 6b00683 towards the centre of the survey unit have experienced the most change, with the greatest change occurring on profile 6b00679 which has gained 7m² of material towards the top of the profile.</td>
</tr>
<tr>
<td>Baseline-Spring</td>
<td>19/05/2007 - 03/02/2018</td>
<td>Since 2007, the majority of the profiles within the survey unit have remained stable, with the exception of profiles 6b00673 and 6b00676 which have experienced low level accretion. Profile 6b00673 has accreted the most, gaining 28m² of material, equating to a 21% increase in cross-sectional area.</td>
</tr>
</tbody>
</table>

---

### Profile Cross-Sectional Area

<table>
<thead>
<tr>
<th>Profile</th>
<th>Spring to Spring</th>
<th>Baseline to Spring</th>
<th>Master Profile Level (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CSA Diff (m²)</td>
<td>% Change</td>
<td>CSA Diff (m²)</td>
</tr>
<tr>
<td>6b00673</td>
<td>-0.26</td>
<td>0</td>
<td>27.75</td>
</tr>
<tr>
<td>6b00676</td>
<td>-6.55</td>
<td>-3</td>
<td>14.08</td>
</tr>
<tr>
<td>6b00679</td>
<td>7.26</td>
<td>4</td>
<td>0.85</td>
</tr>
<tr>
<td>6b00683</td>
<td>5.35</td>
<td>1</td>
<td>-1.03</td>
</tr>
<tr>
<td>6b00687</td>
<td>-0.61</td>
<td>0</td>
<td>3.69</td>
</tr>
</tbody>
</table>
Actual Change in Cross-sectional Area (Baseline 2007 to Spring 2018)

Accretion
- > 30 m²
- 15 - 30 m²
- 5 - 15 m²
No Change
- < 5 m²
Erosion
- 5 - 15 m²
- 15 - 30 m²
- > 30 m²
Survey Unit Boundary

Aerial Photography from 2017

0 125 250 m
Survey Unit | 6bSU21-8
Local Name | Broadsands

The year on year analysis shows the entire survey unit has remained stable over the past year. Each of the profiles have experienced a 1% change in cross-sectional area.

Since 2007, the long term trend is of accretion across the survey unit. Profile 6b00717 has experienced no significant change with only a 1% increase in cross-sectional area. Profile 6b00721 and 6b00725 have both experienced low level accretion. Both profiles have gained >10m² of material, mainly towards the mid and lower sections.

<table>
<thead>
<tr>
<th>Survey Type</th>
<th>Dates Surveyed</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring-Spring</td>
<td>Beach Change</td>
<td>23/07/2017 - 03/02/2018</td>
</tr>
<tr>
<td>Baseline-Spring</td>
<td>Beach change</td>
<td>02/08/2007 - 03/02/2018</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Profile</th>
<th>Spring to Spring</th>
<th>Baseline to Spring</th>
<th>Master Profile Level (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Jul 2017 to Feb 2018</td>
<td>Aug 2007 to Feb 2018</td>
<td></td>
</tr>
<tr>
<td>CSA Diff (m²)</td>
<td>% Change</td>
<td>CSA Diff (m²)</td>
<td>% Change</td>
</tr>
<tr>
<td>6b00717</td>
<td>-3.39</td>
<td>-1</td>
<td>2.50</td>
</tr>
<tr>
<td>6b00721</td>
<td>2.77</td>
<td>1</td>
<td>15.30</td>
</tr>
<tr>
<td>6b00725</td>
<td>-1.36</td>
<td>-1</td>
<td>10.52</td>
</tr>
</tbody>
</table>
Actual Change in Cross-sectional Area (Spring 2017 to Spring 2018)

- **Accretion**
  - > 30 m²
  - 15 - 30 m²
  - 5 - 15 m²
  - < 5 m²

- **Erosion**
  - 5 - 15 m²
  - 15 - 30 m²
  - > 30 m²

Survey Unit Boundary

Aerial Photography from 2017
South West Regional Coastal Monitoring Programme
Annual Survey Report 2018

Actual Change in Cross-sectional Area (Baseline 2007 to Spring 2018)

Accretion
> 30 m²
15 - 30 m²
5 - 15 m²
No Change
< 5 m²
5 - 15 m²
15 - 30 m²
> 30 m²

Erosion

Survey Unit Boundary

Aerial Photography from 2017

m

0 100 200

Survey Unit Boundary

6b00717 (1%) 6b00721 (7%) 6b00725 (4%)
Since 2017, erosion has been the dominant factor across the survey unit. Profiles 6b01175 and 6b01179 have both experienced high level erosion, resulting in a >90m² decrease in cross-sectional area across both profiles. Profile 6b01182 has experienced low level erosion experiencing a 1% decrease in cross-sectional area. Profile 6b01186 located towards the southern end of the survey unit has experienced high level accretion gaining 118m² of material, resulting in a steepening of the beach face and increase in berm height.

Since 2007, high level accretion has dominated the survey unit. Profiles 6b01179, 6b01182 and 6b01186 have all gained more than 175m² of material, with the largest amount of accretion occurring on profile 6b01186. Profile 6b01175 has experienced low level erosion, losing 5m² of material, equating to a 1% decrease in cross-sectional area.

### Profile Cross-Sectional Area

<table>
<thead>
<tr>
<th>Profile</th>
<th>Spring to Spring</th>
<th>Baseline to Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Jul 2017 to Mar 2018</td>
<td>May 2007 to Mar 2018</td>
</tr>
<tr>
<td></td>
<td>CSA Diff (m²)</td>
<td>% Change</td>
</tr>
<tr>
<td>6b01175</td>
<td>-92.72</td>
<td>-17</td>
</tr>
<tr>
<td>6b01179</td>
<td>-93.61</td>
<td>-13</td>
</tr>
<tr>
<td>6b01182</td>
<td>-9.30</td>
<td>-1</td>
</tr>
<tr>
<td>6b01186</td>
<td>117.98</td>
<td>18</td>
</tr>
</tbody>
</table>
Actual Change in Cross-sectional Area (Spring 2017 to Spring 2018)

- Accretion:
  - > 30 m²
  - 15 - 30 m²
  - 5 - 15 m²
- Erosion:
  - < 5 m²
  - 5 - 15 m²
  - 15 - 30 m²
  - > 30 m²

Survey Unit Boundary

Aerial Photography from 2017
### Survey Unit: 6bSU26-1

**Local Name:** Slapton Sands

<table>
<thead>
<tr>
<th>Survey Type</th>
<th>Dates Surveyed</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring-Spring</td>
<td>14/07/2017 - 06/03/2018</td>
<td>Over the last year, high level erosion has dominated the northern and middle sections of the survey unit and accretion has dominated the southern section at Torcross. Profiles 6b01220 to 6b01298 have experienced high level erosion. Recession of the beach face of up to 10m can be seen on certain profiles, leading to the destruction of a section of the A379 road. This damage was caused during Storm Emma that occurred in March 2018. The greatest change has occurred on profile 6b01220 at the northern end (Strete), which has lost 221m² of material, equating to a 46% reduction in cross-sectional area. Profiles 6b01306 to 6b01323 have experienced accretion and 6b01315, 6b01319 and 6b01323 have experienced significant accretion with each profile gaining 33m², 62m² and 48m² of material respectively across the entire profile lengths.</td>
</tr>
<tr>
<td>Baseline-Spring</td>
<td>24/03/2008 - 06/03/2018</td>
<td>Since 2007, high level erosion has dominated the survey unit, with accretion occurring in some areas. Profiles 6b01227 to 6b01237 at the northern end of the survey unit and 6b01319, 6b01323 at the southern end have experienced high level accretion, with each profile gaining more than 30m³ of material. The remaining profiles have experienced high level erosion, typically across most of the profile lengths, with a build up of sediment towards the bottom of each profile. The greatest change is observed on profile 6b01220 which has lost 208m² of material across the entire length of the profile.</td>
</tr>
<tr>
<td>Spring-Spring</td>
<td>14/07/2017 - 22/05/2018</td>
<td>Towards the northern end of the survey unit at Strete, a large area of erosion can be seen extending from MLWS to the HW level. A narrow band of erosion can be seen at the top of the beach and low level accretion is observed at the MLWS level below. A narrow band of high level erosion at the very top of the beach is observed across the entire middle section of the beach, with a mixture of erosion and accretion observed in between. High level accretion is observed across the majority of the beach in front of the seawall at Torcross, with around 2.5m increase in elevation in front of the sea wall. Net sediment balance above MLWS: -35,118 m³. Net sediment change: -2 %.</td>
</tr>
<tr>
<td>Baseline-Spring</td>
<td>24/03/2008 - 22/05/2018</td>
<td>Erosion dominates the survey unit. At the northern end of the survey unit, a large area of high level erosion is observed. A large band of accretion is visible towards the lower section of the beach and a narrow band of high level erosion is visible at the top of the beach. The middle of the beach is dominated by erosion, with high level erosion present at the very top of the beach. Towards the southern end of the survey unit at the foot of the sea wall in Torcross, high level accretion is observed. Net sediment balance above MLWS: -97,767 m³. Net sediment change: -4 %.</td>
</tr>
</tbody>
</table>

**Comments:** *Please note for the topographic difference models, the 2008 baseline data is LiDAR and the 2018 baseline data is topographic data. Therefore caution should be taken when analysing the baseline-spring difference model due to the different resolutions of the data set. The reason that LiDAR has been used and not the original topographic baseline is due a change in the landward...*
### Profile Cross-Sectional Area

<table>
<thead>
<tr>
<th>Profile</th>
<th>Spring to Spring</th>
<th>Baseline to Spring</th>
<th>Master Profile Level (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CSA Diff (m²)</td>
<td>% Change</td>
<td>CSA Diff (m²)</td>
</tr>
<tr>
<td>6b01220</td>
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</tr>
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<td>66.88</td>
</tr>
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<td>43.87</td>
</tr>
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<td>6b01243</td>
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<td>6b01247</td>
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<td>-9.21</td>
</tr>
<tr>
<td>6b01319</td>
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<td>41</td>
<td>60.76</td>
</tr>
<tr>
<td>6b01323</td>
<td>48.16</td>
<td>38</td>
<td>37.46</td>
</tr>
</tbody>
</table>
South West Regional Coastal Monitoring Programme

Annual Survey Report 2018

Actual Change in Cross-sectional Area (Spring 2017 to Spring 2018)

- Accretion
  - > 30 m²
  - 15 - 30 m²
  - 5 - 15 m²
  - < 5 m²

- Erosion
  - > 30 m²
  - 15 - 30 m²
  - > 30 m²

Survey Unit Boundary

Survey Unit Boundary

Aerial Photography from 2017

0 200 400 m

No Change

Survey Unit Boundary

6bSU26-1 Slapton Sands - Beach Change (1 of 3)

SDADCAG - South Devon
Actual Change in Cross-sectional Area (Spring 2017 to Spring 2018)

- **Accretion**:
  - > 30 m²
  - 15 - 30 m²
  - 5 - 15 m²
- **Erosion**:
  - < 5 m²
  - 5 - 15 m²
  - 15 - 30 m²
  - > 30 m²

Survey Unit Boundary

Aerial Photography from 2017

SDADCAG - South Devon
Actual Change in Cross-sectional Area (Spring 2017 to Spring 2018)

- **Accretion**
  - > 30 m$^2$
  - 15 - 30 m$^2$
  - 5 - 15 m$^2$
- **Erosion**
  - < 5 m$^2$
  - 5 - 15 m$^2$
  - 15 - 30 m$^2$
  - > 30 m$^2$
- **No Change**

Survey Unit Boundary

Aerial Photography from 2017
Actual Change in Cross-sectional Area (Baseline 2007 to Spring 2018)

- Accretion:
  - > 30 m²
  - 15 - 30 m²
  - 5 - 15 m²
- Erosion:
  - < 5 m²
  - 5 - 15 m²
  - 15 - 30 m²
  - > 30 m²

Survey Unit Boundary

Survey Unit 6b01220: (45%) Erosion
Survey Unit 6b01227: (4%) Erosion
Survey Unit 6b01233: (8%) Erosion
Survey Unit 6b01237: (5%) Erosion
Survey Unit 6b01243: (4%) Erosion
Survey Unit 6b01247: (-7%) Erosion
Survey Unit 6b01253: (-19%) Erosion

Aerial Photography from 2017

Survey Unit Boundary

No Change: 94
Actual Change in Cross-sectional Area (Baseline 2007 to Spring 2018)

<table>
<thead>
<tr>
<th>Change in Cross-sectional Area</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 30 m²</td>
<td>-21%</td>
</tr>
<tr>
<td>15 - 30 m²</td>
<td>-25%</td>
</tr>
<tr>
<td>5 - 15 m²</td>
<td>-19%</td>
</tr>
<tr>
<td>&lt; 5 m²</td>
<td>-17%</td>
</tr>
<tr>
<td>No Change</td>
<td>-17%</td>
</tr>
<tr>
<td>5 - 15 m²</td>
<td>-17%</td>
</tr>
<tr>
<td>15 - 30 m²</td>
<td>-19%</td>
</tr>
<tr>
<td>&gt; 30 m²</td>
<td>-25%</td>
</tr>
</tbody>
</table>

Survey Unit Boundary

Aerial Photography from 2017

0 200 400 m
Actual Change in Cross-sectional Area (Baseline 2007 to Spring 2018)

- **Accretion**:
  - > 30 m²
  - 15 - 30 m²
  - 5 - 15 m²
  - < 5 m²

- **Erosion**:
  - 5 - 15 m²
  - 15 - 30 m²
  - > 30 m²

Survey Unit Boundary

Aerial Photography from 2017
Change in Elevation (m) Between July 2017 and May 2018

Aerial Photography from 2017

- EROSION
- NO CHANGE
- ACCRETION

Model Extent
Change in Elevation (m) Between July 2017 and May 2018

Aerial Photography from 2017

Model Extent

Change in Elevation (m)

-0.25  -  0.25
-0.5  -  -0.25
-1  -  -0.5
-1.5  -  -1
-2  -  -1.5
-2.5  -  -2
-3  -  -2.5

<= -3
2.5  -  3
2  -  2.5
1.5  -  2
1  -  1.5
0.5  -  1
0.25  -  0.5
NO CHANGE
ACCRETION
EROSION
Change in Elevation (m) Between March 2008 and May 2018

*2008 baseline data is from LiDAR
Change in Elevation (m) Between March 2008 and May 2018

*2008 baseline data is from LiDAR
2008 baseline data is from LiDAR

Change in Elevation (m) Between March 2008 and May 2018

Aerial Photography from 2017

Model Extent
Aerial Photography from 2017

Sediment Type
- Gravel
- Gravel & Sand
- Sand
- Boulder
- Dune
- Dune Vegetated
- Grass
- Gravel & Mud
- Mud
- Mud & Sand
- Rock
- Saltmarsh
- Sea Defence
- Shell
- Water Body
- Mixture
- Obstruction

0 200 400 m
<table>
<thead>
<tr>
<th>Survey Type</th>
<th>Dates Surveyed</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring-Spring</td>
<td>13/07/2017 - 06/03/2018</td>
<td>Since 2017, erosion has dominated the survey unit. Profiles 6b01330 to 6b01346 have experienced high level erosion, each losing more than 16m² of material. Profiles 6b01338, 6b01342 and 6b01346 show a recession of the beach face of ±10m, which can be attributed to Storm Emma. The greatest change has occurred on profile 6b01342 with a loss of 47m² of material. Profile 6b01350 and 6b01354 located towards the southern end of the survey unit have both accreted, gaining 7m² and 17m² of material respectively.</td>
</tr>
<tr>
<td>Baseline-Spring</td>
<td>24/03/2008 - 06/03/2018</td>
<td>Since 2007, the long term trend is of erosion, with the majority of profiles experiencing high level erosion. Profile 6b01354 is the only profile that has shown an increase in cross-sectional area of 19m². The rest of the profiles in the survey unit have all experienced erosion with each of them losing more than 20% of their cross-sectional area. The greatest change is observed on profile 6b01346 which has lost 130m² of material equating to 27% loss in cross-sectional area.</td>
</tr>
<tr>
<td>Spring-Spring</td>
<td>13/07/2017 - 17/05/2018</td>
<td>Erosion is dominant across the majority of the survey unit. A narrow band of very high level erosion is present at the top of the beach where the grass bank has eroded (up to 10m in places) as a result of Storm Emma. A small area of accretion is noted towards the southern end of the survey unit along the lower section of the beach. Net sediment balance above MLWS: -11,982 m³. Net sediment change: -3%</td>
</tr>
<tr>
<td>Baseline-Spring</td>
<td>24/03/2008 - 17/05/2018</td>
<td>The survey unit has experienced high level erosion over the long term. A band of very high level erosion can be seen towards the centre of the survey unit at the top of the beach. An area of no change is observed at the very northern and southern ends of the survey unit. Net sediment balance above MLWS: -90,151 m³. Net sediment change: -20%</td>
</tr>
</tbody>
</table>

Comments

*Please note for the topographic difference models, the 2008 baseline data is LiDAR and the 2018 baseline data is topographic data. Therefore caution should be taken when analysing the baseline-spring difference model due to the different resolutions of the data set. The reason that LiDAR has been used and not the original topographic baseline is due a change in the landward boundary following Storm Emma. Remedial work has been carried out to the sea defence in front of the main village, with additional boulders placed in front of the first section of road that services the houses at the eastern end of the beach.*
<table>
<thead>
<tr>
<th>Profile</th>
<th>CSA Diff (m²)</th>
<th>% Change</th>
<th>CSA Diff (m²)</th>
<th>% Change</th>
<th>Level (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Spring to Spring</td>
<td>Baseline to Spring</td>
<td>Master Profile</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Jul 2017 to Mar 2018</td>
<td>Mar 2008 to Mar 2018</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6b01330</td>
<td>-38.19</td>
<td>-35</td>
<td>-96.55</td>
<td>-58</td>
<td>-2.02</td>
</tr>
<tr>
<td>6b01334</td>
<td>-32.19</td>
<td>-14</td>
<td>-67.59</td>
<td>-26</td>
<td>-2.02</td>
</tr>
<tr>
<td>6b01338</td>
<td>-24.90</td>
<td>-8</td>
<td>-96.16</td>
<td>-25</td>
<td>-2.02</td>
</tr>
<tr>
<td>6b01342</td>
<td>-46.50</td>
<td>-13</td>
<td>-127.00</td>
<td>-29</td>
<td>-2.02</td>
</tr>
<tr>
<td>6b01346</td>
<td>-16.56</td>
<td>-4</td>
<td>-130.21</td>
<td>-27</td>
<td>-2.02</td>
</tr>
<tr>
<td>6b01350</td>
<td>7.17</td>
<td>9</td>
<td>-29.14</td>
<td>-25</td>
<td>-2.02</td>
</tr>
<tr>
<td>6b01354</td>
<td>16.79</td>
<td>17</td>
<td>19.38</td>
<td>20</td>
<td>-2.02</td>
</tr>
</tbody>
</table>
Actual Change in Cross-sectional Area (Baseline 2007 to Spring 2018)

- **Accretion**
  - > 30 m²
  - 15 - 30 m²
  - 5 - 15 m²
- **No Change**
  - < 5 m²
- **Erosion**
  - 5 - 15 m²
  - 15 - 30 m²
  - > 30 m²

Aerial Photography from 2017

Survey Unit Boundary
Aerial Photography from 2017

Sediment Type
- Gravel
- Gravel & Sand
- Sand
- Boulder
- Dune
- Dune Vegetated
- Grass
- Gravel & Mud
- Mud
- Mud & Sand
- Rock
- Saltmarsh
- Sea Defence
- Shell
- Water Body
- Mixture
- Obstruction
Survey Unit: 6bSU26-3  
Local Name: Hallsands

### Survey Type: Spring-Spring  
Dates Surveyed: 26/07/2017 - 06/03/2018  
Observations: Over the last year, all profiles in the survey unit have accreted. Profile 6b01384 and 6b01385 have both increased their cross-sectional area by more than 20% along their entire profile lengths. The material that has been gained on profile 6b01382 and 6b01383 has accreted at the top of the beach and the berm has grown in height.

### Survey Type: Baseline-Spring  
Dates Surveyed: 26/09/2007 - 06/03/2018  
Observations: Since 2007, all profiles have experienced erosion, losing a significant amount of material. All profiles have lost >23m² of material across their entire profile lengths. Profile 6b01382 has experienced the greatest change, losing 56m² of material, equating to a 24% decrease in cross-sectional area.

### Survey Type: Spring-Spring  
Dates Surveyed: 26/07/2017 - 17/05/2018  
Observations: Since 2017, accretion has dominated the survey unit with a large area present towards the northern end. A small area of erosion can be seen at the top of the beach. Net sediment balance above MLWS: -15,117 m³  
Net sediment change: -18 %

### Survey Type: Baseline-Spring  
Dates Surveyed: 26/09/2007 - 17/05/2018  
Observations: In comparison to the year on year analysis, the trend is for erosion since 2007. Erosion dominates most of the beach area, with highest levels present at the foot of the sea defence towards the southern end of the survey unit. Net sediment balance above MLWS: -61,885 m³  
Net sediment change: -48 %

### Comments:  
Some remedial work was carried out at the southern extent of the survey unit after the winter storms in 2013/14, with the addition of a boulder defence to protect the access road.

### Profile Cross-Sectional Area

<table>
<thead>
<tr>
<th>Profile</th>
<th>CSA Diff (m²)</th>
<th>% Change</th>
<th>CSA Diff (m²)</th>
<th>% Change</th>
<th>Master Profile Level (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6b01382</td>
<td>5.58</td>
<td>3</td>
<td>-55.79</td>
<td>-24</td>
<td>-2.02</td>
</tr>
<tr>
<td>6b01383</td>
<td>22.20</td>
<td>10</td>
<td>-40.18</td>
<td>-15</td>
<td>-2.02</td>
</tr>
<tr>
<td>6b01384</td>
<td>23.23</td>
<td>25</td>
<td>-27.35</td>
<td>-19</td>
<td>-2.02</td>
</tr>
<tr>
<td>6b01385</td>
<td>19.75</td>
<td>21</td>
<td>-23.95</td>
<td>-17</td>
<td>-2.02</td>
</tr>
</tbody>
</table>
Actual Change in Cross-sectional Area (Spring 2017 to Spring 2018)

- 6b01382 (3%): Accretion, > 30 m²
- 6b01383 (10%): Accretion, 15 - 30 m²
- 6b01384 (25%): Accretion, 5 - 15 m²
- 6b01385 (21%): Erosion, > 30 m²

Survey Unit Boundary

Aerial Photography from 2017

Accretion
- > 30 m²
- 15 - 30 m²
- 5 - 15 m²

Erosion
- < 5 m²
- 5 - 15 m²
- 15 - 30 m²
- > 30 m²

Survey Unit Boundary
Actual Change in Cross-sectional Area (Baseline 2007 to Spring 2018)

- 6b01382 (-24%)
- 6b01383 (-15%)
- 6b01384 (-19%)
- 6b01385 (-17%)

Survey Unit Boundary

Aerial Photography from 2017

Survey Unit Boundary
Aerial Photography from 2017

Sediment Type
- Gravel
- Gravel & Sand
- Sand
- Boulder
- Dune
- Dune Vegetated
- Grass
- Gravel & Mud
- Mud
- Mud & Sand
- Rock
- Saltmarsh
- Sea Defence
- Shell
- Water Body
- Mixture
- Obstruction

SDAD-CAG - South Devon

6bSU26-3: Hallsands - Sediment Distribution
Cross Sectional Area above MP Trend for Location: 6b00002 and BMS Extended

Area Above MP Trend: Eroding at -0.665 m²/year
Cross Sectional Area above MP Trend for Location: 6b00005 and BMS Extended

Area Above MP Trend: Eroding at -2.700 m²/Year

Survey Date:
- 04/12/2007
- 03/12/2008
- 03/12/2009
- 03/12/2010
- 03/12/2011
- 02/12/2012
- 02/12/2013
- 02/12/2014
- 02/12/2015
- 02/12/2016
- 01/12/2017

Area (m²):
- 0
- 50
- 100
- 150
- 200
- 250
- 300
- 350
- 400
- 450
- 500
- 550
- 600
- 650
- 700
- 750
- 800
- 850
- 900
- 950
- 1,000
- 1,050
- 1,100
- 1,150
- 1,200
- 1,250
- 1,300
- 1,350

Survey Unit for 6bSU16-3
Cross Sectional Area Charts
Cross Sectional Area above MP Trend for Location: 6b00007 and BMS Extended

Area Above MP Trend: Eroding at -22.994 m²/year
Cross Sectional Area above MP Trend for Location: 6bU0009 and BMS Extended

Area Above MP Trend: Eroding at -37.752 m²/year

Survey Date

04/12/2007  03/12/2008  03/12/2009  03/12/2010  03/12/2011  02/12/2012  02/12/2013  02/12/2014  02/12/2015  01/12/2016  01/12/2017

0  50  100  150  200  250  300  350  400  450  500  550  600  650  700  750  800  850  900  950  1000  1050  1100  1150  1200  1250  1300  1350

Area (m²)
Survey Unit for 6bSU16-3

Cross Sectional Area Charts

Cross Sectional Area above MP Trend for Location: 6b00011 and BMS Extended

Area above MP Trend: Eroding at -51.235 m²/year
Cross Sectional Area above MP Trend for Location: 6b00014 and BMS Extended

Area Above MP Trend, Eroding at -62.566 m²/year

Survey Date

04/12/2007 03/12/2009 03/12/2010 03/12/2011 03/12/2012 02/12/2013 02/12/2014 02/12/2015 01/12/2016 01/12/2017

Area (m²)

0 50 100 150 200 250 300 350 400 450 500 550 600 650 700 750 800 850 900 950 1000 1050 1100 1150 1200 1250 1300 1350
Cross Sectional Area above MP Trend for Location: 6b00017 and BMS Extended

Area Above MP Trend: Eroding at -36.721 m²/year
Cross Sectional Area above MP Trend for Location: 6b00019 and BMS Extended

Area Above MP Trend: Eroding at -16.497 m²/Year
Cross Sectional Area above MP Trend for Location: 6b00021 and BMS Extended

Area Above MP Trend: Eroding at -2.560 m²/Year

Survey Date

Area (m²)

04/12/2007 03/12/2008 03/12/2009 03/12/2010 03/12/2011 03/12/2012 02/12/2013 02/12/2014 02/12/2015 01/12/2016 01/12/2017

- Recycling Event
- Area Above MP
- Area Trend
Cross Sectional Area above MP Trend for Location: 6b00024 and BMS Extended

Area Above MP Trend: Accreting at 25.679 m²/Year
Cross Sectional Area above MP Trend for Location: 6b00026 and BMS Extended

Area Above MP Trend: Accreting at 23.003 m²/Year
Cross Sectional Area above MP Trend for Location: 6b00029 and BMS Extended

Area Above MP Trend: Accreting at 0.245 m²/year
Cross Sectional Area above MP Trend for Location: 6b00031 and BMS Extended

Area Above MP Trend: Accreting at 10.93 m²/Year
Cross Sectional Area above MP Trend for Location: 6b00032 and BMS Extended

Area Above MP Trend: Accreting at 10.161 m²/Year

Survey Unit for 6bSU16-3
Cross Sectional Area Charts
Cross Sectional Area above MP Trend for Location: 6b00034 and BMS Extended

Area Above MP Trend: Accreting at 0.046 m²/Year

Survey Date:

<table>
<thead>
<tr>
<th>04/12/2007</th>
<th>03/12/2009</th>
<th>03/12/2010</th>
<th>03/12/2011</th>
<th>03/12/2012</th>
<th>02/12/2013</th>
<th>02/12/2014</th>
<th>02/12/2015</th>
<th>02/12/2016</th>
<th>01/12/2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>300</td>
<td>350</td>
<td>400</td>
<td>450</td>
<td>500</td>
<td>550</td>
<td>600</td>
<td>650</td>
<td>700</td>
<td>750</td>
</tr>
</tbody>
</table>

Legend:
- Yellow: Recycling Event
- Green: Area above MP
- Light Green: Area Trend
Cross Sectional Area above MP Trend for Location: 6b00046A and EMS Extended

Area Above MP Trend: Accreting at 3.745 m²/Year
Cross Sectional Area above MP Trend for Location: 6b00051 and BMS Extended

Area Above MP Trend: Eroding at -0.513 m²/year
Cross Sectional Area above MP Trend for Location: 6b00056 and BMS Extended

Area Above MP Trend: Eroding at -0.362 m²/Year

Survey Date

04/12/2007 03/12/2008 03/12/2009 03/12/2010 03/12/2011 02/12/2012 02/12/2013 02/12/2014 02/12/2015 01/12/2016 01/12/2017

Area (m²)
Cross Sectional Area above MP Trend for Location: 6b0056 and BMS Extended

Area Above MP Trend: Eroding at -2.178 m²/year
Survey Unit for 6bSU17
Cross Sectional Area Charts

Cross Sectional Area above MP Trend for Location: 6b00070 and BMS Extended

Area Above MP Trend: Eroding at -1.316 m²/year

Survey Date
04/12/2007 03/12/2008 03/12/2009 03/12/2010 03/12/2011 02/12/2012 02/12/2013 02/12/2014 02/12/2015 01/12/2016 01/12/2017

Area (m²)
152 146 144 142 136 134 132 128 122 120 118 114 112 110 106

Recycling Event  ●  Area Above MP  ●  Area Trend
Cross Sectional Area above MP Trend for Location: 6b00074 and BMS Extended

Area Above MP Trend, Eroding at -2.329 m²/Year
Cross Sectional Area above MP Trend for Location: 6b000178 and BMS Extended

Area Above MP Trend: Eroding at -1.754 m²/Year

Survey Date


- Recycling Event
- Area Above MP
- Area Trend
Cross Sectional Area above MP Trend for Location: 6b00082 and BMS Extended

Area Above MP Trend: Eroding at -0.771 m²/year

Survey Date:
- 04/12/2007
- 03/12/2008
- 03/12/2009
- 03/12/2010
- 03/12/2011
- 02/1/2012
- 02/2/2013
- 02/1/2014
- 02/12/2015
- 01/12/2016
- 01/12/2017

Legend:
- Yellow: Recycling Event
- Green: Area Above MP
- Green Line: Area Trend
Cross sectional Area above MP Trend for Location: 6b00090 and BMS Extended

Area Above MP Trend: Eroding at -0.130 m²/year

Survey Date:
- 04/12/2007
- 03/12/2008
- 03/12/2009
- 03/12/2010
- 03/12/2011
- 03/12/2012
- 02/12/2013
- 02/12/2014
- 02/12/2015
- 01/12/2016
- 01/12/2017
Cross Sectional Area above MP Trend for Location: 6b00102 and BMS Extended

Area Above MP Trend: Eroding at -4.013 m²/year
Cross Sectional Area above MP Trend for Location: 6b00111 and BMS Extended

Area Above MP Trend: Eroding at -2.649 m2/year

Survey Date

04/12/2007 03/12/2008 03/12/2009 03/12/2010 03/12/2011 02/12/2012 02/12/2013 02/12/2014 02/12/2015 01/12/2016 01/12/2017

Area (m²)
Cross Sectional Area above MP Trend for Location: 6b00113 and BMS Extended

Area Above MP Trend: Eroding at -2.365 m²/year

Survey Date

04/12/2007 03/12/2006 03/12/2009 03/12/2010 03/12/2011 03/12/2012 02/12/2013 02/12/2014 02/12/2015 01/12/2016 01/12/2017

Survey Unit for 6bSU17
Cross Sectional Area Charts
Cross Sectional Area above MP Trend for Location: 6b00119 and BMS Extended

Area Above MP Trend: Eroding at -2.362 m²/year

Survey Date:
- 04/12/2007
- 03/12/2009
- 03/12/2010
- 03/12/2011
- 02/12/2012
- 02/12/2013
- 02/12/2014
- 01/12/2015
- 01/12/2016
- 01/12/2017

Survey Unit for 6bSU17
Cross Sectional Area Charts
Cross Sectional Area above MP Trend for Location: 6b00161 and BMS Extended

Area Above MP Trend: Eroding at -2.728 m²/year

Survey Date:
- 04/12/2007
- 03/12/2009
- 03/12/2010
- 03/12/2011
- 02/12/2012
- 02/12/2013
- 02/12/2014
- 02/12/2015
- 01/12/2017

Survey Unit for 6bSU18-1
Cross Sectional Area Charts
Cross Sectional Area above MP Trend for Location: 6b00172 and BMS Extended

Area Above MP Trend: Accreting at 0.024 m²/Year

Survey Date

Survey Unit for 6bSU18-1
Cross Sectional Area Charts

04/12/2007 03/12/2008 03/12/2009 03/12/2010 03/12/2011 02/12/2012 02/12/2013 02/12/2014 02/12/2015 01/12/2015 01/12/2017

10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43
Cross Sectional Area above MP Trend for Location: 6b00191 and BMS Extended

Area Above MP Trend: Eroding at -1.779 m²/year
Cross Sectional Area above MP Trend for Location: 6b00204 and BMS Extended

Area Above MP Trend: Eroding at -0.425 m2/Year

Survey Date

Area (m²)

- Recycling Event
- Area Above MP
- Area Trend
Cross Sectional Area above MP Trend for Location: 6b00212 and BMS Extended

Area Above MP Trend: Eroding at -5.118 m²/Year

Survey Date

04/12/2007 03/12/2008 03/12/2009 03/12/2010 03/12/2011 03/12/2012 02/12/2013 02/12/2014 02/12/2015 01/12/2016 01/12/2017 01/12/2018

Area (m²)

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190
Cross Sectional Area above MP Trend for Location: 6b00216 and BMS Extended

Area Above MP Trend: Eroding at -1.661 m²/Year

Survey Date:
- 04/12/2007
- 03/12/2006
- 03/12/2009
- 03/12/2010
- 03/12/2011
- 03/12/2012
- 02/12/2014
- 02/12/2015
- 01/12/2016
- 01/12/2017
- 01/12/2018

Graph with data points and trend line showing erosion over time.
Cross Sectional Area above MP Trend for Location: 6b00219 and BMS Extended

Area Above MP Trend: Eroding at -15.071 m²/year

Survey Date

Area (m²)

04/12/2007 03/12/2008 03/12/2009 03/12/2010 03/12/2011 03/12/2012 03/12/2013 03/12/2014 03/12/2015 03/12/2016 03/12/2017

350 360 370 380 390 400 410 420 430 440 450 460 470 480 490 500 510 520 530 540 550

Survey Unit for 6bSU18-1
Cross Sectional Area Charts
Cross Sectional Area above MP Trend for Location: 6b00228 and BMS Extended

Area Above MP Trend: Eroding at -0.980 m²/Year

Survey Date:
04/12/2007, 03/12/2008, 03/12/2009, 03/12/2010, 03/12/2011, 02/12/2012, 02/12/2013, 02/12/2014, 02/12/2015, 01/12/2016, 01/12/2017

Legend:
- Yellow: Recycling Event
- Green: Area Trend
- Red: Area Above MP
Cross Sectional Area above MP Trend for Location: 6b00249 and BMS Extended

Area Above MP Trend: Eroding at -4.194 m²/Year
Cross Sectional Area above MP Trend for Location: 6b00252 and BMS Extended

Area Above MP Trend: Eroding at -1.846 m²/year
Cross Sectional Area above MP Trend for Location: 6bUU254 and BMS Extended

Area Above MP Trend: Eroding at -3.716 m²/Year

Survey Date:
- 04/12/2007
- 03/12/2008
- 03/12/2009
- 03/12/2010
- 03/12/2011
- 02/12/2012
- 02/12/2013
- 02/12/2014
- 02/12/2015
- 01/12/2016
- 01/12/2017

Legend:
- Recycling Event
- Area Above MP
- Area Trend
Cross Sectional Area above MP Trend for Location: 6b00253 and BMS Extended

Area Above MP Trend: Eroding at -2.257 m²/year

Survey Date

04/12/2007  03/12/2008  03/12/2009  03/12/2010  02/12/2011  02/12/2012  02/12/2013  02/12/2014  02/12/2015  01/12/2016  01/12/2017

Survey Unit for 6bSU18-2
Cross Sectional Area Charts

SAIRS
Cross Sectional Area above MP Trend for Location: 6b00397 and BMS Extended

Area Above MP Trend: Eroding at -2.524 m²/Year
Cross sectional Area above MP Trend for Location: 6b00409 and BMS Extended

Area Above MP Trend: Eroding at -1.067 m²/year

Survey Date

Survey Unit for 6bSU20-1
Cross sectional Area Charts
Cross Sectional Area above MP Trend for Location: 6b00524 and BMS Extended

Area Above MP Trend: Eroding at -4.553 m²/year
Cross Sectional Area above MP Trend for Location: 6b00527 and BMS Extended

Area Above MP Trend: Eroding at -3.361 m²/Year
Cross Sectional Area above MP Trend for Location: 6b00574 and BMS Extended

Area Above MP Trend: Eroding at -3.26 m²/Year
Cross Sectional Area above MP Trend for Location: 6b00578 and BMS Extended

Area Above MP Trend: Accreting at 0.047 m²/Year

Survey Date

04/12/2007  03/12/2009  03/12/2010  03/12/2011  02/12/2012  02/12/2013  02/12/2014  02/12/2015  01/12/2016  01/12/2017

Survey Unit for 6bSU21-4
Cross Sectional Area Charts
Cross Sectional Area above MP Trend for Location: 6b00585 and BMS Extended

Area Above MP Trend: Eroding at -3.674 m²/year
Cross Sectional Area above MP Trend for Location: 6b00592 and BMS Extended

Area Above MP Trend: Eroding at -1.180 m²/year
Cross Sectional Area above MP Trend for Location: 6b00595 and BMS Extended

Area Above MP Trend: Eroding at -1.169 m²/year
Survey Unit for 6bSU21-5
Cross Sectional Area Charts

Cross Sectional Area above MP Trend for Location: 6b00614 and BMS Extended

Area Above MP Trend: Accreting at 1.903 m²/Year

Survey Date

04/12/2007 03/12/2008 03/12/2009 03/12/2010 03/12/2011 02/12/2012 02/12/2013 02/12/2014 02/12/2015 01/12/2016 01/12/2017

Area (m²)

90 92 94 96 98 100 102 104 106 108 110 112 114 116 118 120 122 124 126 128 130 132

- Recycling Event
- Area Above MP
- Area Trend
Cross Sectional Area above MP Trend for Location: 6b00624 and BMS Extended

Area Above MP Trend: Accreting at 2.417 m²/Year

Survey Date

04/12/2007  03/12/2008  03/12/2009  03/12/2010  03/12/2011  02/12/2012  02/12/2013  02/12/2014  02/12/2015  02/12/2016  01/12/2017

Area (m²)

90  92  94  96  98  100  102  104  106  108  110  112  114  116  118  120  122  124  126  128  130  132  134  136  138  140  142

Legend:
- Yellow Square: Recycling Event
- Green Circle: Area Above MP
- Green Line: Area Trend
Cross Sectional Area above MP Trend for Location: 6b00628 and BMS Extended

Area Above MP Trend: Increasing at 1.55 m²/year
Cross Sectional Area above MP Trend for Location: 6bCU21-5 and BMS Extended

Area Above MP Trend: Accreting at 0.106 m²/Year

Survey Date

04/01/2007  03/12/2008  03/12/2009  03/12/2010  03/12/2011  03/12/2012  03/12/2013  03/12/2014  03/12/2015  03/12/2016  03/12/2017

Area (m²)

178  179  180  181  182  183  184  185  186  187

Survey Unit for 6bSU21-5
Cross Sectional Area Charts
Cross sectional area above MP trend for location: 6b00679 and BMS Extended

Area above MP trend: increasing at 0.574 m²/year

Survey dates range from 04/12/2007 to 01/12/2017.
Cross Sectional Area above MP Trend for Location: 6b00687 and BMS Extended

Area Above MP Trend: Eroding at -0.594 m²/year
Cross Sectional Area above MP Trend for Location: 6bDD717 and BMS Extended

Area Above MP Trend: Accreting at 0.026 m²/Year

Survey Date

04/12/2007  03/12/2006  03/12/2009  03/12/2010  03/12/2011  02/12/2012  02/12/2013  02/12/2014  02/12/2015  01/12/2016  01/12/2017

Area (m²)
Cross Sectional Area above MP Trend for Location: 6bSU21-8 and BMS Extended

Area Above MP Trend: Accreting at 1.006 m²/Year

Survey Date

04/12/2007  03/12/2006  03/12/2010  03/12/2011  02/12/2012  02/12/2013  02/12/2014  02/12/2015  01/12/2016  01/12/2017

Area (m²)
Cross Sectional Area above MP Trend for Location: 6b01175 and BMS Extended

Area Above MP Trend: Accreting at 16.706 m²/Year

Survey Date

Area (m²)

Recycling Event

Area Above MP

Area Trend
Cross Sectional Area above MP Trend for Location: 6b01179 and BMS Extended

Area Above MP Trend: Accreting at 27.067 m²/Year

Survey Date

04/12/2007 03/12/2008 03/12/2009 03/12/2010 03/12/2011 02/12/2012 02/12/2013 02/12/2014 02/12/2015 01/12/2016 01/12/2017

Area (m²)
Cross Sectional Area above MP Trend for Location: 6b01186 and BMS Extended

Area Above MP Trend: Accreting at 31.454 m²/Year
Cross Sectional Area above MP Trend for Location: 6b01220 and BMS Extended

Area Above MP Trend: Accreting at 5.356 m²/Year
Cross Sectional Area above MP Trend for Location: 6b01227 and BMS Extended
Area Above MP Trend: Accreting at 15.135 m²/Year
Cross Sectional Area above MP Trend for Location: 6bSU123 and BMS Extended

Area Above MP Trend: Accreting at 10.664 m²/Year
Cross Sectional Area above MP Trend for Location: 6b01237 and BMS Extended

Area Above MP Trend: Accreting at 5.356 m²/Year
Cross Sectional Area above MP Trend for Location: 6b01247 and BMS Extended

Area Above MP Trend: Eroding at -4.540 m²/year
Cross Sectional Area above MP Trend for Location: 6b01267 and BMS Extended

Area Above MP Trend, Eroding at -1.233 m²/year

Survey Date:
- 04/12/2007
- 03/12/2008
- 03/12/2009
- 03/12/2010
- 03/12/2011
- 03/12/2012
- 02/12/2013
- 02/12/2014
- 02/12/2015
- 01/12/2016
- 01/12/2017

Legend:
- Yellow square: Recycling Event
- Green square: Area Above MP
- Green line: Area Trend
Cross Sectional Area above MP Trend for Location: 6b01268A and EMS Extended

Area Above MP Trend: Eroding at -9.533 m²/year

Survey Date
04/12/2007 03/12/2008 03/12/2009 03/12/2010 03/12/2011 02/12/2012 02/12/2013 02/12/2014 02/12/2015 01/12/2016 01/12/2017

Area (m²)
265 270 275 280 285 290 295 300 305 310 315 320 325 330 335 340 345 350 355 360 365 370 375 380 385 390 395 400

Legend:
- Recycling Event
- Area Above MP
- Area Trend
Cross Sectional Area above MP Trend for Location: 6b01272A and EMS Extended

Area Above MP Trend: Eroding at -4.033 m²/year

Survey Date:
- 04/12/2007
- 03/12/2008
- 03/12/2009
- 03/12/2010
- 03/12/2011
- 02/12/2012
- 02/12/2013
- 02/12/2014
- 02/12/2015
- 01/12/2016
- 01/12/2017

Legend:
- Recycling Event
- Area Above MP
- Area Trend
Cross Sectional Area above MP Trend for Location: 6b01277 and BMS Extended

Area Above MP Trend: Eroding at -9.760 m²/year
Cross Sectional Area above MP Trend for Location: 6b01278A and EMS Extended

Area Above MP Trend: Eroding at -3.347 m²/Year

Survey Date

04/12/2007  03/12/2008  03/12/2009  03/12/2010  03/12/2011  02/12/2012  02/12/2013  02/12/2014  02/12/2015  01/12/2016  01/12/2017

Survey Unit for 6bSU26-1
Cross Sectional Area Charts
Cross Sectional Area above MP Trend for Location: 6b01287 and BMS Extended

Area Above MP Trend: Eroding at -7.705 m²/Year
Cross Sectional Area above MP Trend for Location: 6b01294 and BMS Extended.
Cross Sectional Area above MP Trend for Location: 6b01298 and BMS Extended

Area Above MP Trend: Eroding at -7.032 m²/Year

Survey Date
04/12/2007 03/12/2008 03/12/2009 03/12/2010 02/12/2011 02/12/2012 02/12/2013 02/12/2014 02/12/2015 01/12/2016 01/12/2017

280 295 300 305 310 315 320 325 330 335 340 345 350 355 360 365 370

Area (m²)
Cross Sectional Area above MP Trend for Location: 6b01302 and BMS Extended

Area Above MP Trend: Eroding at -0.367 m²/year
Cross Sectional Area above MP Trend for Location: 6b01310 and BMS Extended

Area Above MP Trend: Eroding at -9.39 m²/Year
Cross Sectional Area above MP Trend for Location: 6b01315 and BMS Extended

Area Above MP Trend: Eroding at -0.410 m²/Year
Cross Sectional Area above MP Trend for Location: 6b01319 and BMS Extended

Area Above MP Trend: Eroding at -4.369 m²/year
Cross Sectional Area above MP Trend for Location: 6b01323 and BMS Extended

Area Above MP Trend: Accrual at 0.252 m²/year

Survey Date
04/12/2007 03/12/2008 03/12/2009 03/12/2010 03/12/2011 02/12/2012 02/12/2013 02/12/2014 02/12/2015 01/12/2016 01/12/2017

Survey Unit for 6bSU26-1
Cross Sectional Area Charts
Profile charts for Survey Unit 6bSU26-1
Profile charts for Survey Unit 6bSU26-1

Profiles: 6b01243

Level (m)

Chainage (m)

2018-03-06  2017-07-14  2008-03-24  Master Profile  Profile Envelope
Survey Unit for 6bSU26-2
Cross Sectional Area Charts

Cross Sectional Area above MP Trend for Location: 6b01330 and BMS Extended

Area Above MP Trend: Eroding at -0.460 m²/year

Survey Date

04/12/2007 03/12/2008 03/12/2009 03/12/2010 03/12/2011 02/12/2012 02/12/2013 02/12/2014 02/12/2015 01/12/2016 01/12/2017

Area (m²)

70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220
Cross Sectional Area above MP Trend for Location: 6b01334 and BMS Extended

Area Above MP Trend: Eroding at -1.703 m²/year

Survey Date:
- 04/12/2007
- 03/12/2008
- 03/12/2009
- 03/12/2010
- 03/12/2011
- 02/12/2012
- 02/12/2013
- 02/12/2014
- 02/12/2015
- 01/12/2016
- 01/12/2017
Cross Sectional Area above MP Trend for Location: 6b01346 and BMS Extended

Area Above MP Trend: Accrualing at 23.556 m²/Year
Cross Sectional Area above MP Trend for Location: 6b01354 and BMS Extended

Area Above MP Trend: Eroding at -4.624 m²/year

Survey Date:
- 04/12/2007
- 03/12/2008
- 03/12/2009
- 03/12/2010
- 03/12/2011
- 03/12/2012
- 02/12/2013
- 02/12/2014
- 02/12/2015
- 01/12/2016
- 01/12/2017

Legend:
- Recycling Event
- Area Above MP
- Area Trend
Cross Sectional Area above MP Trend for Location: 6bSU26-3 and BMS Extended

Area Above MP Trend: Eroding at -23.037 m²/year
Survey Unit for 6bSU26-3
Cross Scetional Area Charts

Cross Sectional Area above MP Trend for Location: 6b01384 and BMS Extended

Area Above MP Trend: Eroding at -0.394 m²/Year

Survey Date:
- 04/12/2007
- 03/12/2009
- 03/12/2011
- 02/12/2012
- 02/12/2013
- 02/12/2014
- 02/12/2015
- 01/12/2016
- 01/12/2017

Legend:
- Yellow: Recycling Event
- Green: Area Trend
- Orange: Area Above MP

Graph shows the trend of area above the MP over time, indicating erosion at a rate of -0.394 m²/year.
Cross Sectional Area above MP Trend for Location: 6b01385 and BMS Extended

Area Above MP Trend: Eroding at -11330 m²/year