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Southampton Water to Hurst Spit

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Southeast Strategic Regional Coastal Monitoring Programme

Annual Survey Report 2011 – West Solent

1. Introduction
Analysis presented in this report provides an overview of beach changes and wave and tidal measurements since the commencement of the Southeast Strategic Regional Coastal Monitoring Programme. It also includes the most recent bathymetric data and habitat maps. The first beach surveys as part of this monitoring programme took place during the winter of 2003 and changes are reported until spring 2011. For North Point and Calshot, historic data exists back to 1989, whereas for most other areas in the West Solent data collection by New Forest District Council began around 2000. The historic data are included in the analysis of this report.

Data are presented at several levels:
- Process cell summary of percentage and actual profile change from 2010 to 2011
- Process cell summary of percentage and actual profile change from 2003 to 2011
- Process cell summary of percentage and actual profile change from the Historic Baseline to 2011
- Detailed beach profile change from 2010 to 2011
- Detailed beach profile change from 2003 to 2011
- Detailed beach profile change from the Historic Baseline to 2011
- Difference model from topographic baseline surveys from 1999 to 2011 for North Point
- Change in position of Mean High Water Springs contour for North Point
- Profile envelope graphs (on CD)
- Trend analysis of beach cross-sectional area (on CD)
- Bathymetric Digital Ground Models of 2009/10 survey set for West Solent and 2011 for Lymington River
- Habitat Maps

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.

Difference models have been produced where there are at least two baseline surveys to compare. In addition, the topographic baseline data has been used to extract the level of Mean High Water Springs (MHWS) from each baseline data set.

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 artifact 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 over time or with other information.

2. **Hydrodynamic data**

a. **Waves**
   The pressure transducer on Royal Lymington Yacht Club (RLYC) was replaced by an Etrometa Stepgauge in April 2007. The full wave report is given at Annex A.

b. **Tides**
   The Lymington step gauge measures tidal elevations and a time series of tidal elevations is given in Annex B.

3. **Survey data – topographic**
   Data analysis in the West Solent was conducted over 3 separate time periods with the majority of regions analysed between 2000 and 2011. For Calshot (LYM13 and 14) and North Point (LYM1) an extensive dataset covering the last 20 years has been included. The topographic baseline data for 2001 has limited coverage due to the difficulty in surveying large areas of mud and gravel. In most cases the data coverage is not to MLWS as only the upper beach was surveyed. However, the 2007 topographic baseline data was collected with lidar flown at a 1m resolution which gave a wider coverage over areas of mud and gravel.

   Over the past year there has been very little change to any of the management units within the West Solent. However, since 2003 there have been notable overall losses at Castle Point (LYM1) and to many of the profiles along the central West Solent within LYM7, LYM6 and the one profile surveyed in LYM5. The historic changes, which in most cases only include analysis of the upper beach, show continued beach growth from Cadland to Calshot (LYM12 to LYM14), with mixed change across most of the remaining units.

   Dates of surveys are shown in Annex E and the detailed topographic survey report is given at Annex F.

4. **Survey data – bathymetric**
   The first baseline bathymetric survey of the West Solent was completed in 2001 with a repeat survey in 2005-07. The most recent full survey of the West Solent was in 2009/10. There have also been bathymetric surveys of Lymington River carried out in 2011.
LYM1 to LYM3 (North Point and Keyhaven) and LYM5 (Sowley) are due for survey in 2011 and the results will be included in the 2012 Annual Survey Report. Bathymetric surveys for LYM14 (Southampton Water entrance) are due for survey in 2011. The remainder of the West Solent (LYM6 – LYM13) is next due for bathymetric survey in 2015.

Tidal control for the baseline survey set was particularly difficult in some areas and has led to inconsistent results when compared with other surveys. Since 2007, surveys were conducted using kinematic GPS-derived tidal elevations, which gave greater confidence in the tidal reduction.

Bathymetric Digital Ground Models (DGMs) of the West Solent have been produced from the 2009/10 dataset and the 2011 dataset for Lymington River. These maps also show 2m contour intervals.

The detailed bathymetric survey report is given at Annex G.

5. Habitat Maps

All habitats within the EA Tidal Floodzone 2 were mapped from the 2008 aerial photography using the Environment Agency’s habitat mapping specification.

Limited ground-truthing was undertaken for areas where it proved difficult to classify the habitat type from the aerial photography alone. Habitats were mapped to level 5 using a modified version of the Integrated Habitat System (IHS), produced by the Somerset Environmental Records Centre.

Habitat maps are shown in Annex H.

6. Lidar – Saltmarsh Extent

In some regions of the West Solent no topographic survey data is available. Most of these coastal areas are fronted by saltmarsh. These areas include Keyhaven Marshes (LYM3) and Lymington Marshes (LYM4 to LYM5). Difference models based on lidar data show changes in saltmarsh extent in these areas.

Lidar difference models are shown in Annex I.
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Annex F – Topographic Survey Report for the West Solent

1. Introduction
Analysis has been conducted for those sites where a minimum of four surveys have been recorded. In general, changes are measured relative to the Mean Low Water Springs (MLWS) level, although this is not possible for much of the historic data at many of the sites as the surveys have not reached MLWS. Where possible, longer-term records from earlier programmes are also presented in the profile analysis, although historical data was often collected using significantly different survey techniques, specifications and even datums. Continuity of record has been attempted but is not always possible.

The profile envelope, along with the two most recent profiles at each profile location, is shown superimposed and relative to a Master Profile (on the accompanying CD). 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 Management 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 on the accompanying CD as a graph for each profile (Figure 2).

![Figure 1: Example Master Profile with CSA calculated from the surveyed GPS profile](image-url)
2. Condition of process sub-cell
The Beach Change Summary maps contain an at-a-glance condition of the whole of the West Solent, with the lines representing the average accretion, no change or erosion for each Management Unit.

3. Condition of individual Management Units
Changes within each Management Unit are summarised on three maps: Beach change map (Spring to Spring), beach change map (Baseline to Spring), and beach change map (Historic Baseline to Spring).

The Beach Change map shows the location of each beach profile, superimposed on the most recent (2008) aerial photograph (note that the profile line has been extended for clarity). Where possible, the annual change in cross-sectional area has been calculated over 3 separate time periods; from spring 2010 to spring 2011, from spring 2003 to spring 2011 and finally the earliest baseline survey to spring 2011. The only exception is Warren Farm Spit (LYM7) which is surveyed during the summer period due to access restrictions.
In order to make best use of the historical and baseline data, which did not extend typically to the level of modern surveys, the ‘historical to spring’ and ‘baseline to spring’ maps only compare the common measured area between historical/baseline and most recent data. Users should be aware that the results of historic and baseline % CSA changes should therefore not be compared directly with the ‘Spring to Spring’ results. The extent to which each historical and baseline profile line has reached is shown on the relevant maps.

**LYM14: Calshot Spit**

**Spring 2010 to Spring 2011**

Only minor erosion (less than 2%) has occurred within this management unit over the past year. This continues the trend of stability seen along this frontage during last year’s analysis.

**Baseline 2003 to Spring 2011**

There has been small-scale net accretion (less than 15%) to all the profiles in this unit since 2003, mainly to the upper beach. None of the 2003 surveyed lines reach MLWS, so comparison between these and the 2011 profiles is of the common measured area, as indicated on the map.

**Historic 1989 to Spring 2011**

Both of the profiles that are available for comparison back to 1989 show substantial net accretion; line 5c00259 has accumulated an extra 50% of its original 1989 CSA. Comparison between 1989 and 2011 profiles only extends to the extent of surveyed historic data (denoted on map).

**LYM13: Calshot Spit to Hill Head**

**Spring 2010 to Spring 2011**

All profiles show minimal CSA change between 2010 and 2011, as was the case between 2009 – 2010 and 2008 – 2009.

**Baseline 2003 to Spring 2011**

The general trend continues to be one of small-scale change (less than 11%) across the management unit. This analysis has only been conducted to the extent of surveyed baseline data, rather than to MLWS (denoted in map).

**Historic 1989 to Spring 2011**

The analysis indicates a consistent and substantial gain to each of the profiles over the past 22 years, with increased accretion to the east of the unit. Profiles 5c00263 and 5c00267 cut across a gravel bar which has gradually migrated onshore. Comparison between 1989 and 2011 profiles only extends to the extent of surveyed historic data (denoted in map).
LYM12: Hill Head to Bourne Gap

Spring 2010 to Spring 2011
Very minor erosion has occurred to this section of frontage within the past year, with all the profiles showing less than 4% CSA losses. This continues the trend of stability seen along this frontage over the past two years.

Baseline 2003 to Spring 2011
All profiles, with the exception of 5c00277 at the eastern end of the unit, show net losses since 2003 most notably at profile 5c00297 with losses of 31% (17m²), although most of this change occurred during the first few years after the outfall pipe was removed in 2002. This analysis only extends to the extent of surveyed baseline data (denoted in map) and not to MLWS.

Historic 2000/01 to Spring 2011
The historic analysis shows a trend for accretion within the eastern half of the unit. This is due to significant accretion below the toe of the upper beach to the majority of profiles between 2006 to 2008, after three years of steady, small-scale erosion. After 2008, the trend of minor erosion was re-established. Conversely, profile 5c00297 to the west shows significant erosion of over 30%. This may be explained by the removal of the outfall pipe in September 2002 (the structure of which is visible in the 2006 Annual Survey Report but not in the current report which uses 2008 aerial photography). This caused material to be redistributed in an easterly direction, consistent with the general direction of littoral drift in this area. This analysis only extends to the extent of surveyed historic data (denoted in map).

LYM11: Bourne Gap to Stansore Point

Spring 2010 to Spring 2011
Very little change has occurred within this management unit between 2010 and 2011. This is a continuation of the very stable frontage seen in the two previous spring to spring analyses (2008 – 2009, 2009 – 2010). The notable exception is profile 5c00335 at Stansore Point which has seen an increase in elevation of the upper seaward slope by approximately 1m (9% CSA change) over the past year. Profile 5c00310A replaced 5c00310 in 2009, and is therefore not present in the Baseline and Historic maps.

Baseline 2003/04 to Spring 2011
Analysis since 2003 shows the upper beach in the majority of this unit to have been very stable over the past 11 years. Profile 5c00326 shows erosion of 7%, although this only constitutes a loss of 2m² over 11 years. At Stansore Point, profile 5c00335 shows a gain of 10m² of material (12% CSA increase) while 5c00340 directly west shows a corresponding loss of similar proportions. This analysis only extends to the extent of surveyed baseline data (denoted in map) and not to MLWS.
**Historic 2000 to Spring 2011**
The whole frontage in this management unit has some erosion over the past 11 years, with the exception of 5c00314 which shows minor net accretion for this period ($9\text{m}^2$ since 2000). Although both the baseline and spring to spring analyses show accretion at Stansore Point (5c00335), the historic analysis shows minor net erosion (6% CSA change) between 2003 and 2011. Past analyses have shown a history of fluctuating erosion and accretion at this profile. Comparison between 2000 and 2011 profiles only extends to the extent of surveyed historic data (denoted in map).

**LYM10: Stansore Point to Lepe**

**Spring 2010 to Spring 2011**
All the profiles within this unit show a CSA change of less than 5% over the past year (as was the case between 2008 - 2009 and 2009 – 2010) suggesting a stable frontage. Profile 5c00344 covers a shingle spit that extends approximately 500m from the upper beach. The seaward end of the spit changes orientation slightly each year. This causes fluctuations in the CSA of profile 5c00344; there was an addition of $17\text{m}^2$ between 2008 and 2009, a small loss of $3\text{m}^2$ between 2009 and 2010 and now another gain of $10\text{m}^2$ over the past year.

**Baseline 2003 to Spring 2011**
The profiles fronting Lepe Country Park (5c00348 – 5c00356) show increased erosion in an easterly direction (up to 16% loss in CSA) between 2003 and 2011. A trend of small-scale erosion to this frontage has been documented since 2007. The loss to the majority of these profiles has occurred mainly to the upper shingle beach. The gain in material seen at profile 5c00344 at the east end of the unit has occurred as a consequence of net accretion to the gravel bar over the past 11 years. This analysis only extends to the extent of surveyed baseline data (denoted in map) and not to MLWS.

**Historic 2000 to Spring 2011**
The trend over the past 11 years has been one of localised erosion and accretion, with notable net accretion (a gain of 98% since 2000) to profile 5c00344, which cuts across a shore-normal gravel bar. West of the sluice gate, profile 5c00360 shows 11% net erosion over the past 10 years. This is primarily due to the deepening of a channel (visible in the 2008 photography) presumably created by riverine discharge from the sluice gate since 2006. Since 2009, however, this channel has been progressively infilling. Comparison between 2000 and 2010 profiles only extends to the extent of surveyed historic data (denoted in map).

**LYM9 & LYM8: Lepe to Inchmerry**

**Spring 2010 to Spring 2011**
There has been very little net sediment change across this frontage over the past year. This trend of minor change (less than 6%) was also observed across both management units during the previous two spring-to-spring analyses (2009 – 2010 and 2008 – 2009).
**Baseline 2003 to Spring 2011**
Since 2003 there has been a trend of losses to the most westerly profiles, with increasing erosion from lines 5c00380 to 5c00383. Profiles 5c00383 and 5c00382 both show approximately 20% erosion to their seaward slopes. In fact, rather than sediment loss, the beach slope in this area has rolled back approximately 12m over the past 8 years (behind the master profile). Central and eastern profiles suggest a relatively stable frontage has prevailed since 2003. This analysis only extends to the extent of surveyed baseline data (denoted in map) and not to MLWS.

**Historic 2000 to Spring 2011**
The historic analysis shows that the pattern of net losses to the four westerly profiles as seen in the baseline analysis (increasing erosion in a westerly direction) has been established since at least 2003. Central profiles suggest that a stable frontage has prevailed over the past 11 years. There has been gradual erosion of 3m$^2$ (15%) to the lower profile of 5c00364 (directly west of the Boat House) since the baseline survey. This analysis only extends to the extent of surveyed historic data (denoted in map).

**LYM7: Gull Island to Warren Beach Cottage**

**Summer 2010 to Summer 2011**
There has been minimal (less than 5%) change to all profiles on Warren Farm Spit over the past year. This trend of minimal change continues that seen during last year’s analysis of 2009 – 2010. Profile 5c00408 at the neck of the spit was added as an interim profile to the 2009 survey set, having only previously been covered by continuous topographic data in 2000. Since 2009, profile 5c00394 at the distal end of the spit has incorporated a shingle bar 200m seaward of a shore-parallel channel.

**Baseline 2003 to Summer 2011**
There has been a mixed picture of erosion and accretion along this frontage since 2003, although erosion has been occurring at a greater scale than accretion. The greatest erosion has taken place at profiles 5c00402 (39% loss), 5c00420 (20% loss) and 5c00438 (16% loss). The seaward beach slopes of all these three profiles have rolled back approximately 15m since 2003. Profile 5c00394 shows 12% accretion over the past 8 years; here the profile has also rolled back, but sediment has migrated to the upper beach, where the crest level has increased by up to 0.8m. Profile 5c00408 was not surveyed during 2003, hence its absence from the map. This analysis only extends to the extent of surveyed baseline data (denoted in map) and not to MLWS.

**Historic 2000/2001 to Summer 2011**
The mixed picture of erosion and accretion is also seen in comparison with the historic data. The greatest losses are again seen to profiles 5c00402, 5c00420 and 5c00438, which have all experienced roll back since 2001 behind the master profile. Although this roll back has been slow, a large storm in 2007 caused losses to the upper beach, roll back of around 20m and lowering of the crest levels. In contrast, there has been a gradual build-up of sediment to the upper beach and crest at the end profile 5c00394 since 2000. This analysis only extends to the extent of surveyed historic data (denoted in map).
LYM6: Warren Beach Cottage to Pitts Deep

Spring 2010 to Spring 2011
There has been less than 5% change to all profiles within this management unit between 2010 and 2011. This suggests a stable frontage has prevailed over the past year.

Baseline 2003 - 2005 to Spring 2011
The general trend since 2003 continues to be one of patchy minor erosion and accretion along the entire frontage. At profile 5c00463, a gravel bar moved shoreward by 40 to 60m between 2006 and 2007, but since then its position has been stable. Likewise around profile 5c00483, a gravel bar has moved progressively shoreward since 2006, although there was a large onshore movement (of around 10m) between 2006 and 2008. West of Sowley spit, the upper beach at 5c00523 has rolled back since 2003, the crest having moved landwards by around 12m. The profile next to it, 5c00527, shows a shallow upper beach which has been consistently lowered since 2003, by up to 1.3m in parts. This analysis only extends to the extent of surveyed baseline data (denoted in map) and not to MLWS.

Historic 2001/02 to Spring 2011
The historic analysis shows very similar trends to that seen in the baseline analysis. There has been beach roll back and lowering west of Sowley spit, whereas profile 5c00519 fronting the spit shows accretion to the beach crest of over 0.5m over the past decade. Almost all of this upper beach change occurred between 2002 and 2003, probably due to movement and infilling of the lagoon entrance, after which a stable profile has ensued. Historic comparison for profile 5c00527 is not possible as the historic profile was derived from lidar data, and a sufficient portion of the profile was not available. This analysis only extends to the extent of surveyed historic data (denoted in map).

LYM1: North Point to Hurst Castle

Spring 2010 to Spring 2011
All profiles from Castle Point to North Point have seen very little change over the past year, with the exception of 5c00574 at the far northern point. This profile shows a loss of 79% over the past year, but this is due to sediment extraction from this area during the recycling scheme that took place in March 2010. Past analyses have shown there to be natural, steady accretion at this location. Around Hurst Castle, profiles 5f00002 and 5f00003 were added to the 2010 survey set to record potential changes to this narrow frontage, although this analysis shows little change over the past year. In comparison to changes seen between 2009 and 2010 in LYM1, there has been noticeably less net sediment movement between 2010 and 2011.

Baseline 2003 to Spring 2011
Although profile 5c00574 shows significant losses due to sediment extraction in March 2010, over the past 7 years it has shown consistent gains (even with removal of material due to recycling events). The mid-section of North Point appears relatively stable, with CSA changes less than 15% between profiles 5c00576 and 5c00584. There is then
accretion of around 18% to both profiles 5c00586 and 5c00587. At Castle Point there have been substantial losses to profiles 5c00590, 5c00594 and 5c00001. This is because the sediment recurve between 5c00590 and 5c00594 is slowly migrating northwards, cutting back in front of Hurst Castle – hence losses of over 70% to 5c00594 between 2003 and 2011, the majority of which has been to the seaward face. This analysis only extends to the extent of surveyed baseline data (denoted in map) and not to MLWS.

**Historic 1990 to Spring 2011**
The long term pattern of beach change at North Point is continued sediment movement around the recurve at Castle Point. Sediment in profile 5c00594 has cut back approximately 44m over the past 21 years. Material is transported north along the spit producing notable accretion to the beach around profile 5c00587. At the northern tip of the spit, the beach has rolled back. This is why profile 5c00580 appears to have lost 50m² since 1990 – the spit is rolling back, outside the master profile. Sediment is periodically taken from the northern point during recycling events, including November 1996, December 2004, March 2007 and March 2010. This analysis only extends to the extent of surveyed historic data (denoted in map).

**Topographic difference model changes Summer 2010 – Summer 2011**
Even over the past year, re-orientation of the sediment bulge at Castle Point is evident. The trend of sediment movement north-eastwards in this area appears to be continuing. Cut back at profile 5c00590 just north of this accretion zone is also still active, as was seen in the 1999 – 2011 comparison. There has been minimal change north of profile 5c00586 over the past year, except for at the northern point where accretion is already apparent after sediment extraction in March 2010.

**Topographic difference model changes Summer 1999 – Summer 2011**
Comparison between the surveyed volume in 1999 and 2011 shows a substantial re-orientation of Castle Point has occurred over at least the past 12 years. Sediment has been eroded from the beach fronting Hurst Castle and deposited further north-east between profiles 5c00590 and 5c00592. Just north of this deposition zone, at 5c00590, there is a pocket of erosion before a 350m stretch of net accretion northwards to profile 5c000582. Further north there has been significant erosion of the seaward beach face and accretion to the crest, suggesting roll-back has occurred.

At the northern tip of the spit, comparison of 1999 data with 2011 data may be misleading because of the sediment that is periodically extracted from this area as part of the recycling scheme. Between 1999 and 2011 there has been significant sediment accretion in this area, which is then extracted and used at another site. This accretion and build-up of the northern point is therefore not evident in this comparison.
Comparison of MHWS lines shows the re-orientation of the sediment recurve that has occurred at Castle Point since 1999. It also shows that the small lagoon just north east of Hurst Castle was present since at least 1999, and has decreased in size. Extension of the northern point occurs by accretion to a recurve arm on the seaward side, which extends out to the edge of a deep channel. This recurve arm is evident in the 1999 MHWS line.

As noted in the difference model analysis between 1999 and 2011, comparison between these datasets at the northern point will be affected by the sediment that is periodically extracted from this area as part of the sediment recycling scheme. Comparison of the 1999 and 2011 MHWS lines suggests that this area has decreased in size, although this is because sediment was extracted from this area in March 2010.
Annex G – Bathymetric Survey Report for the West Solent

The reported bathymetric plots are derived from surveys conducted using single-beam echosounders and the position controlled with differential GPS; this provides a positional accuracy of approximately +/- 1m for each individual sounding. Soundings are reduced to the appropriate datum using kinematic GPS, which provides water level elevations at the point of the sounding measurements. The vertical accuracy of soundings is estimated at +/- 0.15m. Survey tracks are run at an interval of approximately 50m, on a predefined grid, but the survey vessel may depart from these lines by approximately +/- 2-3m, due to factors such as currents and obstructions. These survey restrictions combine to create an envelope of potential errors in the data.

Where precise values of soundings are required, these can be obtained from the track plot raw data that identifies location and elevation of individual soundings within the survey error explained above. Each sounding is shown as a 3-d position. Straight lines should not be forced through the data to generate profiles, since the boat track varies slightly during survey capture.

Survey data shown in this report has been combined to generate the plots shown using a technique known as ground modelling. This approach uses a range of techniques to interpolate data to provide a best fit. When used at small scales over large areas this approach can be very effective. However, the accuracy and reliability of ground modelling has a strong dependence on a variety of factors, including:

- **Seabed bathymetry** For example, where there is a uniformly sloping seabed over a wide area there can be a higher degree of confidence in the reliability of the ground model because there are more data points recorded. However, over a steeply sloping or very uneven seabed there is a lower data density as the survey vessel passes over.

- **Data spread** The practicalities of bathymetric surveying also mean that an uneven spread of data is unavoidable; for example, the boat typically slows down close to the shore or near obstructions, leading to a clustering of data points. If data points are clustered around a certain area and sparser in another, interpolation may produce inaccuracies between data points in the ground model.

The use of ground models to calculate changes in volumes is a specialist technique and requires a good understanding of the many limitations of modelling. The interpolation between soundings is linear, based on the nearest neighbour point. The ground modelling process is strongly dependent upon the density of data. For example, survey tracks which are only 10 m apart are likely to enable good quality ground models to be developed. Those at 50 m on a fairly even seabed will produce suitable details to determine an overview of the area. This is the typical interval used for the Southeast Strategic Regional Coastal Monitoring Programme. More widely spaced survey tracks, or those across rough and rocky seabed do not lend themselves well to ground modelling.
Examples are shown below to illustrate the differences between 50m survey tracks on a regular seabed and very detailed swath (multibeam) bathymetry data. As a result of the combination of these factors, the bathymetric plots shown in this report are for illustrative purposes only and are not necessarily suitable for detailed comparisons with previous years.
Annex H – Habitat Maps for the West Solent
Annex I – Lidar – Saltmarsh Extent

The lidar difference models in this report are based on lidar data captured in October 2007, November 2008 and November 2009. The lidar data is unfiltered, meaning that buildings, trees and other vertical structures have not been removed. Lidar has a vertical accuracy of approximately +/- 0.15m. Each lidar cell provides a single value for a square measuring 1 metre. The difference plots identify only changes greater than +/- 0.25m. Whilst smaller changes may have occurred, these have not been plotted to in order to improve clarity and because changes may occur within the expected tolerance of survey error. Caution should be exercised when using lidar in the lower intertidal zone to ensure that water surface is removed from the data.

On the difference model plots, shades of red indicate areas of net erosion with shades of blue indicating areas of net accretion. Whilst there can be some confidence in the areas of net erosion or accretion on the exposed saltmarsh seaward edge, caution is needed when considering blue shaded areas on the interior of saltmarsh or in channels. This is because lidar can produce misleading results for wet or shiny (reflective) surfaces, meaning that the difference models in channels, some mudflats and in the middle of saltmarshes may not represent real net accretion/erosion but may be an artefact of this survey technique.
Lymington Tide Gauge

Location
OS: 434874E 93526N
WGS84 Latitude: 50° 44' 25.0638” N Longitude: 01° 30' 25.6398” W

SE leg of Royal Lymington Yacht Club
Starting Platform

Instrument Type
Etrometa Step Gauge

The gauge was installed on 19 April 2007

Benchmarks
Benchmark Description
TGBM = 3.919m above Ordnance Datum Newlyn Top of step gauge frame

TGZ = -2.22m above Ordnance Datum Newlyn
TGZ = -0.24m above Admiralty Chart Datum
TGZ = 6.136m below TGBM

Datum information
All data are to Ordnance Datum Newlyn. The height of Chart Datum relative to Ordnance Datum at Lymington is -1.98m (Admiralty Tide Tables, Supplementary Table III).

Survey information
The site was last surveyed on 20 December 2007. All data recorded by the step gauge prior to this date were adjusted to the correct level.

Site characteristics
The RLYC Starting Platform is approx. 1.7km offshore, in the Western Solent. Spring tidal range is ~2.4m.

Measurements
Tidal elevations are derived every 10 minutes. The measuring burst is 1 minute at 2.56Hz, every 10 minutes, time stamped at the start of the burst.

Data Quality

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Residuals and Elevations

Residuals and Elevations (OD and CD) for the whole year are shown in Figures 1 to 3 respectively. It should be noted that, given the small tidal range and double High Waters, tidal predictions are particularly difficult at this site, both for elevation and especially for timing. Accordingly, there may be instances of apparent tidal surge and/or a periodicity in the surge which are, in reality, an artefact of the predictions.

Statistics

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<td>0.33</td>
<td>05-Jan-2010 23:10</td>
<td>-0.43</td>
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</tr>
<tr>
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<td>0.58</td>
<td>25-Feb-2010 14:10</td>
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<tr>
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</tr>
<tr>
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<td>02-Apr-2010 09:30</td>
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<td>12-Apr-2010 08:00</td>
</tr>
<tr>
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<td>25-May-2010 17:10</td>
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</tr>
<tr>
<td>June</td>
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<td>20-Jun-2010 00:40</td>
<td>-0.25</td>
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<td>-0.36</td>
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<table>
<thead>
<tr>
<th>Month</th>
<th>Extreme maxima</th>
<th></th>
<th>Extreme minima</th>
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<tr>
<td></td>
<td>Elevation (OD)</td>
<td>Date/Time</td>
<td>Elevation (OD)</td>
<td>Date/Time</td>
</tr>
<tr>
<td>January</td>
<td>1.39</td>
<td>03-Jan-2010 12:00</td>
<td>-1.73</td>
<td>31-Jan-2010 17:10</td>
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<tr>
<td>February</td>
<td>1.53</td>
<td>28-Feb-2010 22:30</td>
<td>-1.77</td>
<td>01-Feb-2010 17:40</td>
</tr>
<tr>
<td>March</td>
<td>1.61</td>
<td>30-Mar-2010 22:40</td>
<td>-1.77</td>
<td>02-Mar-2010 17:10</td>
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<tr>
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<td>1.33</td>
<td>02-Apr-2010 00:10</td>
<td>-1.58</td>
<td>27-Apr-2010 15:20</td>
</tr>
<tr>
<td>May</td>
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</tr>
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<td>1.17</td>
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<td>-1.64</td>
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<tr>
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<td>15-Jul-2010 00:40</td>
<td>-1.49</td>
<td>14-Jul-2010 05:40</td>
</tr>
<tr>
<td>August</td>
<td>1.28</td>
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<td>-1.77</td>
<td>12-Aug-2010 05:10</td>
</tr>
<tr>
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<td>09-Sep-2010 10:40</td>
<td>-1.72</td>
<td>10-Sep-2010 05:10</td>
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<tr>
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<td>1.44</td>
<td>06-Oct-2010 09:00</td>
<td>-1.60</td>
<td>09-Oct-2010 04:40</td>
</tr>
<tr>
<td>November</td>
<td>1.43</td>
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<td>-1.55</td>
<td>07-Nov-2010 16:40</td>
</tr>
<tr>
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<table>
<thead>
<tr>
<th>Month</th>
<th>Mean Level</th>
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<tr>
<td>No. of days</td>
<td>Elevation (OD)</td>
</tr>
<tr>
<td>January</td>
<td>31</td>
</tr>
<tr>
<td>February</td>
<td>28</td>
</tr>
<tr>
<td>March</td>
<td>31</td>
</tr>
<tr>
<td>April</td>
<td>30</td>
</tr>
<tr>
<td>May</td>
<td>31</td>
</tr>
<tr>
<td>June</td>
<td>30</td>
</tr>
<tr>
<td>July</td>
<td>31</td>
</tr>
<tr>
<td>August</td>
<td>31</td>
</tr>
<tr>
<td>September</td>
<td>30</td>
</tr>
<tr>
<td>October</td>
<td>31</td>
</tr>
<tr>
<td>November</td>
<td>30</td>
</tr>
<tr>
<td>December</td>
<td>31</td>
</tr>
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</table>
## Highest values in 2010

<table>
<thead>
<tr>
<th>Value (m)</th>
<th>Date/Time</th>
<th>Elevation (OD)</th>
<th>Date/Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.68</td>
<td>12-Nov-2010 17:00</td>
<td>1.61 (0.49)</td>
<td>30-Mar-2010 22:40</td>
</tr>
<tr>
<td>0.63</td>
<td>08-Nov-2010 05:30</td>
<td>1.54 (0.41)</td>
<td>30-Mar-2010 10:30</td>
</tr>
<tr>
<td>0.63</td>
<td>11-Nov-2010 08:20</td>
<td>1.53 (0.42)</td>
<td>28-Feb-2010 22:30</td>
</tr>
<tr>
<td>0.61</td>
<td>11-Nov-2010 08:30</td>
<td>1.52 (0.43)</td>
<td>28-Feb-2010 10:30</td>
</tr>
<tr>
<td>0.58</td>
<td>16-Dec-2010 21:30</td>
<td>1.51 (0.40)</td>
<td>29-Mar-2010 22:10</td>
</tr>
<tr>
<td>0.58</td>
<td>25-Feb-2010 14:10</td>
<td>1.51 (0.55)</td>
<td>27-Feb-2010 09:10</td>
</tr>
<tr>
<td>0.57</td>
<td>31-Oct-2010 03:50</td>
<td>1.50 (0.45)</td>
<td>03-Feb-2010 01:00</td>
</tr>
<tr>
<td>0.57</td>
<td>27-Feb-2010 08:50</td>
<td>1.50 (0.32)</td>
<td>01-Mar-2010 10:50</td>
</tr>
<tr>
<td>0.57</td>
<td>25-Feb-2010 19:40</td>
<td>1.49 (0.39)</td>
<td>15-Jul-2010 00:40</td>
</tr>
<tr>
<td>0.56</td>
<td>08-Nov-2010 08:30</td>
<td>1.47 (0.44)</td>
<td>27-Feb-2010 21:50</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 average values should not be used for any purpose without consideration of the recovery rate.

### Acknowledgements

Tidal predictions were produced by EMU Limited. The step gauge is installed on their Starting Platform by kind permission of the Royal Lymington Yacht Club
Figure 1  Residuals for 2010
Figure 2  Tidal elevations relative to Ordnance Datum for 2010
Figure 3  Tidal elevations relative to Chart Datum for 2010
Beach Change Summary - Spring 2010 to Spring 2011

Annual % Change in Cross-sectional Area (Spring 2010 to Spring 2011)

- **Accretion**
  - > 30%
  - 15 - 30%
  - 5 - 15%

- **No Change**
  - Less than 5%
  - 5 - 15%
  - 15 - 30%
  - > 30%

- **Erosion**
  - > 30%

% Change in Cross-sectional Area

- Actual Annual Change in Cross-sectional Area (m²)

MU boundary

5g00212 (3)

Accretion: Erosion

No Change: Less than 5%

> 30%: 15 - 30%

5 - 15%: 15 - 30%

< 5%: > 30%
Southeast Strategic Regional Coastal Monitoring Programme

Annual Actual Change in Cross-sectional Area (Spring 2010 to Spring 2011)

- Accretion
  - > 30 m²
  - 15 - 30 m²
  - 5 - 15 m²
- No Change
  - Less than 5 m²
  - 5 - 15 m²
  - 15 - 30 m²
  - > 30 m²

Annual Actual Change in Cross-sectional Area (m²)

- Actual Annual Change in Cross-sectional Area (m²)

Actual Change in Cross-sectional Area (m²)

MU boundary

Actual Change in Cross-sectional Area (Spring 2010 to Spring 2011)
% Change in Cross-sectional Area (Baseline Spring 2003 - 2005 to Spring 2011)

- **Accretion**
  - > 30%
  - 15 - 30%
  - 5 - 15%
- **Erosion**
  - Less than 5%
  - 5 - 15%
  - 15 - 30%
  - > 30%

% Change in Cross-sectional Area

**Actual Annual Change in Cross-sectional Area (m²)**

- MU boundary
- 5g00212 (3)

East Solent

- SCOPAC - West Solent

Beach Change Summary - Spring 2003 - 2005 to Spring 2011

Annual Report 2011
% Change in Cross-sectional Area (Historic Baseline to Spring 2011)

- **Accretion**
  - > 30%
  - 15 - 30%
  - 5 - 15%
- **Erosion**
  - Less than 5%
  - 5 - 15%
  - 15 - 30%
  - > 30%
- **No Change**

Actual Annual Change in Cross-sectional Area ($m^2$)

MU boundary

% Change in Cross-sectional Area

5g00212 (3)
Actual Change in Cross-sectional Area (Historic Baseline to Spring 2011)

<table>
<thead>
<tr>
<th>Change in Area</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 30 m²</td>
<td>Blue</td>
</tr>
<tr>
<td>15 - 30 m²</td>
<td>Light Blue</td>
</tr>
<tr>
<td>5 - 15 m²</td>
<td>Light Green</td>
</tr>
<tr>
<td>Less than 5 m²</td>
<td>Dark Green</td>
</tr>
<tr>
<td>No Change</td>
<td>Black</td>
</tr>
</tbody>
</table>

Legend:
- **Accretion**
- **Erosion**

**Actual Change in Cross-sectional Area (m²)**

**Actual Annual Change in Cross-sectional Area (m²)**

**MU boundary**

**5g00212 (3)**

**Actual Beach Change Summary - Historic Baseline to Spring 2011**

**SCOPAC - West Solent**
Southeast Strategic Regional Coastal Monitoring Programme

Annual % Change in Cross-sectional Area (Spring 2010 to Spring 2011)

- > 30%
- 16 - 30%
- 5 - 15%
- Less than 5%
- 5 - 15%
- 16 - 30%
- > 30%

Actual Annual Change in Cross-sectional Area (m²)

0 100 200 m
% Change in Cross-sectional Area (Spring 2003 to Spring 2011)

<table>
<thead>
<tr>
<th>Percentage Change</th>
<th>Legend</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 30%</td>
<td>Erosion</td>
</tr>
<tr>
<td>16 - 30%</td>
<td>Erosion</td>
</tr>
<tr>
<td>5 - 15%</td>
<td>Erosion</td>
</tr>
<tr>
<td>Less than 5%</td>
<td>No Change</td>
</tr>
<tr>
<td>5 - 15%</td>
<td>No Change</td>
</tr>
<tr>
<td>16 - 30%</td>
<td>No Change</td>
</tr>
<tr>
<td>&gt; 30%</td>
<td>Accretion</td>
</tr>
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</table>

Actual Annual Change in Cross-sectional Area (m²)

2008 aerial photography

MLWS

Seaward extent of baseline profiles

MU boundary

5g00212 (3)

5c00250 (17)

5c00255 (6)

5c00259 (9)
% Change in Cross-sectional Area (Historic Baseline 1989 to Spring 2011)

- **Accretion**
  - > 30%
  - 16 - 30%
  - 5 - 15%
  - Less than 5%

- **Erosion**
  - 16 - 30%
  - > 30%

<table>
<thead>
<tr>
<th>No Change</th>
<th>5 - 15%</th>
</tr>
</thead>
</table>

**Actual Change in Cross-sectional Area (m²)**

- **5g00212 (3)**
- **5c00255 (23)**
- **5c00259 (29)**

**Seaward extent of historic profiles**

**MLWS**

2008 aerial photography
### Annual % Change in Cross-sectional Area (Spring 2010 to Spring 2011)

**Accretion**
- > 30%
- 16 - 30%
- 5 - 15%
- Less than 5%

**Erosion**
- > 30%
- 16 - 30%
- 5 - 15%
- Less than 5%

**No Change**

---

**Actual Annual Change in Cross-sectional Area (m²)**

2008 aerial photography

---

**MU Boundary**

---

**LYM13 - Beach Change**

**SCOPAC - West Solent**

---

**Annual Report 2011**
% Change in Cross-sectional Area (Spring 2003 to Spring 2011)

<table>
<thead>
<tr>
<th>% Change</th>
<th>Colour</th>
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<tr>
<td>&gt; 30%</td>
<td>Blue</td>
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<td>16 - 30%</td>
<td>Blue</td>
</tr>
<tr>
<td>5 - 15%</td>
<td>Blue</td>
</tr>
<tr>
<td>Less than 5%</td>
<td>Grey</td>
</tr>
<tr>
<td>5 - 15%</td>
<td>Grey</td>
</tr>
<tr>
<td>16 - 30%</td>
<td>Red</td>
</tr>
<tr>
<td>&gt; 30%</td>
<td>Red</td>
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</tbody>
</table>

MU boundary

Actual Annual Change in Cross-sectional Area (m²)

2008 aerial photography

Seaward extent of baseline profiles

MLWS

+ - 200 m

LYM13 - Beach Change

SCOPAC - West Solent

Annual Report 2011
Southeast Strategic Regional Coastal Monitoring Programme

LYM13 - Beach Change

% Change in Cross-sectional Area (Historic Baseline 1989 to Spring 2011)

<table>
<thead>
<tr>
<th>% Change</th>
<th>Legend</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 30%</td>
<td>Acretion (Blue)</td>
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<td>Acretion (Blue)</td>
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<tr>
<td>5 - 15%</td>
<td>Acretion (Blue)</td>
</tr>
<tr>
<td>Less than 5%</td>
<td>No Change (Gray)</td>
</tr>
<tr>
<td>5 - 15%</td>
<td>Erosion (Red)</td>
</tr>
<tr>
<td>16 - 30%</td>
<td>Erosion (Red)</td>
</tr>
<tr>
<td>&gt; 30%</td>
<td>Erosion (Red)</td>
</tr>
</tbody>
</table>

MU boundary

Actual Change in Cross-sectional Area (m²)

2008 aerial photography

2011 aerial photography

Seaward extent of historic profiles

MLWS

2011 aerial photography

SCOPAC - West Solent
**Southeast Strategic Regional Coastal Monitoring Programme**

**Annual Report 2011**

**LYM12 - Beach Change**

**SCOPAC - West Solent**

---

**Annual % Change in Cross-sectional Area (Spring 2010 to Spring 2011)**

- **Accretion**
  - > 30%
  - 16 - 30%
  - 5 - 15%
  - Less than 5%

- **Erosion**
  - 5 - 15%
  - 16 - 30%
  - > 30%

---

**Actual Annual Change in Cross-sectional Area (m²)**

- 5g00212 (3)

---

**Position of outfall removed in 2002**

2008 aerial photography
% Change in Cross-sectional Area (Spring 2003 to Spring 2011)

- **Accretion**
  - > 30%
  - 16 - 30%
  - 5 - 15%
  - Less than 5%

- **Erosion**
  - 5 - 15%
  - 16 - 30%
  - > 30%

No Change

---

2008 aerial photography

MLWS

Position of outfall removed in 2002

Seaward extent of baseline profiles

SCOPAC - West Solent

LYM12 - Beach Change

MU boundary

Actual Annual Change in Cross-sectional Area (m²)

E Annual Report 2011

01 00 2 00 m

Southeast Strategic Regional Coastal Monitoring Programme
### % Change in Cross-sectional Area
(Historic Baseline 2000/01 to Spring 2011)

<table>
<thead>
<tr>
<th>Category</th>
<th>Variation</th>
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<tbody>
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<td>16 - 30%</td>
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<tr>
<td></td>
<td>5 - 15%</td>
</tr>
<tr>
<td></td>
<td>Less than 5%</td>
</tr>
<tr>
<td>No Change</td>
<td></td>
</tr>
<tr>
<td>Erosion</td>
<td>&gt; 30%</td>
</tr>
<tr>
<td></td>
<td>16 - 30%</td>
</tr>
<tr>
<td></td>
<td>5 - 15%</td>
</tr>
<tr>
<td></td>
<td>Less than 5%</td>
</tr>
</tbody>
</table>

#### Actual Change in Cross-sectional Area (m²)

- **MLWS**
- **Position of outfall removed in 2002**
- **Seaward extent of historic profiles**
- **2008 aerial photography**

---

---

**Southeast Strategic Regional Coastal Monitoring Programme**  
**Annual Report 2011**  
**LYM12 - Beach Change**  
**SCOPAC - West Solent**
Annual % Change in Cross-sectional Area (Spring 2010 to Spring 2011)

- **Accretion**
  - > 30%
  - 16 - 30%
  - 5 - 15%
- **No Change**
  - Less than 5%
  - 5 - 15%
- **Erosion**
  - 16 - 30%
  - > 30%

Annual % Change in Cross-sectional Area (Spring 2010 to Spring 2011)

Accretion

- > 30%
- 16 - 30%
- 5 - 15%

No Change

- Less than 5%
- 5 - 15%

Erosion

- 16 - 30%
- > 30%

Actual Annual Change in Cross-sectional Area (m$^2$)

2008 aerial photography
% Change in Cross-sectional Area (Spring 2003 to Spring 2011)

- **Accretion**
  - > 30%
  - 16 - 30%
  - 5 - 15%
  - Less than 5%

- **Erosion**
  - 5 - 15%
  - 16 - 30%
  - > 30%

No Change

Actual Annual Change in Cross-sectional Area (m²)

2008 aerial photography

MLWS

Seaward extent of baseline profiles

Southeast Strategic Regional Coastal Monitoring Programme

Annual Report 2011

LYM11 - Beach Change

SCOPAC - West Solent
% Change in Cross-sectional Area
(Historic Baseline 2000 to Spring 2011)

Accretion
- > 30%
- 16 - 30%
- 5 - 15%

No Change
- Less than 5%
- 5 - 15%
- 16 - 30%

Erosion
- > 30%

MU boundary

Actual Change in Cross-sectional Area (m^2)

Erosion: Less than 5%
- 5-15%
- 16-30%
- >30%

Accretion: No Change
- 5-15%
- 16-30%
- >30%

MLWS

Seaward extent of historic profiles

2008 aerial photography
Southeast Strategic Regional Coastal Monitoring Programme

% Change in Cross-sectional Area (Spring 2003 to Spring 2011)

- **Accretion**
  - > 30%
  - 16 - 30%
  - 5 - 15%
  - Less than 5%

- **No Change**
  - 5 - 15%

- **Erosion**
  - 16 - 30%
  - > 30%

Actual Annual Change in Cross-sectional Area (m²)

MU boundary

2008 aerial photography

MLWS

Seaward extent of baseline profiles

LYM10 - Beach Change

SCOPAC - West Solent
### % Change in Cross-sectional Area
(Historic Baseline 2000 to Spring 2011)

<table>
<thead>
<tr>
<th>Change</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accretion</td>
<td>&gt; 30 %</td>
</tr>
<tr>
<td></td>
<td>16 - 30 %</td>
</tr>
<tr>
<td></td>
<td>5 - 15 %</td>
</tr>
<tr>
<td>Erosion</td>
<td>Less than 5 %</td>
</tr>
<tr>
<td></td>
<td>5 - 15 %</td>
</tr>
<tr>
<td></td>
<td>16 - 30 %</td>
</tr>
<tr>
<td></td>
<td>&gt; 30 %</td>
</tr>
</tbody>
</table>

#### Actual Change in Cross-sectional Area (m²)

- **MU boundary**
- **5g00212 (3)**
- **Actual Change in Cross-sectional Area**

#### Seaward extent of historic profiles
- **MLWS**
- **2008 aerial photography**

---

**Southeast Strategic Regional Coastal Monitoring Programme**

**LYM10 - Beach Change**

**SCOPAC - West Solent**

**Annual Report 2011**
% Change in Cross-sectional Area (Spring 2003 to Spring 2011)

- **Accretion**
  - > 30%
  - 16 - 30%
  - 5 - 15%
  - Less than 5%

- **Erosion**
  - 5 - 15%
  - 16 - 30%
  - > 30%

No Change

Actual Annual Change in Cross-sectional Area (m²)

Seaward extent of baseline profiles

2008 aerial photography

MLWS

2001 00 2 00 m
% Change in Cross-sectional Area (Historic Baseline 2000 to Spring 2011)

- > 30 %
- 16 - 30 %
- 5 - 15 %
- Less than 5 %
- 5 - 15 %
- 16 - 30 %
- > 30 %

Actual Change in Cross-sectional Area (m²)

MU boundary

2008 aerial photography

MLWS

Seaward extent of historic profiles
Annual % Change in Cross-sectional Area (Summer 2010 to Summer 2011)

- **Accretion**
  - > 30%
  - 16 - 30%
  - 5 - 15%
- **Erosion**
  - > 30%
  - 16 - 30%
  - < 5%
- **No Change**
  - Less than 5%
  - 5 - 15%

**Legend**
- MU boundary
- Actual Annual Change in Cross-sectional Area (m²)
% Change in Cross-sectional Area (Baseline 2003 to Summer 2011)

- **Accretion**:
  - > 30%
  - 16 - 30%
  - 5 - 15%
- **Erosion**:
  - Less than 5%
  - 5 - 15%
  - 16 - 30%
  - > 30%

**MU boundary**

**Actual Annual Change in Cross-sectional Area (m²)**

- **5g00212 (3)**
% Change in Cross-sectional Area
(Historic Baseline 2000 to Summer 2011)

- > 30%
- 16 - 30%
- 5 - 15%
- Less than 5%
- 5 - 15%
- 16 - 30%
- > 30%

Scour

Accretion

No Change

Erosion

Actual Change in Cross-sectional Area (m²)

MU boundary

5g00212 (3)

2008 aerial photography

Seaward extent of historic profiles
LYM7 - Beach Change (2 of 2)

Southeast Strategic Regional Coastal Monitoring Programme

Annual % Change in Cross-sectional Area (Summer 2010 to Summer 2011)

Accretion
- > 30%
- 16 - 30%
- 5 - 15%
- Less than 5%
- 5 - 15%
- 16 - 30%
- > 30%

No Change
- < 5%
- 5 - 15%
- 16 - 30%
- > 30%

Actual Annual Change in Cross-sectional Area (m²)

MU boundary

2008 aerial photography

SCOPAC - West Solent

Annual Report 2011
% Change in Cross-sectional Area (Baseline 2003 to Summer 2011)

- > 30%
- 16 - 30%
- 5 - 15%
- Less than 5%
- 16 - 30%
- > 30%

Actual Annual Change in Cross-sectional Area (m^2)

2008 aerial photography

MLWS

Seaward extent of baseline profiles

MU boundary

5g00212 (3)

5c00420 (22)

5c00426 (9)

5c00462 (5)

5c0048 (1)

Seaward extent of baseline profiles

Erosion

Accretion

No Change

Less than 5%

5 - 15%

16 - 30%

> 30%

Annual Report 2011

Southeast Strategic Regional Coastal Monitoring Programme

LYM7 - Beach Change (2 of 2)

SCOPAC - West Solent
% Change in Cross-sectional Area (Historic Baseline 2000/01 to Summer 2011)

- **Accretion**
  - > 30%
  - 16 - 30%
  - 5 - 15%
  - Less than 5%

- **Erosion**
  - 5 - 15%
  - 16 - 30%
  - > 30%

**Actual Change in Cross-sectional Area (m²)**

**Seaward extent of historic profiles**

**MU boundary**

**5000420 (26)**

**5000429 (6)**

**MLWS**

**2008 aerial photography**

**SCOPAC - West Solent**

**LYM7 - Beach Change (2 of 2)**

**Annual Report 2011**

**Southeast Strategic Regional Coastal Monitoring Programme**
Southeast Strategic Regional Coastal Monitoring Programme

LYM6 - Beach Change (1 of 3)

Annual Report 2011

SCOPAC - West Solent

Annual % Change in Cross-sectional Area (Spring 2010 to Spring 2011)

- Erosion
  - > 30%
  - 16 - 30%
  - 5 - 15%
  - Less than 5%
- No Change
- Accretion
  - > 30%
  - 16 - 30%
  - 5 - 15%
  - Less than 5%

Actual Annual Change in Cross-sectional Area (m²)

2008 aerial photography
% Change in Cross-sectional Area (Spring 2003 - 2005 to Spring 2011)

- **Accretion**
  - > 30%
  - 16 - 30%
  - 5 - 15%

- **Erosion**
  - Less than 5%
  - 5 - 15%
  - 16 - 30%
  - > 30%

Actual Annual Change in Cross-sectional Area (m²)

2008 aerial photography

MLWS

Seaward extent of baseline profiles

MU boundary

5g00212 (3)

YPM6 - Beach Change (1 of 3)

SCOPAC - West Solent

Annual Report 2011

Southeast Strategic Regional Coastal Monitoring Programme
% Change in Cross-sectional Area
(Historic Baseline 2001/02 to Spring 2011)

- Accretion
  - > 30%
  - 16 - 30%
  - 5 - 15%
- Erosion
  - Less than 5%
  - 5 - 15%
  - 16 - 30%
  - > 30%

Actual Change in Cross-sectional Area

- MU boundary
- 5g00212 (3)
- 5g00447 (4)
- 5g00451 (12)
- 5g00455 (4)

2008 aerial photography
**Southeast Strategic Regional Coastal Monitoring Programme**

**Annual Report 2011**

**LYM6 - Beach Change (2 of 3)**

**SCOPAC - West Solent**

*Annual % Change in Cross-sectional Area (Spring 2010 to Spring 2011)*

- **Accretion**
  - > 30%
  - 16 - 30%
  - 5 - 15%
  - Less than 5%

- **Erosion**
  - > 30%
  - 16 - 30%
  - 5 - 15%
  - Less than 5%

*Actual Annual Change in Cross-sectional Area (m²)*

2008 aerial photography
% Change in Cross-sectional Area (Spring 2003 - 2005 to Spring 2011)

- > 30%
- 16 - 30%
- 5 - 15%
- Less than 5%
- 5 - 15%
- 5 - 15%
- 16 - 30%
- > 30%

Actual Annual Change in Cross-sectional Area (m²)

MLWS

2008 aerial photography

Seaward extent of baseline profiles

0 100 200 m
% Change in Cross-sectional Area (Historic Baseline 2001/02 to Spring 2011)

<table>
<thead>
<tr>
<th>Change Type</th>
<th>&gt; 30%</th>
<th>16 - 30%</th>
<th>5 - 15%</th>
<th>Less than 5%</th>
<th>5 - 15%</th>
<th>16 - 30%</th>
<th>&gt; 30%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accretion</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Erosion</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Actual Change in Cross-sectional Area (m²)

- >30%
- 16 - 30%
- 5 - 15%
- Less than 5%

MLWS

Seaward extent of historic profiles

2008 aerial photography

Southeast Strategic Regional Coastal Monitoring Programme

LYM6 - Beach Change (2 of 3)

SCOPAC - West Solent

Annual Report 2011
**Southeast Strategic Regional Coastal Monitoring Programme**

**Annual Report 2011**

**LYM6 - Beach Change (3 of 3)**

**SCOPAC - West Solent**

---

**Annual % Change in Cross-sectional Area (Spring 2010 to Spring 2011)**

- **Accretion**
  - > 30%
  - 16 - 30%
  - 5 - 15%
  - Less than 5%

- **Erosion**
  - 5 - 15%
  - 16 - 30%
  - > 30%

**MU boundary**

**Actual Annual Change in Cross-sectional Area (m²)**

2008 aerial photography
% Change in Cross-sectional Area (Spring 2003 - 2005 to Spring 2011)

- **Accretion**
  - > 30%
  - 16 - 30%
  - 5 - 15%
  - Less than 5%

- **Erosion**
  - 5 - 15%
  - 16 - 30%
  - > 30%

**Actual Annual Change in Cross-sectional Area (m²)**

- **Accretion**
  - > 30%
  - 16 - 30%
  - 5 - 15%
  - Less than 5%

- **Erosion**
  - 5 - 15%
  - 16 - 30%
  - > 30%

**MU boundary**

**Seaward extent of baseline profiles**

**2008 aerial photography**

**MLWS**
% Change in Cross-sectional Area (Historic Baseline 2001/02 to Spring 2011)

<table>
<thead>
<tr>
<th>Category</th>
<th>Symbol</th>
<th>Description</th>
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<tbody>
<tr>
<td>Accretion</td>
<td>&gt; 30%</td>
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<tr>
<td></td>
<td>16 - 30%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5 - 15%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Less than 5%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5 - 15%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>16 - 30%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt; 30%</td>
<td></td>
</tr>
</tbody>
</table>

Actual Change in Cross-sectional Area (m²)

Seaward extent of historic profiles

MLWS

2008 aerial photography

01 00 2 00 m

E

Annual Report 2011

Southeast Strategic Regional Coastal Monitoring Programme

LYM6 - Beach Change (3 of 3)

SCOPAC - West Solent
**Southeast Strategic Regional Coastal Monitoring Programme**

**Annual Report 2011**

### Annual % Change in Cross-sectional Area (Spring 2010 to Spring 2011)

<table>
<thead>
<tr>
<th>Change</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 30 %</td>
<td>Blue</td>
</tr>
<tr>
<td>16 - 30 %</td>
<td>Blue</td>
</tr>
<tr>
<td>5 - 15 %</td>
<td>Light Blue</td>
</tr>
<tr>
<td>Less than 5 %</td>
<td>Light Blue</td>
</tr>
<tr>
<td>5 - 15 %</td>
<td>Red</td>
</tr>
<tr>
<td>16 - 30 %</td>
<td>Red</td>
</tr>
<tr>
<td>&gt; 30 %</td>
<td>Red</td>
</tr>
</tbody>
</table>

**No Change**

**Accretion**

**Erosion**

### Actual Annual Change in Cross-sectional Area (m²)

**2008 aerial photography**

**Area of sediment extraction during recycling events**

**LYM1 - Beach Change**

**SCOPAC - West Solent**
% Change in Cross-sectional Area (Baseline 2003 to Spring 2011)

- **Accretion**
  - > 30%
  - 16 - 30%
  - 5 - 15%
  - Less than 5%

- **Erosion**
  - 5 - 15%
  - 16 - 30%
  - > 30%

Actual Annual Change in Cross-sectional Area (m²)

Seaward extent of baseline profiles

Area of sediment extraction during recycling events

2008 aerial photography

LYM1 - Beach Change

SCOPAC - West Solent

Southeast Strategic Regional Coastal Monitoring Programme

Annual Report 2011
### % Change in Cross-sectional Area (Historic Baseline 1990 to Spring 2011)

<table>
<thead>
<tr>
<th>Change Type</th>
<th>Range</th>
<th>Symbol</th>
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</thead>
<tbody>
<tr>
<td>Erosion</td>
<td>&gt; 30%</td>
<td>Red</td>
</tr>
<tr>
<td></td>
<td>16 - 30%</td>
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</tr>
<tr>
<td></td>
<td>5 - 15%</td>
<td>Light Blue</td>
</tr>
<tr>
<td></td>
<td>Less than 5%</td>
<td>Grey</td>
</tr>
<tr>
<td></td>
<td>5 - 15%</td>
<td>Light Blue</td>
</tr>
<tr>
<td></td>
<td>16 - 30%</td>
<td>Blue</td>
</tr>
<tr>
<td></td>
<td>&gt; 30%</td>
<td>Red</td>
</tr>
</tbody>
</table>

### Actual Change in Cross-sectional Area (m²)

- **MLWS**
- **Seaward extent of historic profiles**
- **Area of sediment extraction during recycling events**

2008 aerial photography
LYM1 - Mean High Water Springs Position

Area of sediment extraction during recycling events

MHWS Position
0.87m OD

- Red: 1999
- Blue: 2010
- Yellow: 2011

mask_extraction
LYM9, LYM10 & LYM11 - Bathymetry 2010

2008 aerial photography

Bathymetric Survey 2010

Elevation (metres OD)

NOT TO BE USED FOR NAVIGATIONAL PURPOSES

West Solent
Bathymetric Survey 2010

Elevation (metres OD)

NOT TO BE USED FOR NAVIGATIONAL PURPOSES
2008 aerial photography
Bathymetric Survey 2010

Elevation (metres OD)

NOT TO BE USED FOR NAVIGATIONAL PURPOSES
SESRCCMP Annual Report 2011

Bathymetric Survey 2009

Elevation (metres OD)

NOT TO BE USED FOR NAVIGATIONAL PURPOSES

LYM1 - LYM5 - Bathymetry 2009 (1 of 3)
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2008 aerial photography
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LS3 - Coastal saltmarsh
LS31 - Salicornia (Glasswort) and other annuals colonising mud and sand
LS32 - Spartina swards (Cord grass)
LS331 - Transitional low-marsh
LS6 - Intertidal shingle
LSZ - Other littoral shingle
SS31 - Coastal vegetated shingle
SS311 - Perennial vegetation of stony banks
SS312 - Annual vegetation of drift lines
SS32 - Other shingle above high tide mark
WB1 - Scrub woodland
WB2 - Mixed woodland
WB3 - Broadleaved woodland
WCZ - Other coniferous woodland
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LYM2 & LYM3 - Habitat Mapping (4 of 4)

SCOPAC - West Solent

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LYM1 - Habitat Mapping

0 100 200 m

2008 aerial photography

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Change in Elevation (m) between Nov 2007 and Nov 2008

EROSIONACCRETIONNo Change

LYM4 & LYM5 - Saltmarsh Difference Model 2007 - 2008 (1 of 3)

SCOPAC - West Solent
Change in Elevation (m) between Nov 2008 and Oct 2009

ACCRETIONNo ChangeEROSION

Lidar Model Extent
Change in Elevation (m) between Nov 2009 and Nov 2010

ACCRETION | No Change | EROSION

LYM4 & LYM5 - Saltmarsh Difference Model 2009 - 2010 (2 of 3)
Change in Elevation (m) between Nov 2007 and Nov 2008

<table>
<thead>
<tr>
<th>Change</th>
<th>0.25 - 0.5</th>
<th>-0.25 - 0.25</th>
<th>-0.5 - -0.25</th>
<th>-1 -</th>
<th>-1.5 - -1</th>
<th>-2 - -1.5</th>
<th>-2.5 - -2</th>
<th>-3 - -2.5</th>
<th>&gt;3</th>
</tr>
</thead>
<tbody>
<tr>
<td>EROSION</td>
<td>No Change</td>
<td>ACCRETION</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Lidar Model Extent
Change in Elevation (m) between Nov 2008 and Oct 2009

ACCRETION No Change EROSION

Lidar Model Extent

LYM4 & LYM5 - Saltmarsh Difference Model 2008 - 2009 (3 of 3)
Change in Elevation (m) between Nov 2009 and Nov 2010

Lidar Model Extent

LYM4 & LYM5 - Saltmarsh Difference Model 2009 - 2010 (3 of 3)
LYM4 & LYM5 - Saltmarsh Difference Model 2007 - 2010 (3 of 3)

SCOPAC - West Solent
LYM2 & LYM3 - Saltmarsh Difference Model 2008 - 2009 (1 of 4)

Change in Elevation (m) between Nov 2008 and Oct 2009

EROSION
ACCRETION
No Change

Lidar Model Extent
LYM2 & LYM3 - Saltmarsh Difference Model 2009 - 2010 (1 of 4)

SCOPAC - West Solent

Change in Elevation (m) between Nov 2009 and Nov 2010

EROSION
ACCRETION
No Change
LYM2 & LYM3 - Saltmarsh Difference Model 2007 - 2010 (1 of 4)
LYM2 & LYM3 - Saltmarsh Difference Model 2009 - 2010 (2 of 4)

SCOPAC - West Solent

Southeast Strategic Regional Coastal Monitoring Programme

Annual Report 2011

Change in Elevation (m) between Nov 2009 and Nov 2010

EROSION
ACCRETION
No Change

Lidar Model Extent
Lidar Model Extent

Change in Elevation (m) between Nov 2007 and Nov 2008

ACCRETION No Change EROSION

LYM2 & LYM3 - Saltmarsh Difference Model 2007 - 2008 (3 of 4)
LYM2 & LYM3 - Saltmarsh Difference Model 2008 - 2009 (3 of 4)

SCOPAC - West Solent
LYM2 & LYM3 - Saltmarsh Difference Model 2009 - 2010 (3 of 4)

SCOPAC - West Solent

Change in Elevation (m) between Nov 2009 and Nov 2010

EROSION
ACCRETION
No Change

Lidar Model Extent

LYM2 & LYM3 - Saltmarsh Difference Model 2009 - 2010 (3 of 4)

SCOPAC - West Solent
LYM2 & LYM3 - Saltmarsh Difference Model 2007 - 2010 (3 of 4)

SCOPAC - West Solent

Southeast Strategic Regional Coastal Monitoring Programme

Annual Report 2011

SCOPAC - West Solent

Lidar Model Extent

Change in Elevation (m) between Nov 2007 and Nov 2010

EROSION
ACCRETION
No Change

>=3
2.5-3
2-2
1.5
1-1.5
0.5-1
0.25-0.5
-0.25-
-0.5
-1-
-1.5-
-2-
-2.5-
-3-
<=-3

0 100 200 m
LYM1 - Saltmarsh Difference Model 2007 - 2008

SCOPAC - West Solent

Change in Elevation (m) between Nov 2007 and Nov 2008

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

EROSION
ACCRETION
No Change

Lidar Model Extent
LYM1 - Saltmarsh Difference Model 2008 - 2009

SCOPAC - West Solent

Change in Elevation (m) between Nov 2008 and Oct 2009

ACCRETION No Change EROSION

Lidar Model Extent
Change in Cross-sectional Area (CSA)

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

\[
\frac{CSA_1 - CSA_2}{CSA_2} \times 100
\]

Eqn (1)

where CSA\(_1\) = most recent springtime survey and CSA\(_2\) = spring survey previous year. Therefore, an annual change of −14% represents erosion during the last year of 14% of the area of last year’s survey.
CPU3 - Summary of beach operations

Limited information exists for management activities within this unit especially with respect to re-profiling and recycling activities. Some information does exist for replenishments. Between the months of September and April, there are 2 bulldozers continually on site for re-profiling.

2003/04 - Imported 7,500 tonnes of shingle ($D_{50} 40 - 70$mm) from the black gate west. The shingle was placed on the back of the defence. Shingle was also won from the bank itself by lowering the crest from around 6.5m to about 5.25m. The result was a much wider crest and a shallower profile on the front. Sand was observed to be building up the face of the defence for the first time in many years. This allowed the bank to overtop rather than breach.

2004/05 - Imported a further 7,500 tonnes of shingle, to the windmill end where the gap between the earth and shingle bank was filled. The crest was slightly lowered again, with the remaining shingle filling in half the car park back at the black gate end.

2008/03 – 11,200 m$^3$ of shingle was removed from the back of the barrier between profile 5a00094 and 5a00076 (700m) and moved to the front of the barrier between profile 5a00048 and 5a00038 (434m). This was carried out to increase the average crest width in this region.

2011/04 – Placement of 37,000 tons of pre graded shingle placed along the frontage at Selsey Bill. From the eastern limit of the car park at the end of Hillfield road to the western limit of the sea defences and sea wall at the start of the open beach at Medmerry (profile SUSS67).

*Full details of beach operations can be obtained from the Environment Agency*

CPU5 – Summary of beach operations

Limited information exists for management activities within this unit, for further details please contact Chichester District Council.

<table>
<thead>
<tr>
<th>Date</th>
<th>Operation</th>
<th>Quantity (m$^3$)</th>
<th>Location/Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>March</td>
<td>Extraction</td>
<td>10,200</td>
</tr>
<tr>
<td></td>
<td>March</td>
<td>Deposition</td>
<td>10,200</td>
</tr>
<tr>
<td>2005</td>
<td>June</td>
<td>Extraction</td>
<td>13,000</td>
</tr>
<tr>
<td></td>
<td>June</td>
<td>Deposition</td>
<td>13,000</td>
</tr>
</tbody>
</table>
CPU6 & CPU7 – Summary of beach operations

The following information was provided by Havant Borough Council in the form of recycling maps/tables and has been assimilated here for ease of representation.
### CPU8 & CPU9– Summary of beach operations

<table>
<thead>
<tr>
<th>Management Unit</th>
<th>Month</th>
<th>Operation</th>
<th>Quantity (m³)</th>
<th>Location/Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU9</td>
<td>October</td>
<td>Extraction</td>
<td>3,500</td>
<td>From between profile HAMP753 and HAMP751 in MU CPU9</td>
</tr>
<tr>
<td>CPU8</td>
<td>October</td>
<td>Deposition</td>
<td>3,500</td>
<td>Placed between POR17 and HAMP712</td>
</tr>
</tbody>
</table>

#### 2010

<table>
<thead>
<tr>
<th>Management Unit</th>
<th>Month</th>
<th>Operation</th>
<th>Quantity (m³)</th>
<th>Location/Notes</th>
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</thead>
<tbody>
<tr>
<td>CPU8</td>
<td>September</td>
<td>Extraction</td>
<td>99</td>
<td>Removal of excess shingle from concrete Hovercraft Apron and stored mound, removed by dumper and transported along seafront and deposited at beach section opposite Naval Memorial. Profile 5a00541 to 5a00540</td>
</tr>
<tr>
<td>CPU8</td>
<td>September</td>
<td>Deposition</td>
<td>99</td>
<td>Placed at eastern end of beach section to provide additional protection to seawall at front of promenade. Profile 5a00532.</td>
</tr>
</tbody>
</table>

#### 2011

<table>
<thead>
<tr>
<th>Management Unit</th>
<th>Month</th>
<th>Operation</th>
<th>Quantity (m³)</th>
<th>Location/Notes</th>
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</thead>
<tbody>
<tr>
<td>CPU8</td>
<td>September</td>
<td>Extraction</td>
<td>180</td>
<td>Removal of excess shingle from concrete Hovercraft Apron and stored mound, removed by dumper and transported along seafront and deposited at beach section opposite Naval Memorial. Profile 5a00541 to 5a00540</td>
</tr>
<tr>
<td>CPU8</td>
<td>September</td>
<td>Deposition</td>
<td>180</td>
<td>Placed at eastern end of beach section to provide additional protection to seawall at front of promenade. Profile 5a00533 to 5a00534.</td>
</tr>
</tbody>
</table>
Beach Profiles: Sd0310A
Changes between 2010-03 and 2011-03
Accretion = 0.00  Erosion = 0.00  Total = 0.00
Beach Profiles: 5c00402
Changes between 2010.08 and 2011.08
Accretion = 4.17  Erosion = -1.79  Total = 2.38
Beach Profiles: 5c00483
Changes between 2010.05 and 2011.05
Accretion = 1.34, Erosion = -1.31, Total = 0.04
Cross Sectional Area above MP Trend for Location: 5d03300 [HAMP 195] and Master Profile MLWG

Area Above MP Trend: Increasing at 10.146 m³/year
Cross Sectional Area above MP Trend for Location: Scd0355 (HMP 175) and Master Profile MLWS

Area Above MP Trend According at 0.04 m/21 Year
Cross Sectional Area above MP Trend for Location - 5c00622 [HAMP 117] and Master Profile MLWS

Area Above MP Trend: Ending at 0.057 ft/Year

Survey Date

[Graph showing area above mean high water with trend line and data points]