

# Executive Summary

## Great Yarmouth

### Beach and Nearshore Monitoring Report 2013

The Great Yarmouth Port Company Ltd started the construction of the Outer Harbour in summer 2007. In 2003, the construction of the Outer Harbour was given consent on the basis that the adjacent coastline and offshore areas would be regularly monitored. The Great Yarmouth Port Authority signed a monitoring agreement in 2003 that covered the surveying and analysis of beach profiles along the coastline and the bathymetry of the Port Limits and various sections of the River Yare. This agreement was inherited by Great Yarmouth Port Company Ltd (GYPC). This report, in our opinion, addresses the items contained within the 2003 Monitoring Agreement through the presentation, analysis and interpretation of the most recent monitoring data from 2013 in relation to past monitoring data collected and provides an assessment of the pre- and post-construction state of the surrounding coastline and offshore areas. The same methodology used in previous years monitoring reports has been adopted for the present study. The main results from the present study are summarised below.

### Data quality

The data provided are generally of good quality with reasonable surveying accuracy. The repeated recording of numerous distinctive "fixed" features on the beach profiles (e.g. little change in the dunes and cliffs) and offshore bathymetry (e.g. dip in seabed east of the Outer Harbour site) indicate that the successive surveys have been consistent, hence giving confidence that any changes shown in the data are genuine. The density of the data varies between surveys, and thus, should be considered when comparing different surveys in any future analyses. Where profiles between two surveys are not co-incident difficulties arise when comparing data for these two profiles as differences in the position and orientation of the profiles relative to the coastline result in varied morphological features being represented by the profiles. Hence, due care and attention should be paid in order to ensure that any resulting trends and changes in beach elevation interpreted from such comparisons are real.

The timing of the quarterly beach surveys of the 'new' GYPC profiles undertaken and the distance between neighbouring profiles within this set of profiles conforms to the requirements of the MA (and the Schedules within), as do the bathymetric surveys of the Port Limits and River Sections 1 and 2 in terms of the general study extent covered by these surveys and their frequency. Although the 'new' GYPC profiles in areas north of the Outer Harbour are very close to shore-normal, the orientation of the 'new' GYPC profiles in areas south of the Outer Harbour are not shore-normal and therefore these southerly profiles do not strictly comply with the MA. It is also noted that several beach surveys (particularly those between GY0833 and GY0841) do not extend as far seawards as the LAT level (e.g. due to dangerous weather conditions to surveying team, etc) and as a result do not conform to Schedule 2 of the MA and also limits assessments of the lower beach. It is therefore recommended that any future surveys focus predominantly on measuring the section of the beach between the 4m (ACD) level and LAT which has been shown to be the most active part of the beach. It is also recommended that the horizontal cross-shore spacing at which measurements are carried out within this portion of the beach is refined to less than 5m in order to enable as much detail of the beach morphology (e.g. sudden changes in the beach gradient) to be captured and to minimise the beach changes derived as artefacts of the sampling interval. Areas of the beach shorewards and seawards of the region between the 4m contour and LAT can be surveyed if required (e.g. for purposes of maintaining the profile

alignment during surveys) but it is not necessary that the more refined cross-shore spacing quoted above is adopted in this region.

Although the 'new' GYPC profiles cannot be directly compared with the pre- Outer Harbour construction surveys of the 'past' GYPC/EA profiles, through discussions with the signatories of the MA it has been agreed that surveying of these 'new' GYPC profiles will be continued in any future monitoring of the Great Yarmouth coastline in order to allow continuity of this set of beach measurements that commenced in June 2008. The additional surveys of the 'past' profiles that have been undertaken since October 2010 to December 2013 with the aim of providing a period of overlap between the 'past' and 'new' profile measurements has been beneficial to determine if the same beach response can be inferred from either set of profiles. The intercomparison of data collected for these two sets of profiles undertaken in the present study as well as in last year's monitoring report confirms this. On this basis it is recommended that a further period of overlap with profile measurements along both the 'new' and 'past' alignments is unwarranted and that any future surveys should continue to monitor the 'new' alignment as agreed between the parties to the MA.

### Beach profiles and offshore bathymetry

One of the most prominent changes seen from the 2013 surveys in all profiles monitored along the Great Yarmouth coastline (i.e. on both side of the OH) has been a sudden and rapid lowering of beach levels on upper parts of the beach (i.e. between the 4m and MSL contours) with a simultaneous increase in beach levels in more seaward areas near the MLWS contour. This suggests that the lowered upper beach levels in March 2013 may be the result of the cross-shore re-distribution of the beach material from upper parts of the beach to locations seaward of the MLWS contour (e.g. following a storm event). Although the March 2013 beach levels are generally the lowest levels recorded for the upper beach since 2003, the June to December 2013 surveys show that the beach levels have rapidly increased and are generally within the 'envelope' of beach levels recorded in previous years. The above changes observed in 2013 are not characteristic of the typical summer-winter seasonal variation of the beach profile, i.e. steepening of the beach in summer and flattening in the winter seen in previous years (HR Wallingford, 2009, 2010, 2011, 2012, 2013a). Instead, they are considered to be short-term responses of the beach to the weather conditions experienced during 2013.

As in last year's monitoring study, the assessment of the long-term changes in beach area and beach width (to specific depth contours) shows that, in general there has been progressive accretion along the coastline between North Beach and Gorleston and in areas near Corton, and erosion at areas near Hopton-on-Sea since January 2000 which is as far back as the data adopted in the present study goes. Estimation of the trends in beach area (i.e. the rate of change in beach area) for the periods January 2000 to September 2008 and June 2008 to December 2013 at a glance indicate that there has been increased accretion of the beach in areas just north of the Outer Harbour and near Gorleston and Corton; and increased erosion in areas near North Denes and Hopton-on-Sea during the latter period. The increased accretion just north of the Harbour is attributed to the expected build-up of sediment against the northern breakwater of the Outer Harbour over time. The enhanced erosion observed at North Denes and Hopton over the June 2008 – December 2013 period may be associated with the short-term rapid decreases in beach elevations seen in late 2008 to early 2009, December 2010 and March 2013, but more importantly, other processes such as the effects of the offshore banks on the nearshore wave climate and longshore sediment transport regime. As highlighted in last year's monitoring study, rapid losses in beach area similar to those observed at Hopton post-2008 have previously occurred in January 2007. Likewise, rapid increases in beach area similar to those observed over the June 2008 to December 2013 period at Gorleston, which have contributed to the increased rate of

accretion at this location, have occurred previously in January 2006. In fact, the rates of change in beach area estimated in this study for the period between January 2006 to September 2008 for locations near Hopton and Gorleston compare well with those estimated for the period between June 2008 and December 2013 at the same locations. This suggests that the increased accretional and erosive trends estimated at Gorleston and Hopton, respectively, during the June 2008 to December 2013 may in fact been prevalent at these locations since January 2006 and therefore cannot be attributed to the effects of the Outer Harbour.

Comparison of the -1m, -2m, -5m and -10m depth contours extracted from the latest 2013 bathymetric surveys of the offshore area defined by the Port Limits with those produced from past bathymetric surveys since January 2000 show that the contours assessed are within the 'envelope' of maximum change in contour positions observed prior to the development of the harbour. This indicates that there has not been a significant change in the bathymetry since the construction of the Outer Harbour to present.

In general, this report shows that there are no significant changes in the *behaviour* of the beach profiles (surveyed along the Great Yarmouth coastline) and the offshore bathymetry of the seabed (within the Port Limits and the River Sections) before and following the construction of the Outer Harbour. The present study shows that similar changes in the beach profiles occur on either side of the Outer Harbour. There is an on-going trend of beach lowering in the Hopton area, whereas to the north of Hopton and as far as the Outer Harbour there has been accretion. On the basis of the rationale described in Appendix A, it is concluded that there is no evidence to indicate that the Outer Harbour has had an erosional impact on the adjacent beaches.