# LOCAL AUTHORITY AND INTERNAL DRAINAGE BOARD

# PROJECT CLOSURE REPORT

| | |
|---|---|
| **Project name** | South West Regional Coastal Monitoring Programme |
| **Promoting Authority** | Teignbridge District Council<br>Environment Agency |
| **Project ref.** | E9/104 CPW/01736 |



**Contents**

# 1. Project objectives

## 1.1 Introduction

The South West Regional Coastal Monitoring Programme has started the production of a long-term data set that will help make decisions on how to manage the South West coast in the future. The programme looks at coastal erosion and managing flood risk in coastal areas and enables coastal managers to fully understand coastal processes e.g. wave action and tides, and the impact of climate change.

The programme provides information that can be used to improve coastal protection and reduce the impact of flooding along the coast. It is funded by the Department for Environment, Food and Rural Affairs (Defra) and is a partnership, managed by Teignbridge District Council, representing the 17 maritime authorities of the South West. The other lead partners are the Environment Agency and Coastal Groups.

The Plymouth Coastal Observatory was set up as a base for the programme. A team of Coastal Scientists coordinate the data that is collected and manage its use.

The aim of the programme is to provide a standard, repeatable and cost-effective method of monitoring the South West coast. The initial area monitored was from Portland Bill in Dorset to Sand Bay in Somerset (including the Isles of Scilly). Later in the programme this was extended further up the Severn Estuary to include the southern shoreline up to Sharpness and from Lydney on the northern shoreline to the welsh border at Chepstow.

## 1.2 Background

The first generation of Shoreline Management Plans suggested that existing monitoring programmes should be continued. The plans also suggested additional monitoring in areas where monitoring was not conducted at that time. This would provide up-to-date and high quality historical data and record coastal change.

The Penning-Rowsell Research and Development committee suggested that increased research expenditure was required in relation to risk. It suggested that unless data collection was continued or improved, that adequate understanding of coastal processes and morphology could not be made.

## 1.3 Objectives

The five year programme of monitoring will provide the following:

- Topographic beach surveys using a combination of remote sensing and ground survey techniques
- Bathymetric survey
- Complete Aerial survey of the coast in years 1, 3 & 5
- Nearshore/offshore wave/tide monitoring (to include analytical observations & annual reporting)
- Ecological monitoring (habitat mapping)

The provision of these data sets will inform high level strategic initiatives.

Data sets will be available to all through a website.

In establishing this monitoring programme it is desirable that monitoring will be continued beyond the initial five-year programme.

1.4 Data use

**Background Beach Recycling**
Every year due to wave action many beaches lose or gain vast quantities of sediment. Monitoring the beaches shows where sand can be taken from to use on beaches where sand has been washed away.

**Topographical Beach Surveying**
Beach surveys are carried out to record the shape of different beaches so that changes over time can be seen.

**Waves and Tides (Hydrodynamics)**
A network of tide gauges and wave buoys have been placed along the coast to record information on the waves and tides. The data from these is used to inform experts on how best to manage coastal risk. The data is also used to improve flood warnings to communities.

**Bathymetric Surveys (Seabed Surveying)**
Seabed surveys are used to predict the way waves approach the coast and to monitor sub tidal sediment movements.

**Aerial Photography**
Aerial photography is excellent for showing the features along the coast and gives a long-term view on how it is changing. Photography is also used to identify different plant communities on the coast.

**Light Detection and Ranging (LiDAR)**
LiDAR is used to survey habitats such as saltmarsh and soft cliffs, which are difficult or unsafe to survey on foot or by boat.

**Data Distribution**
All data collected by the programme is available to everyone free of charge. Real time wave and tidal data, along with a host of other information is on the project web-site.

## 2. Project performance data

### 2.1 Original approved budget against actual expenditure

| Activity | Costs £ | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Year 1 2006/7 | | Year 2 2007/8 | | Year 3 2008/9 | | Year 4 2009/10 | | Year 5 2010/11 | | All years totals | |
| | Estimated | Actual | Estimated | Actual | Estimated | Actual | Estimated | Actual | Estimated | Actual | Estimated | Actual |
| Topographic surveys | 283,200 | 344 | 109,200 | 354,888 | 109,200 | 138,827 | 109,200 | 165,555 | 109,200 | 248,131 | 720,000 | 907,745 |
| Bathymetric surveys | 607,400 | 0 | 16,200 | 336,185 | 16,200 | 285,197 | 16,200 | 237,212 | 22,400 | 133,805 | 678,400 | 992,399 |
| Wave buoy and tide gauge purchase. | 404,500 | 188,907 | 57,500 | 13,514 | 57,500 | 150,734 | 57,500 | 91,974 | 57,500 | 216,097 | 634,500 | { 661,226 |
| Purchase offshore wind/wave and tidal data and buoy maintenance. | | 86,217 | | 145,590 | | 124,175 | | 144,359 | | 195,993 | | { 696,334 |
| Ecological monitoring (Teignbridge District Council) | | | | | | | | | n/a | 33,488 | n/a | 33,488 |
| Wave programme management and analysis | 41,400 | 41,400 | 41,400 | 41,400 | 41,400 | 41,400 | 41,400 | 41,400 | 41,400 | 41,400 | 207,000 | 207,000 |
| Detailed design, Data management, analysis, procurement, project management and dissemination | 211,100 | 133,100 | 211,100 | 67,400 | 211,100 | 187,200 | 211,100 | 207,300 | 211,100 | 207,600 | 1,055,500 | 802,600 |
| Regional review and analysis, data and software purchase and infrastructure establishment (PCO Regional Office) | 63,100 | 6,591 | 63,100 | 25,330 | 63,100 | 13,048 | 63,100 | 19,310 | 63,100 | 213,805 | 315,500 | 278,084 |
| Client group management | 21,100 | 9,384 | 21,100 | 6,986 | 21,100 | 10,023 | 21,100 | 8,363 | 21,100 | 22,770 | 105,500 | 57,526 |
| LIDAR (EA) | 412,300 | 200,000 | 68,100 | 230,000 | 225,900 | 156,000 | 68,100 | 106,000 | 412,300 | 316,000 | 1,186,700 | 1,008,000 |
| Aerial surveys (EA) | 187,700 | 31,000 | 0 | 38,000 | 187,700 | 45,000 | 0 | 74,000 | 187,700 | 61,000 | 563,100 | 249,000 |
| Orthophotos (EA) | 187,700 | 3,000 | 0 | 33,000 | 0 | 71,000 | 0 | 54,000 | 187,700 | 83,000 | 375,400 | 244,000 |
| Ecological monitoring (EA) | 0 | 0 | 260,000 | 26,000 | 0 | 104,000 | 0 | 120,000 | 0 | 6,000 | 260,000 | 256,000 |
| Totals | 2,419,500 | 699,943 | 847,700 | 1,318,293 | 933,200 | 1,326,604 | 587,700 | 1,269,473 | 1,313,500 | 1,779,089 | 6,101,600 | 6,393,402 |

## 2.2 Time

| **Topographic Surveys** | Year 1 2007 | Year 2 2008 | Year 3 2009 | Year 4 2010 | Year 5 2011 |
|---|---|---|---|---|---|
| Target Number of Baseline Surveys | 104 | 0 | 6[1] | 3[2] | 0 |
| Actual Number of Baseline Surveys | 104 | 0 | 6 | 3 | 0 |
| Percentage Complete | 100% | n/a | 100% | 100% | n/a |
| | | | | | |
| Target Number of Interim Surveys | 84 | 206 | 215 | 227 | 134 |
| Actual Number of Interim Surveys | 84 | 206 | 215 | 227 | 134 |
| Percentage Complete | 100% | 100% | 100% | 100% | 100% |
| | | | | | |
| Target Number of BMP Surveys | 3 | 5 | 5 | 12 | 1 |
| Actual Number of BMP Surveys | 3 | 5 | 5 | 12 | 1 |
| Percentage Complete | 100% | 100% | 100% | 100% | 100% |
| | | | | | |
| Number Post Storm Surveys carried out | 14 | 15 | 22 | 9 | 5 |

| **Bathymetric Surveys** | Year 1 2007 | Year 2 2008 | Year 3 2009 | Year 4 2010 | Year 5 2011 |
|---|---|---|---|---|---|
| Target $Km^2$ of Bathymetric Surveys | 676.27 | 363.03 | 272.89 | 153.30 | 19.28 |
| Actual $Km^2$ of Bathymetric Surveys | 313.24 | 90.14 | 119.59 | 134.02 | 19.28 |
| Percentage Complete | 46% | 25% | 44% | 87% | 100% |
| | | | | | |
| Target Number of Annual Bathymetric Surveys | n/a | 2 | 2 | 2 | 2 |
| Actual Number of Annual Bathymetric Surveys | n/a | 1 | 2 | 4[3] | 2 |
| Percentage Complete | n/a | 50% | 100% | 100% | 100% |

| **LiDAR Surveys** *(Flying Seasons Extend from September to May)* | Year 1 2006/07 | Year 2 2007/08 | Year 3 2008/09 | Year 4 2009/10 | Year 5 2010/11 |
|---|---|---|---|---|---|
| Target $Km^2$ of LiDAR Surveys | 1,137.17 | 659.00 | 423.92 | 172.35 | 1,274.13 |
| Actual $Km^2$ of LiDAR Surveys | 615.43 | 636.76 | 390.00 | 172.35 | 1,028.28 |
| Percentage Complete | 54% | 97% | 92% | 100% | 81% |

The low percentage completed for Year 1 reflects delays in setting up and beginning the LiDAR contract. In year 5 the aim was to fly the whole coast. This proved overambitious timing and only 81% was completed.

[1] Baseline Surveys of Severn Estuary extension area
[2] Baseline Surveys of management units added at Westward Ho! and Crow Point (7cWEST1, 7cWEST2 and 7cSAUN1)
[3] Exe Estuary surveyed twice; once with single-beam and once with multi-beam. Also includes additional multi-beam survey of Dawlish Warren and Exmouth.

| **Aerial Photography** *(Flying Seasons Extend from May to August)* | Year 1 2006 | Year 2 2007 | Year 3 2008[4] | Year 4 2009 | Year 5 2010 |
|---|---|---|---|---|---|
| Target $Km^2$ of Aerial Surveys | 1,545.89 | 1,126.97 | 2,314.61 | 300.60 | 1846.49 |
| Actual $Km^2$ of Aerial Surveys | 418.92 | 358.25 | 768.72 | 300.60 | 1846.49 |
| Percentage Complete | 27.10% | 31.79% | 33.21% | 100% | 100% |

The original plan was to fly the whole of the coast in Year 1, and repeat in Years 3 and 5. In the first three years, the weather was poor due to unusually cloudy conditions and this meant that the first full flight took three flying seasons. With good contrast in vegetation required for habitat mapping, the conditions were not satisfactory. However, Year 4 and 5 gave more opportunity for flying and a full second baseline was acquired relatively easily.

| **Habitat Mapping** | Year 1 2006/07 | Year 2 2007/08[5] | Year 3 2008/09 | Year 4 2009/10 | Year 5 2010/11 |
|---|---|---|---|---|---|
| Target $Km^2$ of Habitat Mapping | 1538.6 | 1538.6 | 1538.6 | 1538.6 | 180.12 |
| Actual $Km^2$ of Habitat Mapping | 0 | 0 | 0 | 1538.6 | 1718.71 |
| Percentage Complete | 0% | 0% | 0% | 100% | 100% |

The habitat mapping is based on the aerial photography collected as part of the coastal monitoring programme. Mapping began once the full baseline had been captured, i.e. at the end of Year 3 and for the original specification was completed by the end of Year 4. A further 180$Km^2$ covering the upper Severn was completed in Year 5.

| **Hydrodynamics** | Year 1 2006/07 | Year 2 2007/08 | Year 3 2008/09 | Year 4 2009/10 | Year 5 2010/11 |
|---|---|---|---|---|---|
| Number of Directional WaveRider Buoys | 4 | 2 | 1 | 3 | 1 |
| | | | | | |
| Number of WaveRadar Rex Tide Gauges | 0 | 1 | 1 | 0 | 1 |
| | | | | | |
| Number of Etrometa Step Gauges | 0 | 0 | 0 | 0 | 2[6] |

[5] Target for final completion of original habitat mapping contract (Portland Bill to Gloucester County Boundary) was 31st December 2008. No data was delivered until 2010

[6] Includes replacement of West Bay Harbour Wave Radar Rex

## 2.3 Products: technical and environmental, monitoring and analytical

### 2.3.1 Planned products

The general technical and environmental objectives of the programme were:

- To develop a better understanding of coastal processes and morphological changes in the region (historic and contemporary), enabling more reliable interpretation of coastal change and earlier identification of trends and cycles in shoreline evolution, thereby increasing the accuracy with which predictions can be made.

[4] Target includes one full set of non-orthorectified aerial photography, for which no data was collected.

• To provide data for the production of sustainable Shoreline Management Plan policies and Strategy Plan options.
• To aid the management of coast defences by providing valuable data for the design and assessment of coastal defence schemes and coastal management activities.
• To provide data that highlights potentially problematic frontages, thereby enabling the implementation of appropriate management approaches that ensure the sustainability of the coast and its resources.
• To reduce the exposure to flood risk and erosion by enhancing the accuracy with which risks can be assessed.
• To enhance the value of existing data.

The specific monitoring and analytical objectives of the programme were:

• Derivation of a baseline of the existing coastal morphology
• Identification of long-term rates and locations of changes in coastal morphology
• Derivation of a baseline of existing coastal ecology
• Identification of long-term rates and location of changes in coastal ecology
• Characterisation of the coastal processes operating along or near to the shoreline
• Identification and quantification of changes in coastal processes
• Characterisation and quantification of changes in coastal ecology in context with coastal processes

2.3.2 Actual products

The project has delivered all the products described in 2.3.1 above. The region is developing a better understanding of coastal processes and morphological changes.

Appendix A gives maps of the South West showing

- Aeriel photo coverage, coloured by year flown
- LiDAR, coloured by most recent year flown
- Topographic survey sites, showing profile surveys and baseline surveys
- Bathymetric survey coverage, coloured by dates
- Wave buoys and tide gauges, location plan

The provision of valuable data for coastal management activities is aiding the management of coast defences. This includes current work on strategies at Severn Estuary and the Exe. The work on the Hinkley Point risk assessment has also used data from this project.

The website interface is well used and Appendix B shows the spread of data use by various parties.

Plymouth Coastal Observatory produce annual reports and these are used by coastal engineers and coastal practitioners as an evidence base.

**3. Explanation of cost variance**

Form G1 17/8/07

Boundary extension from Avonmouth to Sharpness. Increase in cost £40k. Approval for supplementary expenditure was not required as sufficient cost savings were made on the original approved cost to cover this work. No increase in time.

Form G2 18/1/08
Additional wave buoy at Tor Bay. Increase in cost £45k. No increase in time.
This deployment was to assist the environment agency in providing flood warnings for Torbay.

Form G3 1/7/08
Extension to Chepstow plus addition of three wave buoys.
The extension provides a linkage with the Welsh Coastal Monitoring Programme and avoids gaps in the national programme. Increase in cost £30k, included within the budget due to delays in the programme. Three wave buoys at Looe, Taw-Torridge Estuary, Weston-super-Mare. Cost £75k x 3. Looe buoy funded from EA Area FCRM budget. Other buoys additional £150k.
No increase in time.

These buoys were not identified at the start of programme as being required. Experience from earlier buoys showed that this technology could be applied elsewhere and savings in other parts of the programme meant money was available.

Form G4 3/8/10
Wave gauge at Severn Bridge. Increase in cost £51k. No increase in time.

Form G5 10/11/10 was not submitted to PAB as it did not involve an increase in cost or time. It was prepared to notify the increased extent of habitat mapping from SW boundary at Sharpness to cover the rest of the Severn Estuary. This was to provide evidence for the SW Regional Habitat Creation Programme. Increase in funding not sought as savings made elsewhere. No increase in time.

## 4. Explanation of time variances

4.1 Bathymetric surveys

All the baseline bathymetric survey data was due for completion in year one of the programme with annual surveys planned on Two of the most dynamic systems (the Teign and the Exe) for subsequent years. Due to weather delays a proportion of the bathymetric surveys had to be completed in the following year (year 2). For one survey area between Land's End to Trevose Head major difficulties were experienced due to weather delays and swell conditions causing the survey work not to be complete until year 5 of the programme.

4.2 Topographical surveys

All Topographical beach surveys that were planned for were completed and delivered on time throughout the five year programme.

4.3 Hydrodynamic services

The initial 6 Wave Buoys and two Tide Gauges were deployed as planned. Following requests from professional partners and subsequent technical analysis & justifications an additional 6 wave buoys and two tide gauges were deployed over the subsequent years of the programme.

4.4 LiDAR Surveys

The coast was split into High frequency, Medium frequency and Low frequency sections, the areas of greater concern/high activity being the high frequency ones. The original plan was as follows:

| | |
|---|---|
| Year 1 2006/2007 | High, Medium, Low frequency locations |
| Year 2 2007/2008 | High frequency locations |
| Year 3 2008/2009 | High, Medium frequency locations |
| Year 4 2009/2010 | High frequency locations |
| Year 5 2010/2011 | High, Medium, Low frequency locations |

Flights were flown over the winter period, when the vegetation cover was at its minimum.

Flights were planned to meet specific tidal windows (usually spring tides) and many of these windows were for short periods meaning that any delays to flights could mean a long wait until the next opportunity. Variations to the original plan in terms of timings included a delay at the beginning of the contract, due to tenders going out later than planned and poor weather.

4.5 Aerial photography

Three flights of aerial photography were planned for Phase 1 of the programme:

- Flight 1 all of coast: Year 1 Summer 2006
- Flight 2 all of coast: Year 3 Summer 2008
- Flight 3 all of coast: Year 5 Summer 2010

Due to a late start in Year 1, waiting for the contract to be in place, and poor weather for flying over the summer period, only 27% of the full baseline was flown. It took two more summers to cover the whole coast. The programme was reassessed and one further flight was planned, spread over Years 4 and 5.

4.6 Habitat mapping

Habitat mapping was dependent on the delivery of the aerial photography. Due to the delay in the aerial photography flights habitat mapping did not begin until Year 4. The mapping was completed in one year as planned. An extension to the mapping was undertaken in Year 5.

## 5. Explanation of product variances

5.1 Topographical surveys

Through out the programme minor adjustments have been made to the Topographical Beach Survey programme to reflect the needs of partners. In year 4 of the programme it was identified that there was a need for topographical beach surveys at Westward Ho! and Crow Point. Other additions included in year 4 the upgrade of 7 management units to annual baseline survey sites.

It has become clear from the monitoring that has taken place over the last phase of the programme that certain sites do not require as frequent surveys. Within the next five year programme adjustments to the monitoring schedule have been made to reflect these observations.

5.2 Bathymetric surveys.

The original scope for the programme required a complete set of baseline single beam bathymetric surveys from Portland Bill to Sand Point. Later this was extended by means of Variation 3 to Severn Beach. Collaboration with the Maritime and Coastguard Agency (MCA) has meant that the two areas of coast have been upgraded to full multi beam surveys. The areas of coast that have been up graded are from Portland Bill to Petitor Point and from Land's End to Harland Point.

This method of collaborative working will be explored in the future phase/s of the programme to allow substantial savings to be made.

5.3 Hydrodynamic services

5.3.1 Wave buoys
The original scope for the hydrodynamic network was to have wave buoys deployed at the following locations

- Chesil
- West Bay
- Start Point
- Penzance
- Perranporth
- Minehead

Opportunities to incorporate additional Wave Buoys and using external funds were implemented at:

- Torbay
- Looe Bay
- Bideford Bay
- Weston Bay

Following requests from professional partners and subsequent technical analysis wave data, Wave Buoys where also deployed using funds from efficiency savings at:

- Dawlish
- Porthleven

5.3.2 Tide gauges

The original provision for the installation of tide gauges was two Wave Radar sites:

- Teignmouth Pier
- West Bay Harbour

Additions to the tide gauge were from the original scope were:

- Port Isaac
- Replacement of West Bay Wave Rex with a step gauge
- Severn Crossing Wave Rex

Throughout the programme it became apparent that there is a lack of good real time tidal data on the North Cornwall Coast. The preferred location was Port Isaac where an Etrometa Step Gauge was installed.

Due to local restrictions at the West Bay site the Wave Radar had to be installed at a less than ideal height. This later caused problems in stormy conditions when the Wave Rader was inundated which caused it to fail. The decision was taken to replace the Wave Rex with an Etrometa step gauge which proved more suitable for the site.

The Environment Agency requested a tide gauge on the River Severn to gain a better understanding of the wave climate in this location. A contribution was made towards the cost of installation and the tide gauge was incorporated into the programme.

Spend on the wave buoy and tide gauge element of this project was £3.6 million, out a total spend of £6.4 million. This highlights that this is an expensive element of the programme and any future deployments need to be carefully considered.

5.4 Plymouth Coastal Observatory

The need for a regional centre for the analysis and processing of the data was identified in the original scope of the project. By close collaboration with the University of Plymouth; the Plymouth Coastal Observatory was set up at a lower cost than originally estimated. This way of working will be continued into future phases of the programme to provide an ongoing saving and opportunities for both the programme and the university.

5.5 Habitat mapping

The habitat mapping delivered was, following validation and feedback requesting changes, as set out in the specification. An issue arose over making the data available due to licensing conditions. It was originally intended to make the GIS files freely available but because the mapping was based on Ordnance Survey (OS) Mastermap data, the GIS files can only be issued to organisations who have a licence to use this OS product. PDF (Adobe) files have been created so that these can be put on the website, but these cannot be edited.

5.6 LiDAR surveys

The LiDAR data delivered was, following validation and feedback requesting changes, as set out in the specification.

5.7 Aerial photography

The Aerial photography data delivered was, following validation and feedback requesting changes, as set out in the specification.

## 6. Benefit in delivery

6.1 Financial

As part of original the PAR submission a detailed cost benefit analyses was carried out in order to ascertain the benefits that the programme will create. The original discounted benefits ranged from £4,303k as the worst case scenario and £19,254k as the best case scenario detailed in table 6.1.

Table 6.1

| **Year Programme** | **Range (£'000)** | | |
|---|---|---|---|
| | **Lower** | **Upper** | **Mid** |
| PV Costs (5Yr) | 6,327 | 6,327 | 6,327 |
| Discounted Benefits (5yr) | 4,303 | 19,254 | 9546 |
| Discounted Costs | 5,862 | 5,862 | 5,862 |
| Benefit/Cost ratio (5yr) | 0.73 | 3.28 | 1.62 |
| | | | |
| Discounted Benefits (50yr) | 59,403 | 254,788 | 123,684 |
| Discounted cost (50yr) | 30,294 | 30,294 | 30,294 |
| Benefit/Cost ratio (50yr) | 1.96 | 8.41 | 4.08 |

When data is downloaded from the Channel Coastal Observatory all users must specify their intended use of the data. The total value of the data downloaded for the 5 year phase of the programme is £95,732k. The split of this data use is shown in Appendix B.

Using the total data value of £95,732k a discounted benefit for the five year period can be estimated at £89,000k.

Using the total spend of the project of £6,600k and discounting it over five years to give £6,200k an actual cost benefit of the programme is 15, which is roughly twice the best predicted estimated in the PAR at the conception of the programme.

6.2 Benefit realisation – tangible

The project has enabled the development of an in-depth understanding of coastal processes and morphological changes in the region (historic and contemporary). This enables a more reliable interpretation of coastal changes as well as earlier identification of trends and cycles in shoreline evolution, thereby increasing the accurate predictions

.

• The project has provided data for the production of sustainable SMP policies and Strategy Plan options.

*The SMP2s are robust compared with SMP1s, for example using LiDAR for 3D modelling.*

• The project is aiding the management of coast defences by providing valuable data for the design and assessment of coastal defence schemes and coastal management activities.

*All coastal schemes are encouraged to use data from this project.*
*There is a good evidence base for the LICCO project (Living with the Changing Coast).*

• The project is providing data that highlights potentially problematic frontages, thereby enabling the implementation of appropriate management approaches that ensure the sustainability of the coast and its resources.

*Coastal Groups and Regional Flood and Coastal Committees are making local decisions on coastal management which are informed by data from this project, e.g. Dawlish Warren*
*Partner organisations are using the data, e.g. Natural England are using the ecological mapping data.*

• Exposure to flood risk and erosion is being reduced by enhancing the accuracy with which risks can be assessed. For example, the data will be used as the evidence base for future updates to the National Coastal Erosion Risk Maps.

• The value of existing data is enhanced.

*Existing monitoring programmes have been integrated within this project and now form part of the overall comprehensive SW regional monitoring programme. Risk analysis is ensuring that monitoring is focussed in the right places. Monitoring programmes have been established and will continue beyond the initial five-year programme.*

The following specific monitoring and analytical objectives have been achieved:

• Derivation of a baseline of the nature of the existing coastal morphology
• Identification of long-term rates and location of changes in coastal morphology
• Derivation of a baseline of the existing coastal ecology
• Identification of long-term rates and location of changes in coastal ecology
• Characterisation of the coastal processes operating along or near to the shoreline
• Identification and quantification of changes in coastal processes
• Characterisation and quantification of changes in coastal ecology in context with coastal processes

6.3 Benefit realisation – intangible

Other benefits, which cannot be financially quantified, are

- Consistency of approach to data collection and management
- High quality data management
- Rapid and wide dissemination of data and analysis
- An extensive existing baseline data set has been completed.
- Considerable long-term value of some existing long-term data sets.

## 7. Outstanding tasks

On completing phase one of the programme all tasks that were deemed to be required were completed. Due to the continuation of the overall programme and the requirement of continuation of data the 12 Wave Buoys and 4 Tide Gauges have remained deployed.

## 8. Outstanding risks

Due to the nature of the monitoring project there is no outstanding risk. The Wave Buoys and Tide Gauges that are currently deployed have been incorporated into phase two of the programme along with the risk associated with their deployment.

Lack of future funding will remain a risk. For such a programme to continue to be a success, data sets covering a long period of time is required for the comparisons required when looking at the strategic management of the coast. The long record for Newlyn tide gauge is evidence of this.

As with projects covering a long timescale, continuation of staffing is key to smooth running of the project, the team managing it is small in number and should team members move on this can cause disruption to the programme. The resilience of the programme must be kept under review at all times. Changes in resource availability, and decisions made regarding replacing staff at the lead authority under testing financial times, may have an impact on the programme.

## 9. Lessons learnt

Using one local authority assigned as lead authority for the project has led to smooth project management which has provided to be cost effective. This does rely on individual members of staff, and it is a small team, and sudden changes in staff could cause problems.

The lessons from existing coastal monitoring projects in the South East and East Anglia have been incorporated. Colleagues involved in the South East programme were heavily involved in the setting up of this project, and the South West programme has operated in a similar way.

Survey work was previously done piecemeal along the coast, managed by a variety of organisations, and undertaken by different agencies from small to large survey companies and in-house engineers. This project has created a much more consistent approach and much more efficiency. A joined up approach is key for datasets across a wide area, as piecing together ad-hoc pieces of work often means the jigsaw pieces will not fit.

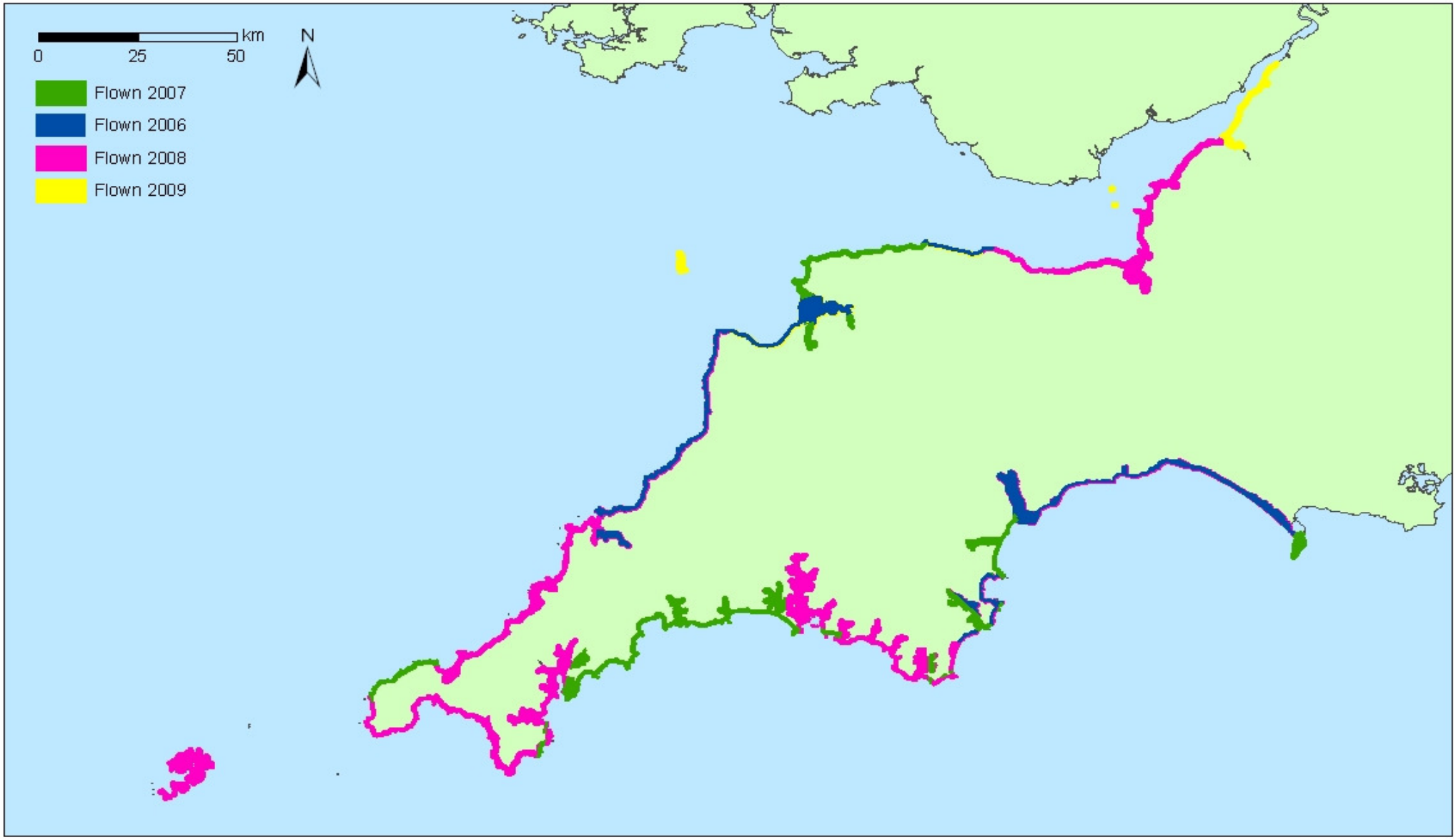
Data management systems are continually being developed and existing ones must keep up with changing requirements. The way data is managed needs to be reviewed when new options become available.

## 10. Benefit realisation

The actual cost benefit of the programme is 15.
All the planned products were delivered and resulted in the tangible and intangible benefits described in 6.2 and 6.3 above.

**Appendix A**
**Maps showing products delivered**

# Southwest Strategic Regional Coastal Monitoring Programme

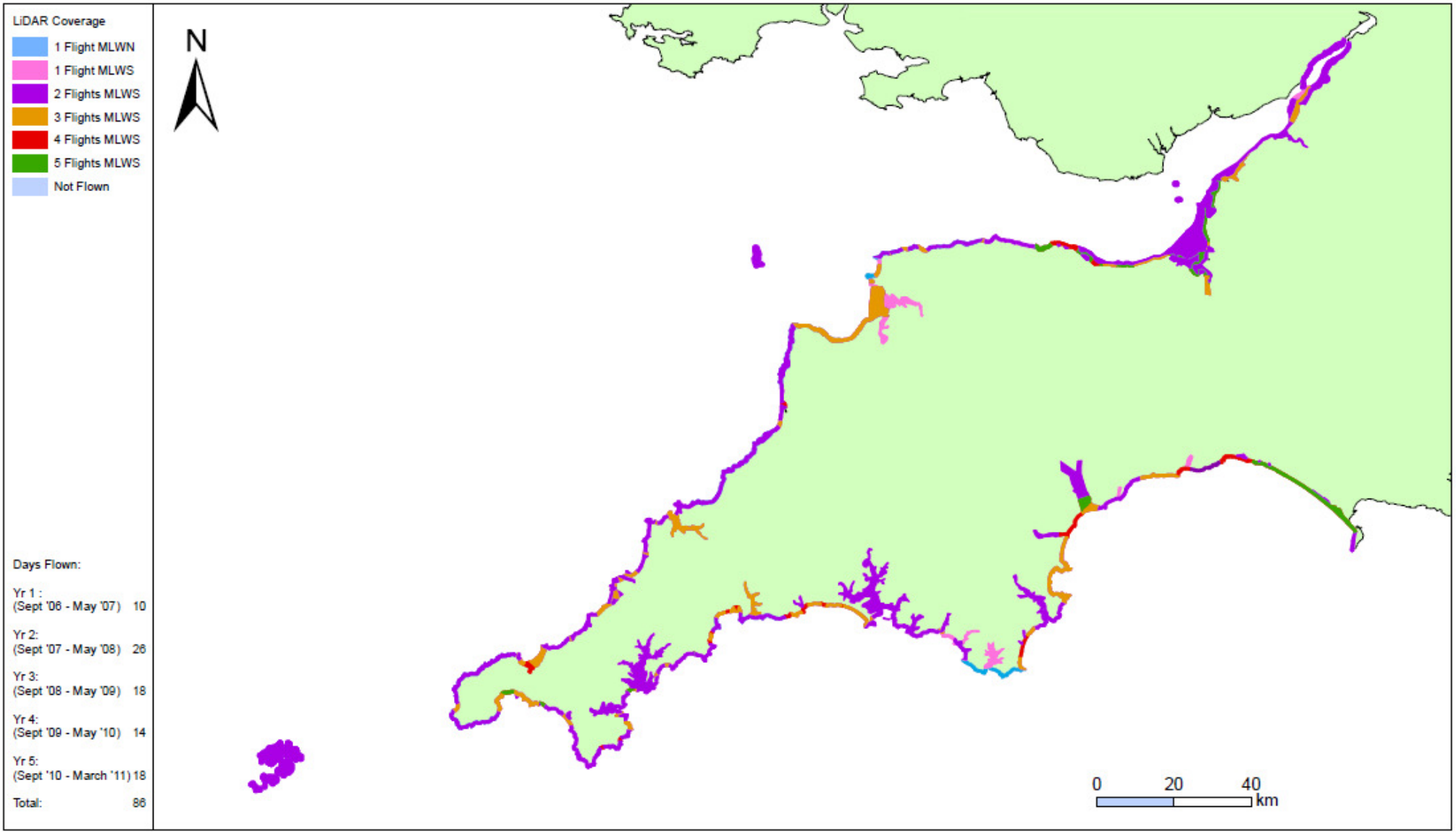



## Aerial Photography Coverage

PLYMOUTH COASTAL OBSERVATORY

# Completed LiDAR

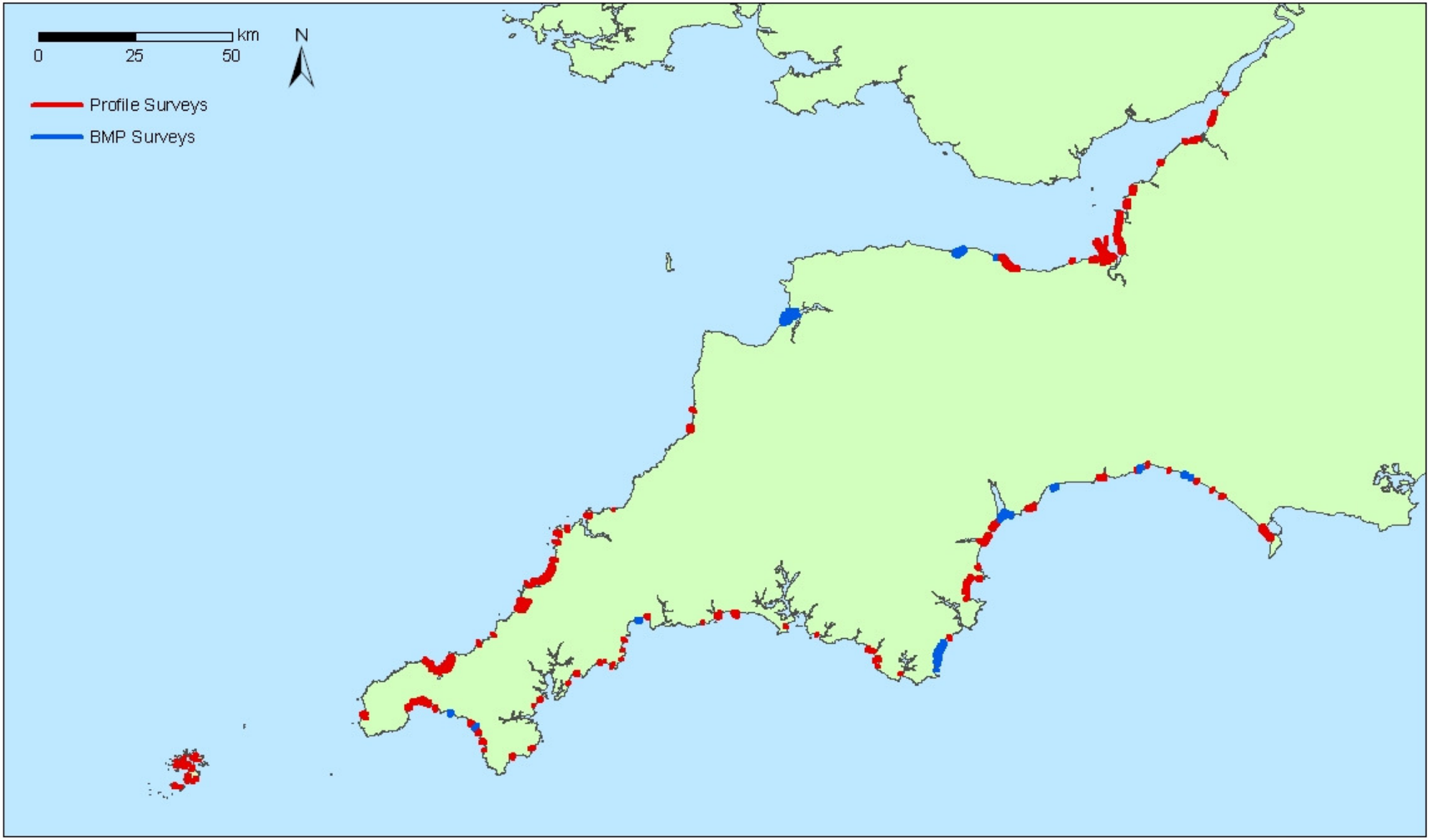
**November 2006 to March 2011**




**Southwest Regional Coastal Monitoring Programme**

PLYMOUTH COASTAL OBSERVATORY

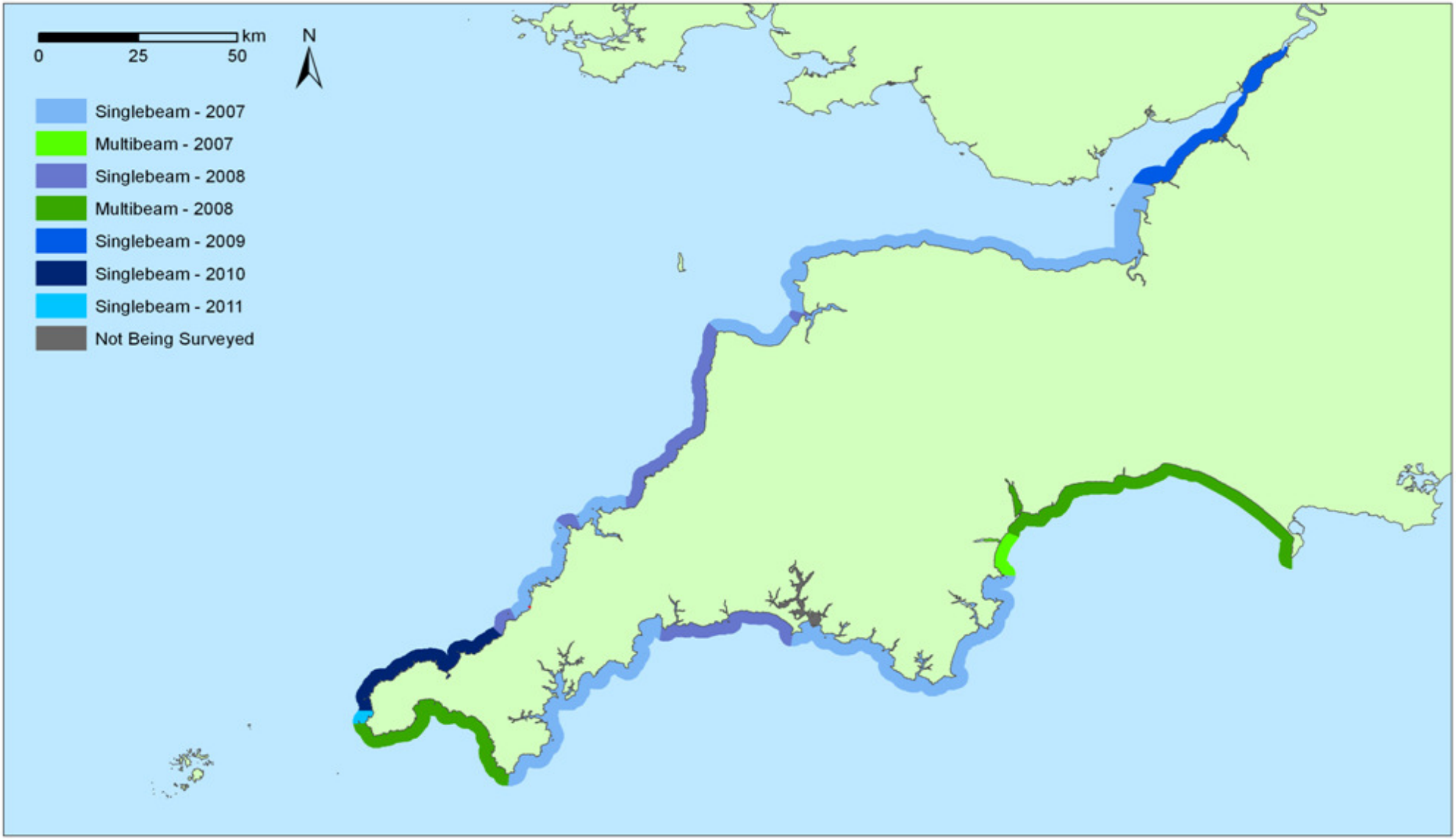
# Southwest Strategic Regional Coastal Monitoring Programme




Topographic Survey Sites

PLYMOUTH COASTAL OBSERVATORY

# Southwest Strategic Regional Coastal Monitoring Programme




## Bathymetric Survey Coverage

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## Wave Buoys and Tide Gauges

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**Appendix B**
**Data use split table (£)**

| Sector | Orthos | Bathy | Lidar | Waves, tides | Topo |
|---|---|---|---|---|---|
| Local Authority or Environment Agency | £81,459 | £1,508,100 | £431,400 | £184,800 | £1,357,800 |
| Conservation organisation | £27,459 | £702,900 | £42,500 | £0 | £502,200 |
| Consultancy on LA or EA project | £136,836 | £4,953,300 | £739,000 | £0 | £369,600 |
| Consultancy on other Govt project | £32,967 | £3,976,500 | £115,700 | £0 | £213,900 |
| Consultancy other | £26,676 | £4,907,100 | £517,700 | £436,800 | £1,289,600 |
| Govt trading fund | £36,126 | £30,165,300 | £374,700 | £352,800 | £145,700 |
| University research | £89,019 | £2,021,250 | £1,278,300 | £756,000 | £1,853,800 |
| University students | £167,427 | £7,872,150 | £2,308,800 | £3,108,000 | £5,539,700 |
| Schools & colleges | £2,862 | £1,145,100 | £21,500 | £0 | £68,200 |
| Other | £260,388 | £8,448,000 | £2,373,300 | £1,478,400 | £3,310,800 |
| Total | £361,219 | £65,699,700 | £8,202,900 | £6,316,800 | £14,651,300 |
| | | | **Grand Total** | | **£95,731,919** |