

Review of Anglian Coastal Monitoring Programme topographic survey schedule for Phase 10 (2021- 2027)- Methodology

Version Control

Version	Date	Initials	Comments
Draft	December 2021	BS	Circulated to Partners for comment with the draft survey category scores
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1. Introduction

The Anglian Coastal Monitoring Programme (ACMP) has been collecting topographic data from beach transects since the early 1990s. The topographic survey schedule for the ACMP has remained largely unchanged since the beginning of Phase 8 (2011- 2016) and throughout Phase 9 (2016- 2021). ACMP enter Phase 10 (2021-2027) with ~20 years of data captured in most locations, and two decades of understanding how coastal practitioners use the data. Completion of this topographic survey review is an action assigned to all regional monitoring programmes from the NNRCMP Strategic Board. In January 2022 ACMP's topographic survey contract must be re-tendered, making it the opportune moment for this assessment of our topographic survey schedule.

The aim of this review is to ensure that topographic data is collected as efficiently as possible in the Anglian region. It should be noted that this review is entirely independent of any financial pressures to reduce costs by reducing surveys and other monitoring. Twenty years of data provides a sufficient evidence base from which to consider reducing survey frequency, in some areas, without compromising the overall representation of the beach behaviour and trends in our dataset.

The review process has three stages:

- (i) The Anglian coast was divided up into new monitoring cells to align with SMP2 policy decision units. This approach to monitoring offers consistency with our partner's management areas and allows more cost-effective and targeted monitoring methods to be implemented on a cell-by-cell basis. The previous (phase 9) monitoring cells, based on sediment cells, were often too large to adequately reflect the nuances in management practices and hence monitoring needs within them.
- (ii) A risk-based, weighted scoring system was developed to objectively analyse the monitoring effort required for each new monitoring Cell. The scores are based on SMP policy, capital work schemes, erosion risk and beach behaviour within each cell. Note that although SMP policy has a considerable influence on the resultant 'Priority Score', it is not the sole determinant of the survey regime.

- (iii) A review of other available survey methods to identify opportunities to improve efficiency of data collection or provide a more appropriate style of monitoring to support the management decisions taken in each area. This includes greater reliance on LIDAR, following the outcomes of the 2019 ACMP report comparing LIDAR and ground-based topographic surveys, and improved confidence in other topographic data collection methods such as photogrammetry from Unmanned Aerial Vehicles (UAVs).

2. Priority Score Method

This method provides details of the risk-based, weighted scoring system as referenced in (ii) above.

A priority score has been calculated objectively for each new monitoring cell according to factors that influences the need for ACMP to monitor coastal change. The score is based on five components; SMP policy, flood risk, erosion risk, capital works and historic beach behaviour, which combine into an overall score indicating the priority for monitoring.

Table 1 shows the breakdown of scores assigned to each component of the total score, further detail on each component is provided in section 2.1 – 2.5. The highest achievable total score is 60. The value of the total score assigns each monitoring cell to a priority score category. The five categories define the monitoring effort, in terms of topographic survey frequency, going forward (Section 3).

Table 1 Priority Score system at a glance.

SMP Policy		Capital Schemes		Flood Warning Area	Erosion risk (NCERM)	Beach Characteristics		Priority Score (Max = 60)
Epoch 1	Epoch 2	Current	Recent			Erosion trend	Variability	
HTL = 5 MR = 2.5 NAI = 0	HTL = 10 MR = 5 NAI = 0	Major = 10 Minor = 5	Major = 5 Minor = 2	Yes = 5 No = 0	0=0, >1=0.5, 1<2=1.5, 2<5=3.5, 5<10=7.5, >10=10	Yes = 5 No = 0	Negligible = 0 Moderate = 5 Severe = 10	

2.1. SMP Policy

Maximum Score: 15

The policy decisions for each Policy Decision Unit (PDU) were extracted from the relevant shoreline management plan (SMP). The policies span three epochs: Epoch 1 at 20 years; Epoch 2 at 20 - 50 years; and Epoch 3 at 50 – 100 years. Coastal management decisions may become increasingly influenced by the policy of Epoch 2 as we near the end of Epoch 1. For this reason, and to future-proof our survey schedule, the policy in Epoch 2 attracts double the score of Epoch 1. No score was assigned to Epoch 3 as it is well beyond this phase of the ACMP Programme.

The score assigned to each policy decision for Epochs 1 & 2 are shown in Table 2. No score was assigned to an 'Advance the Line' (ATL) policy as it does not currently appear in any ACMP monitoring cell.

Table 2 Scores given for SMP policy decisions

Policy decision	Epoch 1 score	Epoch 2 score
Hold The Line (HTL)	5	10
Managed Realignment (MR)	2.5	5
No Active Intervention (NAI)	0	0

2.2. Capital Schemes

Maximum Score: 15

Capital schemes often involve coastal engineering which may affect the rates of coastal change and existing topography. Monitoring data is required before a scheme in order to provide a baseline and support business cases production, as well as afterwards, in order to monitor scheme performance.

A list of planned, active and recently completed schemes was compiled using Environment Agency databases and through additional information gained from partners. The schemes were classified as 'major' or 'minor' based on the spatial and temporal extent over which they might impact topography &/or coastal processes. Small scale repairs and maintenance projects, such as patching and filling seawalls, were not included as these have no significant effect on monitoring requirements.

The scores assigned for capital schemes are shown in Table 3. If a monitoring cell has multiple schemes within it, the highest scoring scheme is taken. Schemes are monitored to observe their performance and environmental impact and therefore a new scheme attracts a higher score than an old schemes. 'Current' schemes refer to schemes which are active or are planned to occur in phase, within the medium-term plan (MTP) (2021 – 2027). Recent schemes are those which were completed in the last MTP (2016 – 2021), corresponding to Phase 9 of ACMP. Works completed before Phase 9 are established in the long-term data archives and no longer need specific monitoring consideration.

Table 3 Scores given for capital schemes

	Current Scheme (MTP 2021 - 2027)	Recent Scheme (within last MTP 2016-2021)
Major Scheme	10	5
Minor Scheme	5	2

2.1. Flood Warning Area

Maximum Score: 5

The Environment Agency's Flood Warning Areas were used to determine the flood risk associated within each monitoring cell. A presence/absence system was adopted, and monitoring cells with flood warning area(s) acquired 5 points. Some sensible adjustments were made where it was clear that the flood risk was not a hazard i.e. did not affect property or infrastructure.

2.1. Erosion Risk

Maximum Score: 10

The National Coastal Erosion Risk Mapping (NCERM 2018-2021) dataset was used to determine the risk of erosion for each monitoring cell. Erosion rates for the 95th Percentile for Epoch 1, *with* SMP implemented, were used as this should offer the most likely scenario. It could be said that using the NCERM data gives monitoring cells with undefended, eroding cliffs, a score advantage. However, these are often areas of dramatic coastal change, that may score lower for SMP policy, and that do justify monitoring.

The scores given for this erosion risk factor are shown in Table 4. This scoring system is in line with that used by the Wales Coastal Monitoring Centre in an attempt to standardise the scoring between regions. Where a monitoring cell contained multiple NCERM values, the highest value was used to assume a worst-case scenario.

NCERM Value	Score
0	0
0-1	0.5
1-2	1.5
2.5	3.5
5-10	7.5
>10	10

Table 4 Scores given for NCERM erosion risk

2.3 Beach Characteristics

Maximum Score: 15

A measure of long-term, cell-wide, shoreline behaviour has been included. The score is made up of two parts.

1) In each monitoring cell, ACMP beach profiles with the longest datasets were grouped. Only the annual *winter* surveys were used. The chainage values at which each profile intersected the level of Mean High-Water Springs* (MHWS) was extracted. The differences in these chainage values between successive winter surveys, was calculated for each profile**. The mean of *all* the differences, for each profile, in each monitoring cell, was sought. If this average change over time was a negative value, the monitoring cell was awarded 5 points on the premise that erosional trends are of greater concern than accretionary trends to coastal managers.

Table 5 Score awarded if topographic profiles showed a trend of erosion

Average change over time	Score
Positive value	0
Negative value	5

2) The standard deviation was then calculated to indicate the spread of values about the mean***. The mean and standard deviation values were multiplied, and the scores split in to three bins, as below.

Table 6 Scores given for beach variability

Mean * Standard Deviation	Score
0-10	0
11-20	5
>20	10

*MHWS offered the greatest availability of data and was deemed a more representative proxy for measuring beach variance, due to its intermediary position between the inter and supra tidal zones.

**Positive (negative) change in chainage equates to beach growth (retreat)

*** More (less) consistency and less (more) variability in beach behaviour is assumed with a low (high) standard deviation value.

3. Revised schedule for topographic surveys

This total score calculated for each monitoring cell serves as a proxy for monitoring priority, so will be known henceforth as 'Priority Score'. Monitoring cells are classified by their Priority Score to generate a Priority Score Survey Categories (Table 7), with the resultant generic survey regime shown in Table 8.

Table 7 Priority Score Survey Category

Priority Score	Priority Score Survey Category	Typical beach management	Description
>=38	Category 1	Beach Management Plan	Typically, sites with an agreed Beach Management Plan/Long term scheme/strategy. Proposed to change 1 profile survey per year to a continuous survey.
<38 and >30	Category 2	Hold The Line – Type A	HTL-A are sites with, for example, capital investment included in the MTP, works planned, underway or recently completed, where there are significant assets at risk. No changes to the existing survey regime are proposed.
<=29 and >18	Category 3	Hold The Line – Type B	HTL-B are sites with no actual or anticipated capital investment or significant risk, but which have maintenance of existing defences/beaches
<=18	Category 4	No Active Intervention	No active beach management is undertaken or anticipated
N/A	Category 5	N/A	Sites which require a bespoke monitoring regime
N/A	N/A	Managed Realignment	Typically regarded as HTL-A/B dependent on timeframe

Table 8 Generic survey regime

Survey Category	Typical beach management	Current surveys	Proposed Surveys	Transect frequency	LIDAR
Cat 1	BMP	Baseline Summer strategic and scheme profiles Winter strategic and scheme profiles	Baseline (Year 1) Winter Walked profiles Strategic and selected Scheme Profiles Annual Summer Continuous*	T1	Annual
Cat 2	HTL-A		Baseline (Year 1) Summer walked profiles Winter walked profiles (Strategic only) Annual call off	T2	Annual
Cat 3	HTL-B		Baseline (Year 1) Walked Summer Profiles (Selected profiles only) Annual call off	t3	Call off (Minimum Year 1, Year 4, Year 6)
Cat 4	NAI		Baseline (Year 1)	t4	Year 1, Year 4, Year 6
Cat 5	N/A		Bespoke Survey Regime specific to location		

* Continuous surveys may be photogrammetry or laser scan or summer lidar.

4. Site-specific considerations

The final survey category (table 8) determining the monitoring regime may be modified according to site-specific considerations, for example:

- if a Cat 3 or 4 site is sedimentologically closely linked to a managed beach, then it may be included with the Cat 1 or 2 survey programme
- location with regard to whole sediment sub-cell e.g. a small Cat 2 unit in between two Category 1 beaches might get included with the Cat 1 surveys, to aid sediment budget assessment
- if there is a long-term strategy or beach management plan which specifically calls for a certain monitoring regime
- if a cat 3 beach is between two cat 4 sites, and is not actively managed, it may be included as a cat 4 programme
- future schemes or changes e.g., if a survey unit adjacent to an existing BMP is likely to have a BMP in the foreseeable future, it may be surveyed to the same level as the BMP site now
- Timing of the surveys may need to be adjusted if there are access constraints e.g., nesting birds, firing ranges etc.
- A very few sites may require a bespoke survey regime (Category 5)

5. Lidar

The LIDAR programme in Phase 10 will complement the capture of topographic data. Annual surveys will be completed at cat 1 and 2 sites, with call off options for other monitoring cells. The LIDAR programme in Phase 10 includes a full coverage baseline (including habitats and estuaries) in years 1 and 4, and a coastal strip in year 6. The continuous surveys in cat 1, will be timed to be used in comparison with the LIDAR survey e.g. continuous surveys in summer, and LIDAR in winter.

References:

ACM, 2019. Comparison of LIDAR and Ground-based Topographic Surveys for Coastal Monitoring. Available: <http://www.coastalmonitoring.org/reports/>