

THE BRIEF FOR TOPOGRAPHIC SERVICES

Scheme Title	Anglian Regional Coastal Monitoring Programme
Employer	The <i>Employer</i> is the Environment Agency
Employer's Address	Environment Agency, Kingfisher House, Goldhay Way, Orton Goldhay, Peterborough, PE2 5ZR
Nominated Employer's Representative	Mr Philip Staley
Survey Title	Anglian Coastal Monitoring programme, Phase 9 (2016 – 2021): Topographic Services
Purpose of Survey	The survey outputs are used as part of a long-term programme of coastal monitoring, to analyse coastal processes and provide data for operational and strategic shoreline management
Specification	<p>The <i>Specification</i> is the <i>Environment Agency National Standard Contract and Specification for Surveying Services, Standard Technical Specifications, Version 3.2, 1 May 2013</i>.</p> <p>The sections that shall apply to this contract are: Section I, Section II, Section III, Section VIII and Section XIII.</p>
Delivery Schedule	o be in accordance with section 2.13 and <i>Activity schedule Topography ACM v0-1.xls</i>
Tender Submission Date	See the invitation to tender
Contract Completion Date	31 March 2021
Known Hazards	The <i>Employer</i> is unaware of any special hazards other than those normally associated with beach and coastal surveying. The <i>Consultant</i> shall carry out a full Risk Assessment before each survey and shall prepare a Safe System of Working based on the Assessment. A copy shall be forwarded to the <i>Employer's</i> Representative. The <i>Consultant's</i> attention is drawn to the desirability, among other things, to check the tidal cycle and the weather forecast and of notifying the Coast Guard and relevant land owners of the survey activities.
Site Conditions/ Restrictions, Access and Public Relations	<i>Consultants</i> will follow the public relations guidance in <i>Section I</i> of the <i>Specification</i> . A letter of introduction will be provided which should be presented as a matter of course, and without it being demanded, at all meetings with landowners or the public. The <i>Consultant</i> shall notify all relevant authorities of the programme of work and shall adhere to the requirements of these authorities. Particular note is made for the need to liaise with managing conservation bodies of sites regarding the status of protected vegetation and nesting birds, and with the National Trust, at Orford Ness, and the MOD with regard to site restrictions and ordnance. The <i>Consultants</i> shall liaise with the relevant authorities throughout the contract period and obtain permissions and licenses if

	<p>required. The <i>Consultants</i> is responsible for obtaining permissions if accessing areas of designated status or MOD property, and to understand and adhere to relevant restrictions this may involve. The <i>Employer's</i> Representative will apply for assent for survey work to occur on behalf of the Contractor when this is a requirement. GIS layers detailing conservation designation sites are available from the Natural England website: http://www.gis.naturalengland.org.uk/pubs/gis/gis_register.asp.</p>
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1. General

This Brief provides details specific to provision of land (e.g. Topographic) survey data utilising GNSS technology, associated monitoring and analytical services along the Anglian Coast (River Humber to the River Thames). The defined surveys will predominantly be for tidal and coastal areas, but there will be a need to provide a rapid response survey service following storms, emergencies or unforeseen incidents. The seasonal surveys provide a dataset and evidence of coastal morphology and beach condition as part of the Anglian Coastal Monitoring project, it supplies data that feeds into numerous Environment Agency functions and their operational and strategic management work, with a specific focus on Flood & Erosion Risk Management.

The Anglian Coastal Monitoring project is divided into five strategic regional frontages, these regions are further subdivided into schemes or 'monitoring cells'. The number of transects and the frequency of surveys within monitoring cells is variable each year depending on budgetary approvals, project works, storm events and coastal partner monitoring requests to the programme. There is no guarantee of work. The *Activity schedule Topography ACM v0-1.xls* to be priced is only a plan of proposed activities over the five years.

1.1 Contract strategy

The Anglian coast has been divided into five regional frontages/Work Packages:

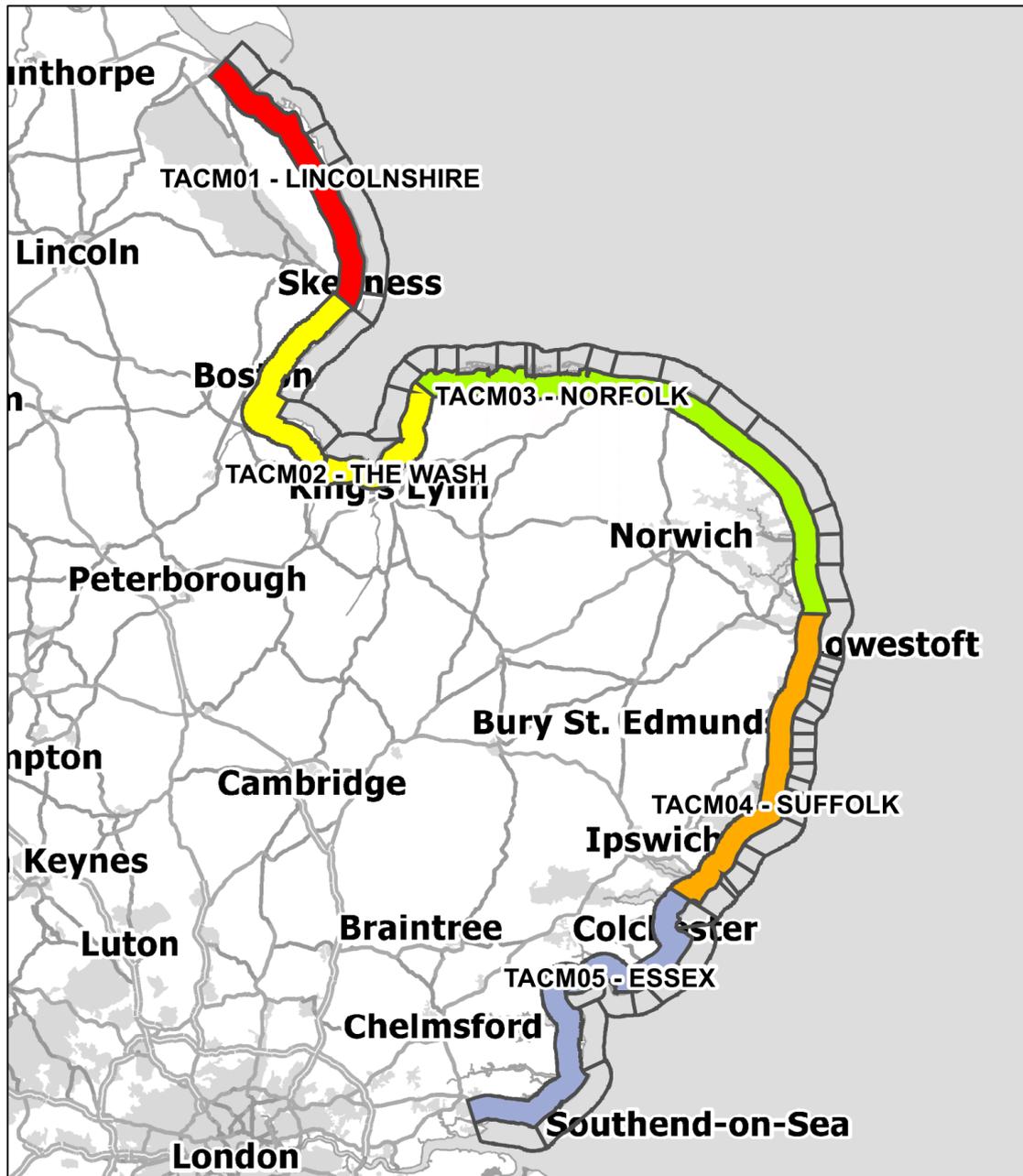
Work Package	Extent	Transects
TACM01	Grimsby to Gibraltar Point (Lincolnshire)	L001 – GP076
TACM02	Wash Banks to North Hunstanton (The Wash)	WB001 – NH045
TACM03	Holme to Lowestoft (Norfolk)	N001 – N123
TACM04	Lowestoft to Languard Point (Suffolk)	S001 – FX115
TACM05	Harwich to Southend on Sea (Essex)	E001 – SE212

Table 1.1: Work packages and extents

Consultants will be appointed on a Work Package basis; however will not be limited to tender for a single Work Package. *Consultants* tendering for multiple Work Packages are requested to provide a price per Work Package and a cumulative price for all Work Packages tendered for. *Consultants* will carry out the topographic surveys on the appointed frontage for the five year contract length. Due to the changing nature of the programme the schedule of work outlined in *Activity schedule Topography ACM v0-1.xls* may vary, including changes to the frequency of coastal surveys, and

additional or reductions in topographic surveys in the schedule. Any additional survey work will be allocated to the *Consultant* responsible for the regional frontage the survey is to be carried out in. If the *Consultant* is not capable of taking on the additional surveys the other contracted *Consultants* will be asked to price for the work. Similarly post event surveys will be allocated to the *Consultant* responsible for a regional frontage. However due to resourcing and the dynamic, unscheduled nature of flood and storm events the *Employer* reserves the right to appoint any contracted *Consultant* to carry out an emergency post event surveys along the Anglian coast.

**Anglian Coastal Monitoring (Phase 9):
Work packages & Monitoring cells**



Key

 Work packages and monitoring cells

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Figure 1.1: Extent of monitoring cells

1.2 Performance monitoring

An annual review will be undertaken by the *Employer* with the *Consultant* to discuss performance, and the following years programme of work. Performance criteria will be agreed with the awarded *consultant(s)*, but are likely to be in the following areas:

- Health and safety
- Unscheduled survey and ensuring value for money
- Adherence to the schedule
- Environmental practices

If the *Consultant* is shown to be failing in his obligations to comply with the terms of the Contract, *Specification* or *Brief*, the *Employer* may exercise his rights under clause 90 of the Conditions of Contract to terminate the contract.

1.3 Quality Assurance

In accordance with *Section I, 13* of the *Specification*, the *Consultant* is responsible for undertaking quality control of the topographic data.

1.4 Health & Safety

The health and safety requirements are that the *Consultant* complies with all statutory requirements in respect of health and safety and:

- follows best practices in respect of all the *Consultants* activities
- has the objective and management processes to work to reduce hazards to people and property
- observes the safety rules of the *Employer* when on Environment Agency owned or controlled sites or premises
- observes all other safety rules and/or best practices related to locations worked at or things being worked on
- will promptly notify the *Employer* of any health and safety hazards or any incident which causes personal injury or damage which may arise in connection with the performance of the Services.

If the *Consultant* has doubt about the extent to which a health and safety matter is the responsibility of the *Consultant*, they shall notify the *Employer* and co-operate to clarify the matter.

The *Employer* shall be empowered to suspend the provision of the Services in the event of non-compliance by the *Consultant* with his legal duties in health and safety matters. The *Consultant* shall not resume provision of the Services or such part until the *Employer* is satisfied that the non-compliance has been rectified.

Equipment and survey personnel provided by the *Consultant* remains the *Consultant's* responsibility at all times. The equipment and survey personnel and any loss, injury or damage suffered or caused by them shall be at the *Consultant's* risk throughout. All risks of data acquisition, including equipment hire will be borne by the *Consultant*.

2. Scope of work & Methodology

2.1 Technical requirements

The technical details given in this section represent the minimum that shall be achieved in terms of data coverage and are based on the assumption of RTK GNSS as the survey method. The *Employer* is committed to continuous improvement. If you consider you can offer any advantage by submission of an alternative method you are encouraged to do so, but it will only be considered if it constitutes a cost effective alternative in accordance with the *Specification*, and providing that the minimum requirements are met.

Details shall be provided in the Method Statement to demonstrate that the *Consultant's* proposed instrumentation and method of survey can fulfil the minimum technical requirements. This should include consideration of the terrain, such as maintaining accuracy during ATV surveys on beach slopes and where wheels may sink into shingle substrate. In addition showing an understanding of the environment is also vital, especially where maintaining a line of sight among surveyors or ensuring a quick withdrawal from the intertidal zone, such as the mudflats of The Wash or Essex where this may be more difficult. The *Consultant* is also encouraged to detail other survey capabilities such as terrestrial LIDAR and laser scanning, even where not applying for Work Package 2.

The Method Statement shall make reference to:

- Health and Safety
- Instrumentation to be used
- Methodology for survey planning, including how to meet seaward boundaries
- Data processing procedures
- Quality control procedures
- Outline programme for achieving survey within given time frame

Continuity in data collection is paramount, especially during handover from the *Employer's* incumbent *Consultant*. The newly appointed *Consultant* will be required to liaise with the *Employer's* Representative and continue surveys according to the programme schedule, carry out any unscheduled surveys and meet project requirements as they arise.

Sufficient ground control shall be established and maintained to meet the requirements of the *Specification (section II)*. Therefore surveys may also consist of establishing new and/or re-establishing any missing or damaged Permanent Ground Markers (PGMs).

2.2 Extent of survey

The start of a transect survey is considered to be a minimum of 20 m from the toe of the landward side of a defence/embankment/first dune from the shoreline or drainage ditch. This point may not be the same as the zero chainage point (ZCP) which may have been established from a PGM brass benchmark plate. The ZCP is maintained as an observation point for all surveys. Measurements will be taken at the crest of a defence feature and either side at the toe. Surveys will be required over Low Water Spring tide periods in order to achieve the required seaward limit of surveys, unless agreed otherwise. Surveys will be programmed to ensure that the required Mean Low Water Spring (MLWS) seaward limit can be achieved. In areas of The Wash (Work package 2) tidal windows and

terrain may not allow for the seaward limit to be reached. In these instances the end coordinate may not extend to the MLWS point (see Shapefile *ACM_Topography_2016-2021_v1-0.shp*).

Measurements are taken at 20 m intervals and at all breaks of slope, and any changes in geology, sediment type and/or habitat type along the transect. Great care must be taken in the surveying of hard sea defences such that the true profile is identified as closely as possible. Transects can be surveyed in sections *e.g.* a cliff top and then the lower beach section, however the transect length must be surveyed within one tidal window.

Survey transect lines have been defined at 50 metre intervals along the Anglian coastline. The historic minimum level of topographic monitoring is surveys of 'strategic' transects spaced at 1 km intervals throughout the five regional sections. The transects within each monitoring cell to be surveyed, along with the start and end co-ordinates and bearings to be priced are detailed in the GIS Shapefile *ACM_Topography_2016-2021_v1-0.shp*. The GIS lines show historic achieved survey extents and so can be used as indicative lengths. The *Consultant* should achieve the landward start point shown, however work to the MLWS as the survey end extent.

References to coastal transect intervals describes the spacing from the previous transect, whether part of that monitoring cell or a strategic 1 km transect line.

2.3 Survey timing and schedule

Topographic surveys occur during Low Water Spring tide times in order to achieve the required seaward extent, unless agreed otherwise.

There are two main seasonal campaigns of survey, in the Winter (January to March) and in the Summer (June to September). In addition, some transects are surveyed quarterly and include Spring (April to May) and/or Autumn (October to November) surveys.

A baseline survey of the coast is required in year 1 of the contract (winter 2016-17) (see *ACM_Topography_baseline_2016-2017_v1-0.shp*). This is a re-observation of the baseline survey carried out in 2011-12, the survey data of which can be supplied to the *Consultant*. The baseline survey consists of additional transects at 50 m intervals on sand and shingle beaches (these additional transects do not include areas of saltmarsh or cliff tops).

2.4 Post event recording surveys

Post-storm surveys will be conducted following storm events of a defined severity or on request from project partners. For post-storm surveys, it is expected that the survey will be timed to be undertaken around Low Water, but the seaward boundary is defined as "as far seaward as can be surveyed safely". Other specifications may exceptionally be relaxed according to weather conditions at the site following mobilisation; the *Employer* will agree these in advance.

Post flood topographical surveys are used to produce a flood outline map and levels at the extent of the flood outline and at any obvious wrack marks within the outlines. The *Consultant* shall provide two man survey teams (as required) to establish debris lines and witnessed levels as well as threshold levels of flooded properties and beach transects surveys.

A photographic record must be undertaken as stated in the *Specification* and in addition photographs capturing the general flooded area, or visible storm damage/impact should be taken.

The *Consultant's* survey team is required to mobilise to site within 24 hours of request by the *Employer*. The *Consultant* will be notified of any hostile sites or access complications (where known). All personnel must pay due consideration to the site conditions and have lifejackets and throw lines

available. The *Consultant* must provide an emergency contact number for each team visiting a site. The *Consultant* will detail in the method statement how to deliver the routine survey programme in addition to proposals for unscheduled post event mobilisation and surveying. The *Consultant* is required to price a day rate for a two man team.

2.5 Survey control

Surveys will be conducted using the control supplied. Locations of the control stations and description sheets will be supplied to the *Consultant* on award of contract. Additional control may be added at the surveyor's convenience or as required for new survey sites.

An Environment Agency E1 High Order Station Control Network is in place (at a 10 km maximum spacing) around the Anglian coastline utilising many existing permanent ground markers (PGMs). RTK base station sites will be surveyed to E2 standards.

If E1 High Order Station Control is required for any PGMs it must be established using the Ordnance Survey Active Network. A new Profile marker reference sheet and a new E1 GPS description sheet must be completed.

If E2 Intermediate Grade Station Control is required for any PGMs it must be established using only the E1 High Order Station Control Network. A new Profile marker reference sheet and a new E2 GPS description sheet must be completed.

A witness diagram produced with a sketch of the control station with at least three tie dimensions shown, a photograph of the control station, Easting, Northing and Elevation (ODN) to three decimal places, ETRS89 co-ordinates, logging duration, and E1/E2 control stations used to establish the new station is to be provided with any new Profile marker description sheet.

Any survey marks used to identify the first point to be surveyed on each transect will be maintained; these will be surveyed on the occasion of each survey and used to check the results of the survey. The type of markers to be used shall be approved by the *Employer*. However due to the improved coverage of the OS Network the establishment of E1 stations is unlikely.

The above must be carried out in accordance with the *Specification*.

2.6 Spot height and ATV surveys

Managed beaches, especially nourished sites are surveyed with quad bikes (or suitable alternative ATV vehicles) to collect continuous spot height measures across an area to produce a digital terrain model (DTM), from which profiles can be extracted and the data can be integrated with other datasets such as laser scanning and LiDAR surveys. Where the use of vehicles is restricted, or not appropriate the survey is to be carried out on foot (as detailed in *Activity schedule Topography ACM v1-0.xls*).

Spot height (baseline) surveys will generate sufficient data to enable contours to be plotted at an interval of 0.25 m. Spot heights along all alongshore lines will be surveyed at a point spacing not exceeding 5 m and including all features of beach topography. Alongshore lines will be surveyed at a maximum cross-shore spacing of 5 m (plus breaks of slope), following the features alongshore. Maximum cross-shore spacing of the alongshore lines may be increased to 10 m, plus breaks of slope, when the seaward boundary lies between 50 – 100 m seaward of the toe of a shingle beach, or more than 50 m onto the low tide terrace of a sand beach. At a distance of 100 m from the beach toe/low tide terrace, shore parallel lines may be spaced at 20 m, plus breaks of slope. At a distance of 200 m from the beach toe/low tide terrace, shore parallel lines may be spaced at 50 m, plus

breaks of slope, until the seaward boundary is reached. ATV surveys are in accordance with *Section VIII* of the *Specification*.

2.7 Laser scanning

Laser scans of cliff frontages may be requested. The only scheduled survey to date is a survey of Hunstanton cliffs in 2017 as part of Work Package 2. Laser scanning surveys are in accordance with *Section III, 8.0* of the *Specification*.

2.8 Feature codes (substrate codes)

Each measured data point is tagged with a Feature Code which represents the sediment/substrate surface type. The only permissible Feature Codes are given in the table below. "X" should only be used for sediment mixtures which cannot be described by GS, MS or GM.

In instances where a PGM, coded as P1, has been lost or destroyed a new P2 point is identified. The marker is on occasion coincidental with the ZCP, in which case the Profile marker identifier is detailed in the output survey data.

Code	Surface coverage
B	Boulder
CE	Cliff edge
CF	Cliff face
CT	Cliff top
D	Dune
DV	Dune, vegetated
F	Forested (may be planted old dune)
FB	Obstruction (foreign body interfacing with surface)
G	Gravel
GM	Gravel and mud
GR	Grass
GS	Gravel and sand
HW	High Water Mark
M	Mud
MS	Mud and sand
P1	Marker point
P2	Marker point
PP	Photo point
R	Rock (bedrock and solid geology not including placed material)
S	Sand
SD	Sea defence (including rock armour, concrete, embankment)
SM	Vegetated saltmarsh
W	Water body
X	Mixture – all material
ZCP	Zero Chainage Point (zero coordinates)
NR	No record

Table 2.1: Substrate feature codes

2.9 Photography

During the summer survey campaign, photographs will be taken using a digital camera at every transect line. A photograph is taken from the seaward end of the transect facing landwards along the length of the transect line. A second photograph is taken at the landward end of the transect facing seawards along the length of the transect. A third photograph is taken roughly perpendicular to the transect line, and offset by approximately 10 m, usually facing north with the sea on the right. The photo should be taken so as to give an indication of the obvious sea defence profile, such as seawall, promenade, cliff or embankment feature.

The point at which the photo is taken should be positioned by GNSS and projected on to the transect line and identified in the data text file as Eastings and Northings only (the height should be that of the profile NOT the photo-point). It should be identified with a PP (Photo-Point) as the substrate code. For each photograph there should be a record made of grid reference, direction of view, date and time.

2.10 Data formats

Text files have a file name based on the transect ID, survey date and survey technique, separated by an underscore, in the following format. There are no spaces in the file name.

Transect ID_YYYYMMDD_Survey technique

e.g. L001_20141201_To.txt or MB121_19921201_To.txt

Where the first one or two letters identifies the monitoring cell. The following three digits are the transect number.

YYYY is the year, MM is the month and DD is the day of survey.

Transect surveys and profiles are derived from various survey methods. The following surveys identifiers are used at the end of the file name:

Survey identifier	Survey technique
To	Topographic survey
ATV	An ATV or walked GNSS survey of spot heights or grid survey
LS	Profile extracted from laser Scan survey
Co	Profile comprised of a combination of survey data

Table 2.2: File name survey identifiers

File names of profiles that have been integrated with other survey data will retain the topographic survey date, or the first day of a representative month can be used.

Data files shall be tab-delimited text files, with the file extension *.txt*. Data is case sensitive and the Transect ID and substrate code are always written in capital letters. There is no variation in the header lines, such as in date formatting. Chainage will be negative at observations landwards of the ZCP point, and positive along the transects after the ZCP.

Example survey file content:

Transect ID reference

Date of Survey DD/MM/YYYY

Type of coordinates

Datum

Bearing of line

Number of records in file

Chainage | Easting | Northing | Level | Feature code

Chainage | Easting | Northing | Level | Feature code

An example topographic survey file is included in Appendix 1.2

Photography image files have the following naming convention:

Photo taken from the transects end point looking up the beach from the shoreline:

Transect ID-From Sea-DDMMYY

e.g. *L001-From Sea-011214.jpg* or *MB121-From Sea-011292.jpg*

Photo taken from the transect defence toe looking down the beach towards the sea:

Transect ID-From Land-DDMMYY

e.g. *L001-From Land-011214.jpg* or *MB121-From Land-011292.jpg*

Photo of the defence/backstop taken looking across the transect:

Transect ID-Sea Defence-DDMMYY

e.g. *L001- Sea Defence -011214.jpg* or *MB121- Sea Defence -011292.jpg*

Where the first one or two letters identifies a coastal frontage monitoring cell. The following three digits are the transect number. *From Sea*, *From Land* or *Sea Defence* is the photo view. *DD* is the day, *MM* is the month and *YY* is the year of survey.

2.11 Metadata

The following metadata shall be supplied with the data files. A template metadata spread sheet will be supplied by the *Employer*. Only one metadata form is required per set of surveys, providing the information is appropriate for all survey files submitted.

METADATA FORM FOR TOPOGRAPHIC SURVEY		
General Information		
Survey Instrumentation Manufacturer & Type		
Survey Instrumentation Model		
Quality Information		
Estimated accuracy of dataset (m)	positional +/-	
	elevational +/-	
Explanation of accuracy estimate		
Name of survey report:		*.pdf
Metadata Information		

Data has been collected by	Company
Comments:	

Metadata of any post processing including integration of survey datasets is to be appropriately recorded.

2.12 Reporting

The survey report supplied by the contractor must highlight:

- Extents not reached and the reasons
- The individual profile surveyors identity
- Time of Low Water (GMT)
- Survey control used
- RTK and/or Total station check observations
- The maximum distance between points along the profile
- A completed validation sheet for each scheme (blank versions to be obtained from the Employer's Representative) detailing:
 - o profiles not surveyed and the reason why
 - o extents not achieved and the reason why
 - o data gaps and the reason why
 - o unusual features encountered
 - o ground markers missing

Consultants must identify where PGMs are not at ground level *e.g.* buried or on sawn-off telegraph poles. It is necessary to take a ground level at this location.

Features that cannot be easily identified in the feature code must be detailed and described in the survey report. The *Consultant* may include photos of unidentifiable surface cover, foreign bodies or obstructions on the transect.

2.13 data processing and delivery

Seasonal survey schedules are to be outlined in the *Consultant's* Method Statement and agreed prior to survey commencement. Sites or monitoring cells may be identified by the *Employer* as a priority for survey and data delivery, *Consultants* will be advised of this prior to survey commencement. For non-routine work, dates for delivery will also be agreed in advance of the survey. Processed, quality-controlled survey data shall be delivered within 14 days of completion of the survey monitoring cell.

Software

All software to be used for survey processing will be agreed in advance. The surveyor shall provide details of all software packages and survey equipment to be used in the Method Statement required as part of the tender.

The *Consultant* will check that the survey output data can be read by the Employer's own software bpiTool, a copy of which will be supplied to the *Consultant*.

Data manipulation

Editing of beach data is restricted to removing erroneous spikes, deletion of unwanted points along the profile and removal of isolated spurious position lines.

APPENDIX

1.1 GIS files:

ACM_Topography_2016-2021_v1-0.shp

ACM_Topography_baseline_2016-2017_v1-0.shp

ACM_Topography_spot_2016-2021_v1-0.shp

ACM_Topography_laserscan_2016-2021_v1-0.shp

ACM_Monitoring_cells_2016-2021_v1-0.shp

Please note the following attributes with the *ACM_Topography_2016-2021_v1-0.shp* GIS:

TRANSECTID – Transect ID

STREASTING – Start point Easting coordinate

STRNORTHING – Start point Northing coordinate

ENDEASTING – End point Easting coordinate

ENDNORTHING – End point Northing coordinate

LENGTH_M – Transect length in metres

MON_CELL – Monitoring cell

PROP_FREQ – Proposed annual frequency of survey of transect line

SEASON – Seasonal campaigns transect is to be surveyed

1.2 Example transect survey output file:

L001

15/07/2015

OS National Grid

OD Newlyn

44

48

-2.92|528437.167|411253.724|5.092|G

-2.92|528437.167|411253.724|5.092|SD

-1.64|528438.061|411254.650|5.113|SD

-1.16|528438.394|411254.995|6.901|SD

-0.43|528438.898|411255.517|6.901|SD

-0.08|528439.141|411255.768|5.104|SD

-0.06|528439.156|411255.783|5.103|SD

0.00|528439.198|411255.827|5.102|ZCP

0.38|528439.462|411256.100|5.097|SD

0.43|528439.499|411256.138|4.555|SD

0.98|528439.880|411256.533|4.554|SD
2.92|528441.226|411257.927|3.611|SD
4.84|528442.557|411259.305|2.712|SD
5.02|528442.682|411259.435|2.527|SD
5.91|528443.304|411260.079|2.378|SD
6.03|528443.387|411260.165|2.173|SD
11.80|528447.395|411264.315|1.170|SD
11.92|528447.479|411264.402|1.025|SD
12.20|528447.671|411264.601|0.962|SD
12.76|528448.060|411265.004|0.647|PP
13.13|528448.317|411265.270|0.519|SD
13.13|528448.317|411265.270|0.519|GS
14.71|528449.417|411266.409|0.361|PP
16.39|528450.581|411267.614|0.193|GS
16.39|528450.581|411267.614|0.193|GM
19.30|528452.602|411269.708|0.036|GM
25.05|528456.597|411273.845|-0.121|GM
29.90|528459.965|411277.332|-0.242|GM
35.00|528463.513|411281.006|-0.359|GM
35.00|528463.513|411281.006|-0.359|MS
39.10|528466.358|411283.952|-0.466|PP
44.02|528469.775|411287.491|-0.511|MS
44.67|528470.228|411287.959|-0.503|MS
49.51|528473.590|411291.441|-0.580|MS
54.59|528477.118|411295.095|-0.694|MS
61.63|528482.013|411300.163|-0.851|MS
69.97|528487.804|411306.160|-1.003|MS
78.43|528493.677|411312.242|-1.179|MS
86.52|528499.299|411318.064|-1.338|MS
95.85|528505.781|411324.776|-1.480|MS
103.97|528511.424|411330.619|-1.605|MS
110.92|528516.252|411335.618|-1.713|MS
119.91|528522.496|411342.085|-1.848|MS
128.77|528528.647|411348.455|-1.947|MS
139.32|528535.975|411356.042|-2.133|MS
145.90|528540.552|411360.782|-2.238|MS
152.79|528545.335|411365.735|-2.318|MS
160.47|528550.669|411371.259|-2.434|MS