Order Form / Work Package Order

FROM

Authority	Natural England
Address	Foss House, Kings Pool, 1-2 Peasholme Green, York YO1 7PX
Contact Ref:	[redacted] Phone: 0208 [redacted] Mobile: 07770 [redacted] Email: [redacted]@naturalengland.org.uk
Order Number	TBC
Order Date	18 May 2023

TO

Contractor	HiDef Aerial Surveying Ltd
For attention of:	Name: [redacted] Phone: 01946 [redacted] Email: [redacted]@hidefsurveying.co.uk
Address	Unit 2 Dobies Business Park Lillyhall Workington Cumbria CA14 4HX

1. SERVICES REQUIREMENTS

(1.1) Services [and deliverables] required:

The service required is provision of all aspects of digital aerial survey (including suitably qualified surveyors, appropriate digital camera equipment, and survey aircraft designed for offshore work over long durations), digital data processing, Quality Assurance and reporting to meet the requirements and objectives of the survey work, as detailed in this specification.

There are four **core objectives** for this contract. These are to:

a) conduct **three** high precision digital aerial surveys of the **Berwick to St. Mary's MCZ plus adjoining areas of potential importance to eiders eg areas of intertidal habitat above Mean High Water and so technically just outside the MCZ boundary, plus areas within the Lindisfarne SPA. The surveys should be scheduled to occur towards the end of each of May, June and July 2023.** Survey data are to be collected using digital video or still imagery at a suitable resolution (typically at least 2 cm Ground Sample Distance (GSD)) to confidently capture and identify to the lowest

taxonomic/age/sex level possible all birds (in flight and on the water) and marine mammals within the survey area;

b) process imagery to identify **all** birds, marine mammals, and other objects of interest captured to the lowest taxonomic/age/sex level possible;

c) Quality Assure results so that pre-agreed data standards are met (e.g. to meet MEDIN standards or equivalent for archival in marine data repositories such as the Marine Data Exchange);

d) produce ArcGIS layers, associated metadata, accompanying .csv files etc. and a brief report detailing survey effort and observations for the surveys within pre-agreed timeframes following completion of the final survey.

There is no requirement to analyse data to produce e.g. abundance estimates or density maps – the contract is solely for data collection, image analyses and provision of data, imagery and associated files to required standards.

Methods

The successful Contractor will need to develop an appropriate survey design to meet the project aims and objectives outlined above.

Requirements

To enable successful delivery, the successful Contractor is expected to:

- Plan the survey design and submit these plans at tendering stage.
- Demonstrate that the survey design/coverage will allow robust population abundance and distribution estimates to be derived from the survey data (after this project).
- Conduct the surveys, including organisation and positioning of aircraft, crew and equipment and ensuring that all health and safety requirements, including Covid-19 requirements, are met.
- Give as much advance warning of planned survey dates and times to the nominated project officer to allow timely mobilisation of land-based volunteer counters to conduct simultaneous or near-simultaneous shore-based counts of the key species.
- Submit a one-page summary report following each of the surveys within 4 weeks of completion of each one.
- Process the acquired imagery.
- Quality Assure results so that pre-agreed data standards are met (e.g. to meet MEDIN standards or equivalent for archival in marine data repositories such as the Marine Data Exchange). Note, that by the time this project is completed it is likely that Marine Scotland's *Digital Aerial Survey Data Standard Guidance Document,* which is currently in preparation (ABPmer in prep), will have been finalised and published. This guidance document is not currently available but will set out details of the data and metadata requirements needed for MEDIN compliance when reporting on digital aerial surveys and will provide templates for the provision of all necessary information in a standard

format. It is likely that the successful framework contractor will be required to provide data and metadata relating to the surveys conducted under this project in accordance with this guidance, once finalised.

- Submit ESRI ArcGIS 10.2 compatible shapefiles (clean of any topology errors) and .csv files showing survey effort (e.g. aircraft tracks and altitude) and observations of birds, marine mammals and other objects of interest, including data fields and metadata to pre-agreed standard (see above). These to be submitted to pre-agreed public repository with accompanying metadata, within pre-agreed period following the final survey. Point and polygon data should be supplied.
- Submit a brief technical report in Microsoft Word format following completion of the final survey and processing of imagery from all surveys, detailing pertinent survey information including: detailed description of, and rationale for, survey methods and design, maps of survey route and coverage; details of surveys as actually flown (dates, time, weather conditions, crew, camera set up, etc.); details of data extraction and processing and associated challenges or limitations (e.g. around species identification). The final report structure and content will be agreed with the nominated officer.
- Submit copies of all survey imagery and above files to The Authority.

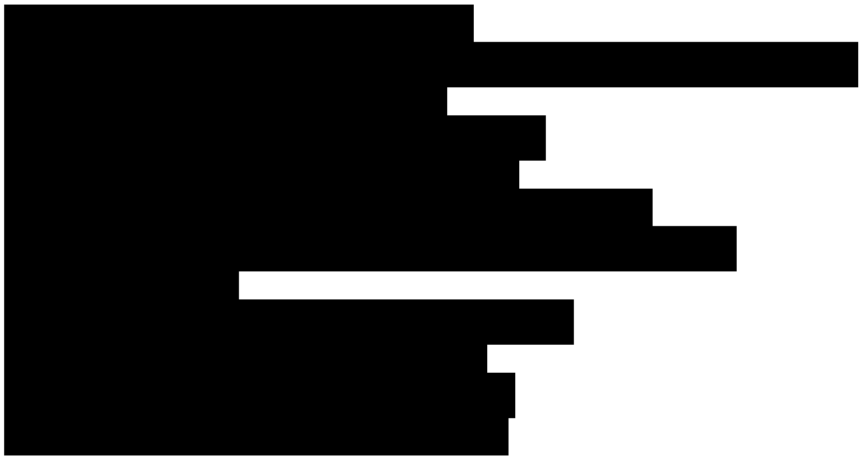
(1.2) Commencement Date: 22 May 2023

(1.2) Completion Date: 30 November 2023

There is the option to extend for up to a further six weeks, subject to availability of funds. To be confirmed by issue of a Contract Change Note (CCN). Any work undertaken after 30 11 2023 will be at Supplier's risk until a CCN is offered and accepted.

2. PERFORMANCE OF THE SERVICES [AND DELIVERABLES]

(2.1) Key Personnel of the Contractor to be involved in the Supply of the Services



(2.2) Performance Standards

Project deliverables

- Digital copies of all the georectified original survey photographs – please indicate available formats.
- A copy of the camera calibration report for the surveys.
- Quality assured datasets of validated and geo-referenced observations (for all species/species groups/other objects of interest recorded) – so that pre-agreed data standards are met (e.g. to meet MEDIN standards or equivalent for archival in marine data repositories such as the Marine Data Exchange) (see guidance at https://medin.org.uk/) and/or compliance with Marine Scotland's *Digital Aerial Survey Data Standard Guidance Document* (ABPmer in prep) (once finalised);
- ESRI ArcGIS 10.2 compatible shapefiles with attached metadata and clean of any typology errors and .csv files showing survey effort (e.g. aircraft tracks and altitude) together with log of conditions (sea state, visibility, cloud cover, glare, precipitation etc) during each survey.
- ESRI ArcGIS 10.2 compatible shapefiles with attached metadata and clean of any typology errors and .csv files showing observations of birds, marine mammals and other objects of interest on each survey, including data fields and metadata to pre-agreed standard. Point and polygon data should be supplied. All datafiles to be submitted to pre-agreed public repository within pre-agreed period following completion of the final survey.
- Raw data files providing details of all the objects observed within each sample frame and subsequent identification. For each object detected, data fields to include, as a minimum, georeferenced position, date, time, number of individuals, assignment to identity (bird species and age/sex or broader category), confidence level in that categorisation, whether in flight or on the water surface and direction of travel. The locations of any objects such as vessels that might influence observed bird distributions should also be recorded within these data files.
- A one-page summary report following each of the surveys within 4 weeks of completion of each one
- A brief technical report in Microsoft Word format detailing pertinent information regarding survey flights (dates, time, weather, crew, camera set up, etc.) and image processing. (Report does not need to contain any descriptive or analytical statistics or modelling).

All data provided must comply with Natural England metadata standards and GIS formats as outlined at Annex 1 and should additionally be in European Seabirds at Sea (ESAS) compatible format (European Seabirds At Sea (ices.dk)) (Format - ESAS (ices.dk)).

HiDef, E01, Methodology

1.1 Understanding of the Scope of Work

Natural England is seeking a contractor to repeat and conduct up to **three** high resolution / definition digital aerial survey of the Berwick to St. Mary's Marine Conservation Zone following a previously commissioned survey in March 2023, using the most up to date digital aerial imagery methods. The resulting imagery is to be processed to provide a comprehensive digital dataset from which robust estimates of the abundance and distribution of birds and marine mammals within the Berwick to St. Mary's MCZ (and some surrounding areas i.e. Lindisfarne Special Protection Area) can be derived.

The survey is scheduled to be carried out towards the end of each of May, June and July 2023. These times will coincide with of common eider (Somateria mollissima) peak "fledging" period, the midpoint of the creching season, and the time when ducklings start to become independent as principle focus of this study. HiDef agrees that a survey effort conducted in late May/June is appropriate to capture the presence of ducklings. HiDef provide a proposal for a survey design based on a power analysis that should allow the estimation of eider abundance (with associated confidence intervals) within the entire Berwick to St Mary's MCZ. Furthermore, the proposed design includes coverage within the adjacent Lindisfarne SPA.

1.2 HiDef Digital Aerial Survey design

HiDef's approach to survey design has been presented to NE through the framework process.

HiDef typically conduct strip transect surveys tailored to study areas to ensure sufficient survey coverage by varying the number and spacing of transects flown and by altering the number of cameras it processes. The number of transects for a site such as this is dictated by ensuring a minimum level of sampling coverage is flown to achieve a defined monitoring objective (see Section 1.6). HiDef uses a survey rig fitted with four separate cameras, each provides data for a 125m strip. All cameras will be used for this survey. HiDef has performed a power analysis to inform the survey design for this study previously (section 1.6) prior to presenting the survey method statement.

1.3 Camera and flight specification

The HiDef rig has been deployed at a large number of offshore surveys since first developed in 2012 and is described in Webb & Nehls (2019). The camera rig is designed specifically for high quality seabird and marine mammal surveys. The rig contains four extreme high- resolution digital video cameras. At ~500-550m altitude, the cameras and lenses each survey a strip of c. 125m, with a Ground Sample Distance image resolution of 2cm, resulting in a total potential strip width of 500m. A gap of c.20m is maintained between the cameras. This has the benefit of ensuring no overlap between strips. Surveys are flown at a ground speed of 220 kph (c.120

knots). These figures have been found to create the best imagery suitable for data collection without negatively impacting on birds from disturbance, but also by flying at a safe and legal height, reducing risk to air crew and client.

1.4 Surveys features

The use of digital video allows our review and identification teams to play and rewind video, highlighting the contrast between sea and target objects and is one of the major advantages of the video technique. HiDef accept all weather risk associated with the delivery of our surveys. The ability to fly in a wide envelope of conditions gives us the opportunity to survey across different sea states and therefore provides a robust picture of the species assemblages that are present under a wider range of meteorological conditions. One of the key reasons why digital video aerial surveys offer higher detection rates is that it is easier to detect objects when there are multiple images of the same object which appear static in footage relative to the patterns of waves. Using digital video means that we typically capture up to eight distinct images of each object identified, from a slightly differing angle in each capture, providing multiple opportunities for successful identification.

1.5 Video review and identification

Once data have been delivered to the HiDef offices, the raw video data are converted into a format for further analysis on data review stations. The survey images are viewed by trained, experienced HiDef reviewers using high resolution viewing screens and an image management software package that allows the reviewer to adjust and control the appearance of the images. Reviewers are not required to identify objects but simply mark the images as requiring further analysis, with this spatial information providing an accurate record of an individual's (or object's) location. A sample of a minimum of 20% of material is subjected to a 'blind' re-review; if the agreement is less than 90% then a further review of the material, and re-training, is initiated as required.

Images that have been marked as requiring further analysis are passed to experienced marine ornithologists who have received training in the analysis of high-definition video imagery of birds, marine mammals and other vertebrates. Images can be managed using software to enhance their appearance and assist in identifying the object. For this project, the ornithologists will identify down to species level where possible and record any other information which is available (behaviour, flight or swimming direction, sex, age, etc.). For any marine mammals identified, their behaviour is also recorded, whether they occur at the surface or subsurface, and their direction of movement between the first and last frame in which they occur.

A randomly selected sample of at least 20% of material is identified independently by a separate group of expert ornithologists and this requires that there is no more than 10% disagreement with the first identification of birds and mammals. The outputs of these results are then compared, and any discrepancies reviewed by a further set of expert ornithologists. In the case of any significant discrepancies (i.e.,

more than 10% disagreement for the whole audit), then the images are re- reviewed by a third ornithologist who acts as an adjudicator in the process to decide on the correct observations.

HiDef surveys provide an average identification rate of >95%, including difficult to differentiate species such as the auk family and diver species. Our seabird ID rates are not affected by sea conditions and wind speeds above Beaufort 3. Four factors contribute to HiDef's high identification rates:

- A commitment to producing the highest possible image quality from our surveys;
- The use of cameras angled from vertical;
- The availability of multiple images of each animal; and
- The employment of the best seabird and marine mammal survey experts.

Table 1 Identification rates of major bird and marine mammal taxa to species during recent HiDef digital aerial surveys.

	Summer '19		Autumn '19		Early winter '19		Late winter '20	
	May – Jul		Aug – Oct		Nov – Jan		Feb – Apr	
Taxon	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
All auks	20675	97%	58875	95%	18431	90%	27783	91%
Cormorant / shag	43	95%	76	95%	169	91%	476	98%
Diver species	45	96%	73	89%	616	94%	1293	97%
Duck species	119	100%	919	99%	13510	99%	18715	100%
All gulls	5195	96%	10216	95%	13841	93%	11201	95%
Large auk	19611	98%	57625	96%	17762	91%	26840	92%
Large gull species	3315	96%	3420	94%	5032	92%	2898	95%
Small gull species	1800	98%	6419	98%	7655	94%	7759	96%

1.6 Power Analysis to inform Survey Design

Power analysis has been undertaken to inform the amount of survey effort required to detect changes in population abundance of eider with a particular probability (e.g.0.8). Power analysis has focussed on eider as the target species; power to detect population changes for other species will be different. To conduct power analysis, information on the density (and associated CV) of eider within the area of interest is required to explore the total survey effort required, number of transects, and spacing to achieve the required monitoring objective. HiDef have found that the generic target CV ≤16% (Thaxter and Burton, 20091) to detect a halving or doubling of the population as the benchmark for designing surveys is not always upheld; such large population changes are often detectable with higher CVs, particularly when the number of surveys and period over which to detect the change is increased. HiDef consider that given the survey is cover an MCZ and include SPAs, that it would be desirable to detect smaller changes in population abundance.

A search for available survey datasets within the region of interest shown there to be none; in lieu of baseline data to inform design, an analysis of previous HiDef surveys

similar in scope was undertaken to better understand the power of the different survey designs to detect changes in eider abundance. We identified two suitable HiDef digital aerial surveys that were flown in March and in regions known to be populated by eider:

A search for available survey datasets within the region of interest shown there to be none; in lieu of baseline data to inform design, an analysis of previous HiDef surveys similar in scope was undertaken to better understand the power of the different survey designs to detect changes in eider abundance. We identified two suitable HiDef digital aerial surveys that were flown in March and in regions known to be populated by eider:

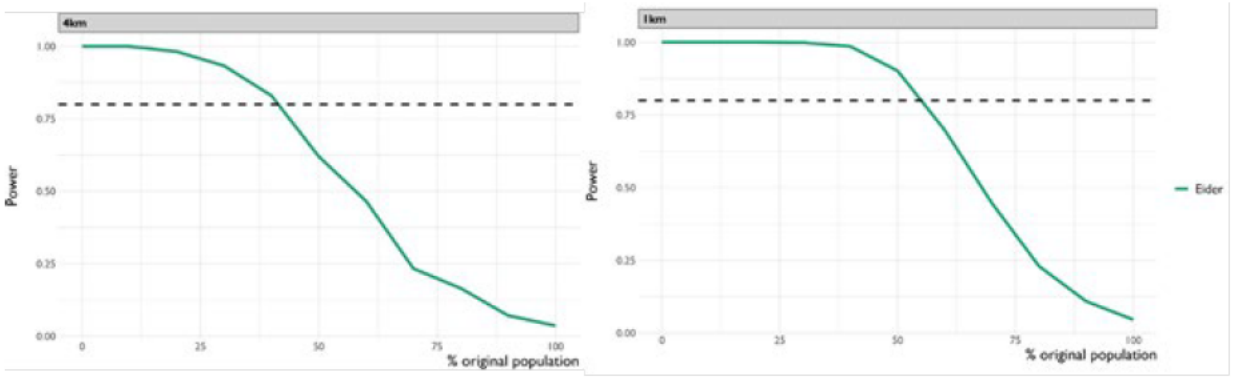
- Moray Firth – 8thMarch 2020 with transects spaced at 4km intervals, ~17% coverage of site of 299km^2
- Belfast Bay – 28th March 2022 with transects spaced at 1km intervals, ~50% coverage of site of 544km^2

The Moray Firth survey gave an estimated total population of 3,316 eider with 1.86 (n/km²) density, and CV of 39.9%. The Belfast Bay survey, with shorter transect spacing, gave a CV of 20.2% with an estimated population of 1,419 eider or 2.58 (n/km²) density. A power analysis was undertaken on these two surveys to test their statistical power to detect changes in abundance from one survey to the next, and thereby provide some context for which to inform the survey design of this proposal.

The results suggest that the survey design undertaken for the Moray Firth survey (4km transect spacing) would require around a 60% decline in eider before an 80% power of detection is reached (Figure 1a), while the 1km transect spacing at the Belfast Bay site would require a 45% decline to reach an 80% power of detection (Figure 1b). Halving of eider abundance could be detected with ~62% and ~88% power for the Moray Firth and Belfast Bay respectively. This analysis suggests that the shorter transect spacing and thereby greater survey coverage gives a greater statistical power to detect change.

[11] Thaxter, C.B. & Burton, N.H.K. (2009) High-Definition Imagery for Surveying Seabirds and Marine Mammals: A Review of Recent Trials and Development of Protocols. British Trust for Ornithology Report Commissioned by Cowrie Ltd.

Figure 1 – Power analysis of (a) Moray Firth survey flown in March 2020 given a 4km transect separation design, and of (b) Belfast Bay survey flown in March 2022 given a 1km transect separation design, as examples of expected statistical power to detect changes in eider abundance



Shorter transect spacings, inherently result in more transects flown and consequently increased survey costs. Therefore, it is important to consider that the proposed survey design will be the basis of a longer-term monitoring programme, where changes in the population abundance are to be detected within a 5-year period and not from one survey to the next. The longer the period of time over which changes are to be detected, the better the power is. Smaller changes are also more readily detected over the course of multiple surveys. Again, using the Moray Firth and Belfast data, analyses were conducted using the powertrend function in R statistical programming language to demonstrate this point (Table 2); over a 5- year period, there is 80% power to detect a 36% population decline in eider based on the 4km survey design which is an improvement on the need to detect changes from one survey to the next (i.e.60%). Similarly, population declines less than 20% over a 5-year period could be detected based on the 1km survey design at Belfast Bay. Increasing survey frequency further improves the power to detect even smaller changes in population abundance (12% and 6% over 5 years for Moray Firth and Belfast Bay, respectively) (Table 2). The power to detect a range of population change (increase or decrease) with changing surveying frequency is more fully explored in

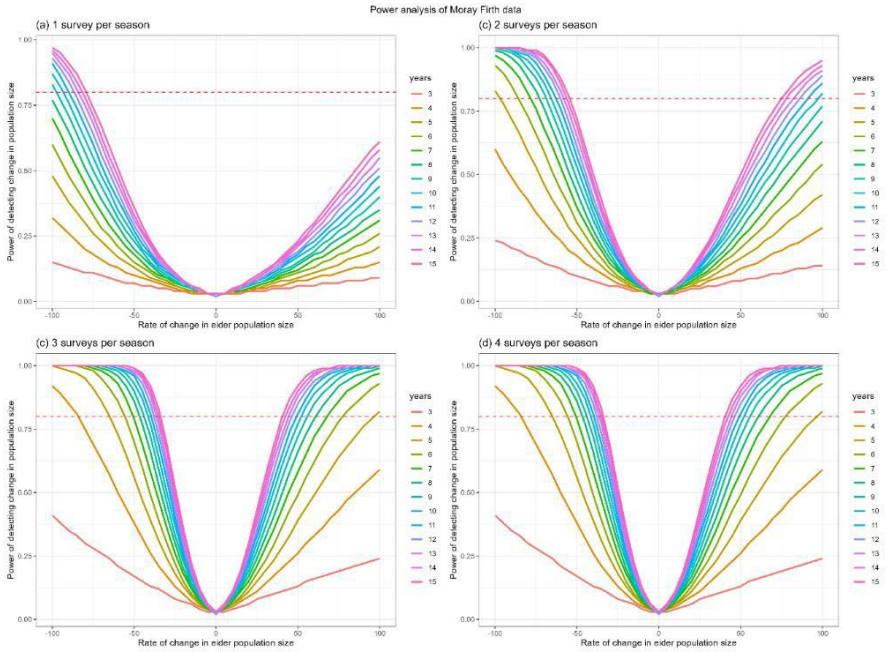
Figure **2**a & b.

Table 2 - Minimum declines in eider abundance that can be detected with 80% power and annual/biannual non-breeding season surveys over a 5 year period based on CVs achieved on eider duck estimates from surveys in the Moray Firth and Belfast Bay spacing.

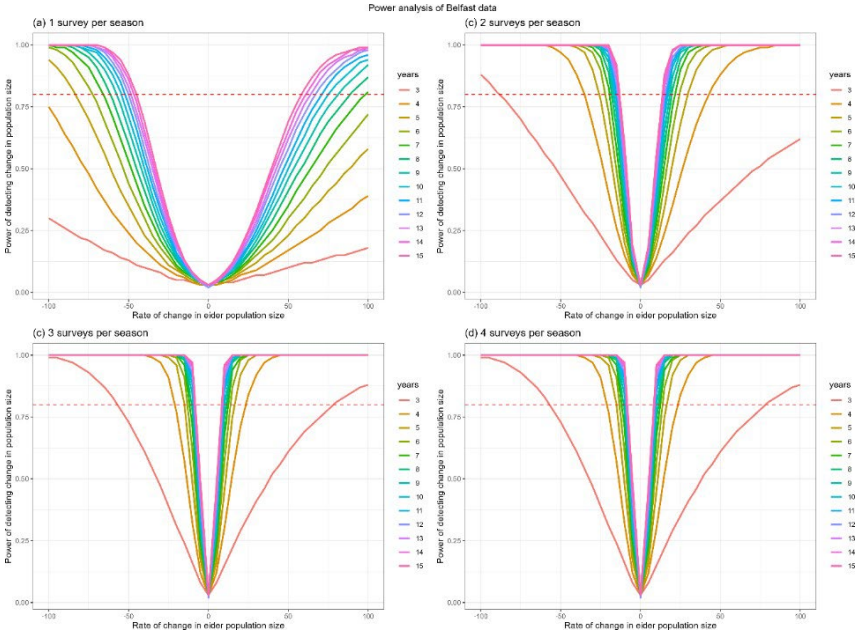
Area	Transect spacing (km)	CV	Number of surveys	Rate of decline per year (%)	Total decline over 5 years (%)
Moray Firth	4	0.4	5	8.5	36
			10	2.6	12
Belfast Bay	1	0.2	5	3.8	18
			10	1.3	6

Figure 2 The power to detect a range of population change (increase or decrease) with changing surveying frequency based on a) Moray Firth and b) Belfast Bay eider survey data.

a) Moray Firth



b) Belfast Bay



These analyses are only indicative of potential power of a survey design at the Berwick – St. Mary's MCZ if eider occur in comparable densities (estimated with similar CVs) as to the datasets we have explored. Significantly different densities and distribution of eider in the MCZ would give rise to different power. Power analyses of the two datasets available to us demonstrate that higher coverage (more transects) and more frequent surveys will likely improve power to detect smaller changes in eider abundance, but this will come at significant cost. Consequently, HiDef advise that a compromise in transect spacing of 2km is used for the repeated survey but that the survey design be re-evaluated using power analysis after this survey is completed and data available. If densities of eider in the MCZ bear no resemblance to those used in our power analyses here, then the design may be insufficient to achieve the agreed monitoring objective. HiDef would welcome discussion with regards to the monitoring objective of any future surveys.

1.7 Proposed Survey Design

Surveys need to be conducted on a single day because of risk of movement of birds through or within the site. This is considerably more likely to occur between days than within days, and the further apart those days are, the more likely that the survey results will be compromised. For example, birds might move from one side of the project area to the other and thus result in double counting. The survey proposed is achievable with a single aircraft.

HiDef will also aim to conduct the survey over periods of +/- 2 hours around the time of high water.

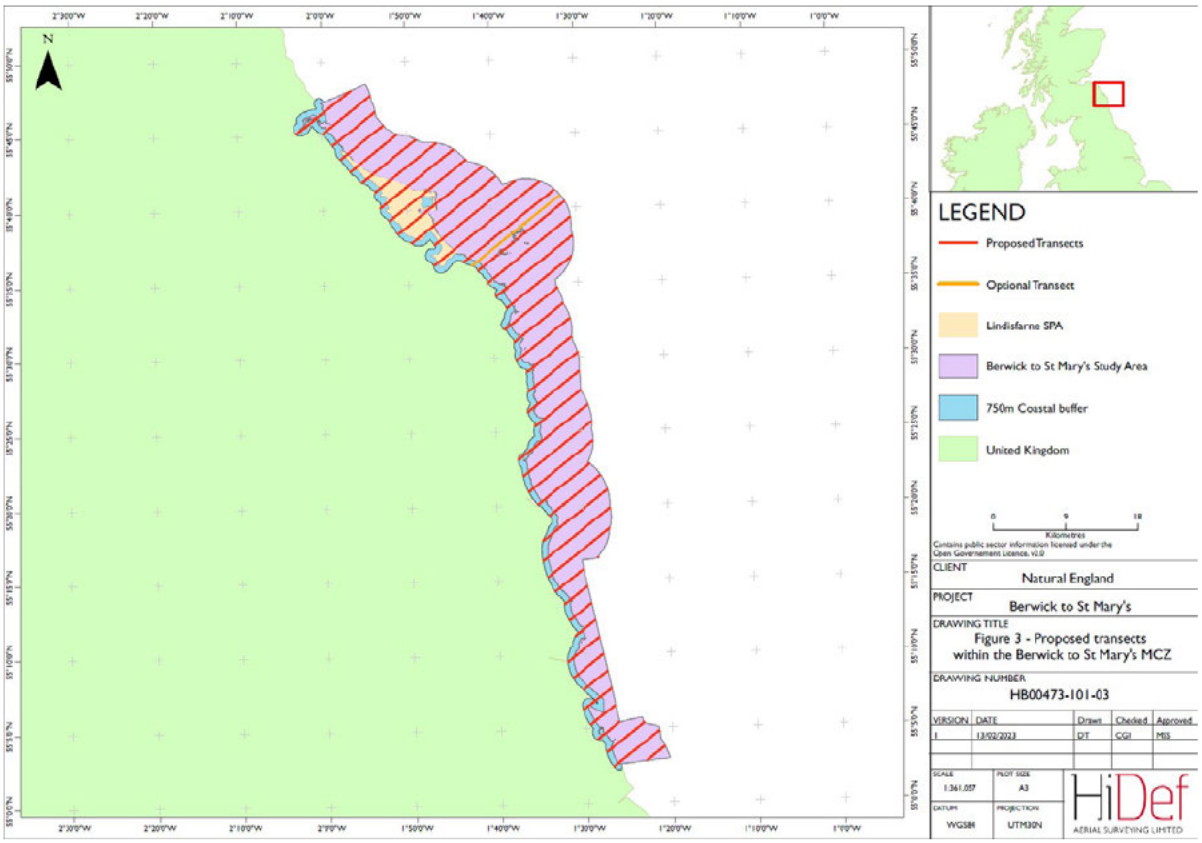
The proposed survey is a systematic line transect with a random start point that achieves ~25% coverage of the survey area (Table 3). Transects are placed 2km apart and the proposal is for all 4 cameras to be processed. Consideration has been given to choosing a transect set and additional optional transect that ensures surveys in close proximity to Coquet Island and the Farne Islands. An further extension of coverage that includes the 750m landward up shore boundary of the MCZ/Lindisfarne SPA is incorporated into the design. As such HiDef can confirm this follows the previously commissioned digital aerial survey of the MCZ exactly (March 2023).

Shapefiles have been provided by the client, demonstrating the extents of the area. Operational restrictions have been covered in E03 and this would capture potential issues with RAF Boulmer, Newcastle Airport and other air traffic users.

Table 3 Survey metrics for Berwick to St Mary's Repeated survey effort

Site	Coverage %	Cameras processed	Transect spacing	No. of transects	Time on Task	Survey area (km²)
Berwick to St Mary's 750m inshore buffer, 2km Transects + Optional transect	25.17	4	2km	46	4.0 hrs	670km²

Figure 3 Repeat survey design, 2km spaced transects of Berwick to St Mary's site



1.8 Milestones and Deliverables

Milestone	Date
Digital Aerial Survey	
First survey by contractor	22nd – 31st of May 2023
Second survey by contractor	21st – 30th June 2023
Third survey by contractor	22nd – 31st July 2023
Conclusion of survey programme	31st July 2023
Project management & Meetings	
Teleconference to discuss conduct of 1st survey	By mid-June 2023
Teleconference to discuss conduct of 2nd survey	By mid-July 2023
Teleconference to discuss conduct of 3rd survey	By mid-August 2023
Reporting & Data Provision	
Supply one-page QHSE summary survey report	Within 7 days post survey
Completion of image processing, QA etc and production of output files relating to all surveys	End October 2023
Brief technical report detailing survey design, effort etc and observations for the surveys.	30th November 2023
Submission of ArcGIS layers, other associated datasets, metadata and imagery to agreed standards	30th November 2023

(2.3) Location(s) at which Services are to be provided: The Berwick to St. Mary's MCZ and adjoining areas including Lindisfarne SPA.

(2.4) Standards: Reporting to pre-agreed standards, see below Annex 1

(2.5) Contract Monitoring Arrangements: Regular catch up/ progress calls between the contract managers acting on behalf of the Authority and the Contractor **in addition to the inception meeting and teleconferences scheduled in the table of Milestones**. Proposed schedule of additional catch-up calls should ensure at least monthly communication between the contract managers acting on behalf of the Authority and the Contractor.

3. PRICE AND PAYMENTS

(3.1) Contract Price payable by the Authority excluding VAT, payment profile and method of payment (e.g. BACS))

£70,462.50 to undertake three surveys.

Hi Def confirmed costs:

3 complete surveys

Total project cost (exclusive of VAT):	**£70,462.50**
VAT	**£14,092.50**
Total project cost (inclusive of VAT):	**£84,555**

Number of complete surveys: 3

Breakdown of total costs (exclusive of VAT):

Item	**Daily staff rates (where applicable)**	**Number of staff days (where applicable)**	**Total staff costs (where applicable)**	**Other associated costs**	**Total value**
Survey/project planning	£		£	£	£ incl.
Hire/operation of aircraft (excluding fuel costs)	£		£	£	[redacted]
Fuel costs	n/a	n/a	n/a	n/a	[redacted]

Flying hours required (in transit to and from survey area) per survey	n/a	n/a	n/a	n/a	[redacted]
Flying hours required (on survey) per survey	n/a	n/a	n/a	n/a	[redacted]
Litres of fuel per flying hour	n/a	n/a	n/a	n/a	[redacted]
Fuel cost per litre, on date tender submitted	n/a	n/a	n/a	n/a	[redacted]
Image Analysis	£		£	£	[redacted]
QA of imagery/data/results so that pre-agreed data formats and standards (e.g.MEDIN compliance) are adhered to	£		£	£	£ incl.
Reporting (including provision of all associated deliverables)	£		£	£	[redacted]
Any other cost element not listed above (please specify and provide a cost for each additional item separately)	£		£	£	£ N/A

(3.2) Invoicing and Payment

Payment of 50% of the total contract value will be made on receipt of a detailed invoice following completion (to the satisfaction of the Natural England Nominated Officer) of the final survey and submission of three one-page summary survey reports (one to be completed after each survey).

Payment of the balance of the total contract value (remaining 50%) will be made on receipt of a second invoice following completion (to the satisfaction of the Natural England Nominated Officer) of all the milestones detailed above, and formal acceptance of the specified outputs

4. INVOICING REQUIREMENTS

HiDef Aerial Surveying Limited to quote Natural England purchase order number (TBC) and Atamis reference number C17482 in their invoice.

Invoice should be emailed to Accounts-Payable.neg@sscl.gse.gov.uk or posted to:
Shared Services Connected Limited
Natural England
PO Box 793
Newport
NP10 8FZ

BY APPROVING THIS ORDER FORM, THE CONTRACTOR AGREES to enter a legally binding contract with the Authority to provide to the Authority the Services specified in this Order Form, incorporating the rights and obligations in the Call-Off Contract that are set out in the Framework Agreement entered into by the Contractor and the Authority on 27th July 2022.

Electronic Signature

Acceptance of the award of this Contract will be made by electronic signature carried out in accordance with the 1999 EU Directive 99/93 (Community framework for electronic signatures) and the uk Electronic Communications Act 2000. Acceptance of the offer comprised in this Contract must be made within 7 days and the Agreement is formed on the date on which the Contractor communicates acceptance on the Authority's electronic contract management system ("Atamis"). No other form of acknowledgement will be accepted.

Signed for and on behalf of the **Supplier**	Signed for and on behalf of the **Authority**
[redacted]	[redacted]

ANNEX 1

Natural England data requirements

This Annex provides high level guidance for contractors regarding Metadata and Geographic Information System deliverables. Final details of requirements for this project, with reference to section 5 of the Specification, will be agreed with the Nominated Officer.

Natural England reserve the right to check the quality of all digital data and reserve the right to return any data that does not meet these compliance requirements. If any part of this guidance is unclear, please make early contact with the Natural England Nominated Officer who will be able to provide clarification in consultation with data management colleagues.

Metadata

A generic MEDIN compliant discovery metadata record should be completed for the project outputs as a whole and for each GIS layer generated. By generating MEDIN compliant metadata, Natural England gain required compliance with both INSPIRE Directive and UK GEMINI 2.1 metadata requirements, while using term list vocabularies fit for marine purposes. There are a variety of mechanisms for generating MEDIN compliant metadata available at the following link along with a full description of the MEDIN standard, XML encoding, and guidance documentation: https://www.medin.org.uk/medin-discovery-metadata-standard. Metadata derived as part of this project must be submitted to Natural England in an XML file which Natural England will archive through Data Archive Centres (DACs). Guidance 'MEDIN Guidance for Contractors' can be provided to the winning contractor.

Beyond the discovery metadata requirement, it is essential that the final GI datasets are accompanied by a detailed 'readme.doc' describing the file structure within submitted outputs, and clearly outlining file associations (e.g. layer files for colours/ fill patterns).

Geographic Information data - format for deliverables

GIS products should be compatible with ArcGIS Desktop 10.2. Data will be supplied as a series of Feature classes in a File geodatabase (.gdb) to an attribute structure to be agreed between the contractor and Natural England on commencement of the contract. One or more ArcMap Document files (.mxd) must be provided to pull out data into distinct layers based on its attribution and these will apply appropriate layer styling.

Data in the Feature classes of File geodatabases will be supplied using the following coordinate system parameters:

Attribute	**Value**
Geographic Coordinate System	GCS_WGS_1984

Datum	D_WGS_1984
Prime Meridian	Greenwich
Angular Unit	Degree

For the purposes of this project ArcMap document files (.mxd) are to display WGS84 data projected from requested feature classes in Lambert Azimuthal Equal Area projection based on ETRS 1989, using an appropriate (eg Petroleum EPSG) transformation between WGS 1984 and ETRS 1989.