Natural England

Fal and Helford SAC
GIS Habitats Mapping - Report

June 2013

NATURAL ENGLAND

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FAL AND HELFORD SAC GIS HABITATS MAPPING REPORT

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This project has been undertaken in accordance with PAA policies and procedures on quality assurance.

Signed:_____

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1. INTRODUCTION

1.1 Penny Anderson Associates Ltd (PAA) was commissioned by Natural England in March 2013 to undertake an extensive habitats mapping exercise using Geographic Information Systems (GIS) for the Fal and Helford Special Area of Conservation (SAC) in south Cornwall, UK.

1.2 The Fal and Helford SAC was identified as a candidate SAC in 1996 and subsequently designated in 2005, under the Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora, for the following Annex 1 (Habitats Directive) habitats interest features:

- Large shallow inlets and bays
- Sandbanks which are slightly covered by sea water all the time (subtidal)
- Mudflats and sandflats not covered by sea water at low tide (intertidal)
- Atlantic salt meadows (saltmarsh)

1.3 The following Annex 1 habitats are present in the SAC but were not a primary reason for the site selection:

- Estuaries
- Reefs

1.4 The brief of the project was to extract existing and potential digital spatial data, relevant to the Annex 1 habitats listed above, from a number of surveys, studies and reports carried out within the SAC boundary over the last 40 years. The extracted data was then used to create a standard habitats dataset, which can be amended, extended and updated as required and used to inform conservation, planning and management of the SAC in the future.

1.5 This report provides a detailed overview to the methods used during the project (Section 2), a full description of the project outputs (Section 3) and some observations made from the data and recommendations for future work (Section 4).

2. METHODOLOGIES

Introduction

2.1 The project was divided into five phases which ran consecutively through the course of the project, as follows:

- **Reports Assessment** - An initial assessment of each report was provided by Natural England, which gave an overview of the report in respect of its use and suitability for this project, the relevant habitat features covered and the current format of spatial data present within the report (ranging from tables of survey points to existing GIS data). This overview document is included in Appendix I. Each report was examined and assessed, confirming the presence and current state of spatial data, assessing the suitability of the data for inclusion in the project, searching for any extra potential data that may have been omitted from Natural England's initial assessment, and detailing the degree of effort required to convert the data to a useable format. A literature search was also carried out for other reports additional to those provided by Natural England. A brief summary of each report is provided in Appendix II.

- **GIS Data Extraction** - The data was extracted from each report in turn and digitized (if required), to create a series of raw GIS datasets. A full description of the source report was added to each record. A summary of the methods used for the data extraction is provided below (paragraph 2.7 onwards).

- **Habitat Classification** - On completion of the GIS data extraction phase, each data record was assigned with Annex 1 habitat features and sub-features (as defined by Natural England, see Table 1), if the record and source report contained enough information to do so. Fields were added to each dataset detailing information on the classification decision making process and a standardised description of the quality of the data with specific relation to the purpose of this study. A summary of methods used for the data analysis is provided below (2.13).

- **Creation of Habitats Polygon Dataset** - The classified report data was then used to create a single habitat layer, classified by Annex 1 features and sub-features. Source information was added to each individual polygon. Decisions on classification of a particular area were carried out on a case-by-case basis, taking into account the scale, age, positional accuracy, collection methods and reliability of each data source, and the presence of other nearby data conflicting with or confirming the habitat classification. A detailed summary of methods and examples of the decision making process are described in paragraph 2.20 onwards

- **Construction of Habitats Map** - The completed data was loaded into an ArcGIS 9.3 map document and structured to enable easy viewing and updating of the habitat polygon layer, with the raw data and classified records also included for comparison and checking purposes. Section 3 contains a detailed description of the habitats map and datasets, together with a set of basic user instructions.

2.2 Each of the above are now described in detail.

Reports Assessment

2.3 The reports assessment stage was initiated to provide effective preparation for the efficient and thorough extraction of GIS data from each individual report. The data was to be extracted into a standard GIS format with several standard attribute fields, and this assessment detailed the exact procedures required for each report to achieve this aim. Using the Data Sources document supplied by Natural England as a base, each report was examined and then assessed on the following key features:

- Confirmation of presence of data in GIS format
- Extent and quality of GIS data
- Presence of spatial data tables relevant to SAC habitat features
- Presence of maps relevant to SAC habitat features that can be georeferenced
- Presence of descriptive text relevant to SAC habitat features than can be linked to a spatial data table or geographic coordinates
- Issues relating to the quality and reliability of resulting spatial datasets
- Coordinate System used

2.4 Several data sources listed by Natural England required liaison with the authors/owners of the data for permission to acquire and use their data. Details of data acquisition are provided in Appendix III.

2.5 A brief literature search was then undertaken for data sources not included in the original data sources list provided by Natural England. One report was retrieved from the search (Morley, R., 2012. *Mapping a sample site of eelgrass in the Fal Estuary.* Falmouth Marine School) and has been added into the reports database.

2.6 Notes on each of the individual report have been provided in Appendix II.

GIS Data Extraction

2.7 The data sources analysis notes were used to extract the spatial data within each report into a standard GIS format, and held within an ArcGIS version 9.3 geodatabase, referenced with the WGS 1984 geographic coordinate system. All features of the same geometry (point, line or polygon) were combined to create one dataset of each geometry type per report. The raw GIS datasets were assigned a standard name format, detailing the lead author, the year and the geometry type (for example, Cook_2000_Point).

2.8 Data extraction methods fell loosely into one of four methods. The first method was to export existing GIS datasets (with relevant habitat information) straight into the standard format in the new SAC habitats geodatabase. If necessary, a geographical transformation was performed on the data – frequently this was a transformation between the OSGB 1936 projection and the WGS 1984 geographic coordinate system. A Seven-parameter Position Vector method was used in these circumstances, with the transformation values dx=446.448, dy=-125.157, dz=542.06, rx=0.15, ry=0.247, rz=0.842 and s=-20.1879. For more information on Position Vector transformations, see the online ESRI ArcGIS help resource (http://tinyurl.com/kmge9sj).

2.9 The second method was used when there were tables of geospatial data within the report (i.e. tables that had both habitat information and a defined geographical location). In this situation, point records were extracted into separate X and Y columns, and then exported into a point feature class automatically. Where the data was linear (for example transects), the start and end points of the linear feature were exported and then converted into a linear feature class. The point and linear features were then transformed to the correct coordinate system (WGS 1984), if necessary, using the technique described in paragraph 2.8.

2.10 The third method was used when habitats data occurred in map format, without any corresponding geographical coordinates. In these cases, the map was georeferenced to WGS 1984 coordinate system, and the features shown on the map were then manually digitized. The attribute table of the features were then populated with the corresponding habitat information. The resultant georeferenced raster maps have been included in the dataset and can be viewed in the ArcMap map (.mxd) document that accompanies this report.

2.11 The fourth method was used when habitat information was available within the text of the report, instead of being held within a table. If the text could be definitively linked to a geographical location, then the location (point line or polygon) would first be digitized, and the attribute table would then be populated with the text (or a summary of the text if the original was too long to fit in two text fields). In some cases species names have been shortened to allow a larger amount of information to be held in the habitat text fields. Where this has been carried out by PAA (rather than in the source report), a standard shortening system has been used, based on the standard for the Marine Nature Conservation Review recording forms.

2.12 Following creation of the raw GIS data for each report, information detailing the source report/survey was added to the attribute table in a standard format, showing the authors, year of publication and full name of the report in separate fields. If available, the survey date and method were also added to the table if not already defined.

Habitat Classification

2.13 Each raw GIS dataset has been exported into an analysis dataset, and assigned an Annex 1 habitat feature, and sub-feature(s). To assign the Feature (see paragraph 1.2), the main factor was the position of the record in relation to the surrounding geomorphology, in combination with the defined habitat. Four different features have been categorised – 'Atlantic Salt Meadows', 'Estuaries', 'Large Shallow Inlets and Bays' and 'Reefs' (See Figure 1). For this purpose, The SAC was divided into three regions:

- Estuary (upstream of Turnaware Point on the Fal Estuary, upstream of Helford Point on the Helford River and upstream of on The Priory on the Percuil River);
- Ria (Carrick Roads, Falmouth Bay and the lower Helford River); and,
- Deeper water (anywhere in Falmouth Bay with a depth greater than 20m, see Figure 4).

2.14 It should be noted that sub-tidal sandbanks and intertidal mudflats and sandflats Annex 1 habitat features do occur in this region, but as sub-features within the 'Estuaries' and 'Large Shallow Inlets and Bays' features rather than standalone features.

2.15 Saltmarsh habitats that occur in an Estuary region are classified as 'Atlantic Salt Meadows' features. All other qualifying habitats in the Estuary region are classified as 'Estuaries' features. The remaining qualifying habitats are classified as 'Large Shallow Inlets and Bays', apart from areas of 'Reef' features, occurring on the edge of the SAC boundary in Falmouth Bay.

2.16 The raw GIS data has then been classified by sub-feature, using the defined habitat information. Habitat data generally fall into one of three data types – general habitat descriptions, classified habitat/biotope codes or tabular sediment and/or species lists. During habitat assessment, three key indicators have been used to assist sub-feature classification, as follows:

- Is the habitat in a littoral or sublittoral environment?
- What is the sediment make-up (if defined)?
- Is there a key habitat community present (eelgrass, maerl, saltmarsh or kelp)?

2.17 Where Marine Habitat Classification biotope codes or European Nature Information System (EUNIS) codes have been used, reference was made to The Marine Habitat Classification For Britain and Ireland (Connor *et al* 2004), which contains detailed descriptions of habitats and biotopes including details of sediment, fauna and algae/plant species.

2.18 Following classification of each feature, a brief explanation of the decision was detailed and included within the attribute table of the analysis feature classes, entitled 'comments'. A standardised assessment of the quality of the data for the specific purposes of the mapping exercise has also been provided, detailing the sampling methodology, spatial accuracy and date of survey, as follows:

- Sampling Methodology: Excellent, Very good, Good, Adequate, Poor, Unknown
- Spatial Accuracy: Excellent, Very good, Good, Adequate, Poor, Unknown
- Survey date: Up-to-date (2011-2012), Very recent (2005-2011), Recent (2000-2005), Quite recent (1990-2000), Not recent (pre 1990)

2.19 As specified in the project tender documentation, particular priority was given to the presence of maerl beds during the classification of habitat sub-features. If the habitat information indicated that maerl was present (and the spatial location and reliability of habitat classification was adequate), the sub-feature was defined as a maerl bed community. Where live maerl was present, and an indication of the percentage or live maerl was given, anything lower than 20% cover was not classified as a 'live maerl bed' sub-feature. The ecological significance of less than 20% cover is that at densities lower than this, maerl nodules tend to occur as dispersed individual nodules, rather than interlocked aggregations that could be regarded as parts of a true maerl bed (Hoskin, unpublished 2012).

Creation of Habitats Polygon Dataset

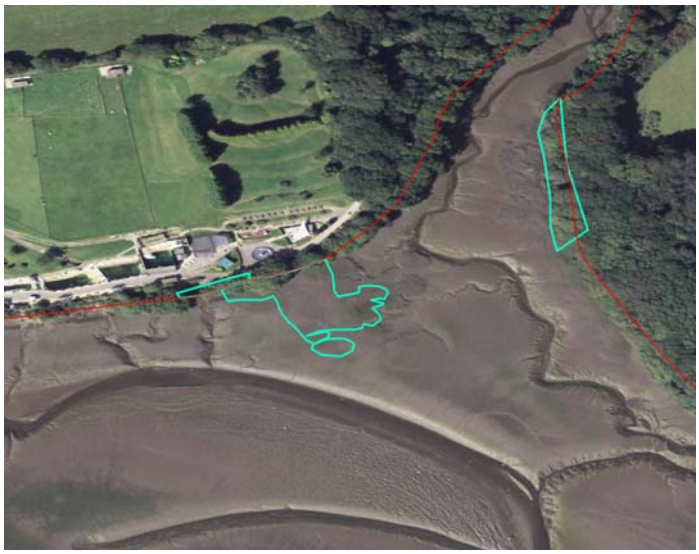
2.20 On completion of the Feature/Sub-feature classification of the raw data, a polygon dataset of the habitat features and sub-features was constructed. All layers were uploaded into an ArcMap document (referenced to WGS 1984 coordinate system), with Ordnance Survey (OS) basemapping, aerial photography (flown summer 2009) and admiralty charts covering the SAC area, and each record was given a specific colour code representing the sub-feature. A polygon dataset was created, and an attribute table was built to house various details about each polygon, namely the Feature and Sub-features, the source information, brief comments on the decision making process, and fields to register future updates.

2.21 The classified raw data was then used as a guide to build the polygon dataset, which was digitized manually to Natural England standards using the OS mapping and aerial photography

as a backdrop. The primary source of each polygon was defined, for example Curtis (2011), along with any sources that confirmed the presence of the classified sub-feature, and also sources that conflicted with the classification (and the conflicting sub-feature category). A comments field contains a brief description of the decision making process and any extra information which may prove useful. In combination, these attributes will enable users of the data to interrogate each polygon, in order to assess the Feature/Sub-feature classification, and to make an informed decision on whether the polygon needs reclassifying, or needs further survey to confirm the presence of the habitat.

2.22 Where necessary (and appropriate), aerial photography, OS basemapping and admiralty data were used to help define the extent of habitats. For example, areas of saltmarsh could be located and their extent defined (often more accurately than the original survey) using the aerial photography as a guide. It should be noted that aerial photography, OS basemapping and admiralty data were not used to define a habitat Feature/Sub-feature without any corresponding source data from one or more of the project reports.

2.23 An example of the decision making process for a polygon feature is as follows:



Primary source defines the areas in green (left) as lower marsh communities. A conflicting source defines the whole area to be intertidal mud/mixed muddy sediment. Aerial photography suggests that there is a saltmarsh community in this location, so the primary source sub-feature category (Atlantic Salt Meadows, lower marsh communities) is used. However, the positioning of the polygon is to west of the saltmarsh habitat, and on the eastern patch the photography suggests the habitat is more extensive than shown.

The habitat polygon is digitized as shown, left. The polygon covers the area shown as yellow cross hatch, and is defined as follows:

Feature: Atlantic salt Meadows,

Sub-Feature: Lower marsh communities

Primary Source: Saltmarsh Mapping Project (Unknown)

Confirm Source: Aerial photography (2009)

Conflicting Source: Curtis (2011) – Intertidal mud/mixed muddy sediment communities

2.24 A brief description of the decision making process is then added to the attribute table.

2.25 On completion of the polygon digitizing, data are checked and corrected for geometrical and typographical anomalies and errors.

Construction of Habitat Map

2.26 The completed polygon layer was then added to an ArcGIS 9.3 map document, and structured in a way that would enable quick and efficient display and interrogation of the polygon dataset and would also meet the specifications detailed in the project tender documents.

2.27 All analysis data and raw data were added to allow further examination of the classification and extent decisions, along with OS basemapping, aerial photography and admiralty data.

2.28 A full description of the layout of the habitats map is given in Section 3.

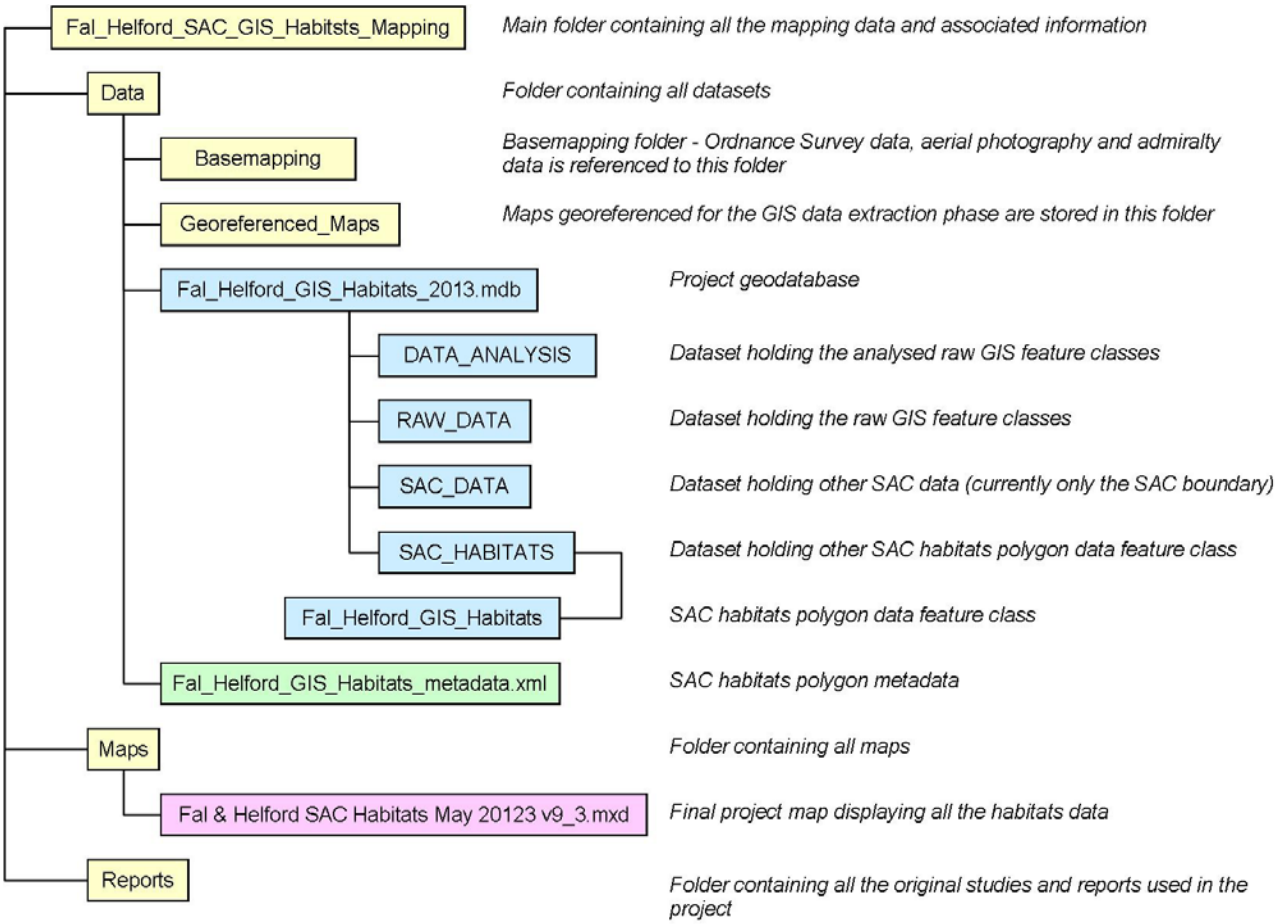
3. PROJECT OUTPUTS

Data and Folder Structure

3.1 The project data and map are stored in a hierarchical folder structure, which can be found on the CD-ROM that accompanies this report. The output is designed to be a standalone product, so that users can copy the complete folder structure to any location and, as long as the positions of each element within the folders is retained, can open and use the map without the need to update the source references from within the document.

3.2 A representation of the folder structure is displayed in Figure 3.1, with a small description of each item. The GIS outputs are stored in an ArcGIS version 9.3 geodatabase. Geodatabases are a secure and organised way of storing GIS data of all types (vector, raster, networks etc), and can also be used to store related non-spatial datasets. Feature classes can be stored in separate datasets (as created for this project), and have a series of defined properties, such as geographic coordinate system and spatial extent. All datasets within the project geodatabase are referenced to WGS1984 geographic coordinate system.

Figure 3.1 Project Folder Structure



Raw GIS Data

3.3 Relevant spatial data was extracted from each report using the methods described above in paragraphs 2.7 - 2.12. Each resultant feature class can be found in the RAW_DATA dataset within the project geodatabase, with the exception of georeferenced maps, which can be found in the Georeferenced_Maps folder. In addition to the data shown from the report, the following fields were added to the attribute table of each feature class:

- 'Report' – The full title of the originating study/report
- 'Year' – Year of publication
- 'Method' – Method of data collection
- 'Surveydate' – Date of data collection (if supplied)
- 'Latitude' and 'Longitude' – X and Y values in decimal degrees detailing sample location

Classified Raw Data

3.4 The classified raw data can be found in the DATA_ANALYSIS dataset within the project geodatabase. The relevant habitat features and sub-features can be found within each feature class attribute table, along with the two additional fields as described in paragraph 2.18 (Comments and Quality).

Habitats Polygon Data

3.5 The habitats polygon data can be found in the SAC_HABITATS dataset within the project geodatabase. The relevant habitat features and sub-features can be found within the feature class attribute table. In addition, the following fields were added to allow users to clearly understand the decision making process during classification (described in paragraph 2.21), and also to allow future changes to the dataset to be logged and accounted for:

- 'Primary_Source' – The report/study that has been used as the primary source for polygon sub-feature classification and/or extent (e.g. Howson (2004))
- 'Confirm_Sources' – Any other reports that confirm the presence of the classified sub-feature for the polygon (e.g. Rostron (1985))
- 'Conflict_Sources' – Any reports that conflict with the sub-feature classification for the polygon, with the habitat detailed by that report (e.g. Curtis (2011) – Estuary, intertidal mixed muddy sediment communities)
- 'Comments' – A brief description of the decision making process for classification of the polygon
- 'Version' – A numerical description of the most recent update for that polygon. All features are currently version '1.0'. This can be updated when future revisions are made to the polygon dataset.

- 'Last_Update' – The date of the most recent update to the particular polygon. All features are currently '30/05/2013'

- 'Recorder' – The name of the person responsible for the most recent update to the polygon. All features are currently 'Chris Chapman (PAA)'

3.6 The polygon dataset accounts for approximately 93% of the SAC boundary. The areas that remain uncategorised are those for which there were no data available or no relevant sub-features attributable. A breakdown of the areas of each of the features and sub-features is detailed in Table 2

3.7 The Annex 1 habitats Features as created during this project can be viewed in Figure 1. The sub-features can be viewed in Figures 2a-2d. The data in these figures has been rendered using the same colouring as can be found in the project map document, discussed in the following section.

Habitats Features GIS Map Document

3.8 The habitats Features map document can be found in the 'Maps' folder within the main project folder accompanying this report. The map is an ESRI ArcGIS version 9.3 map document, and is designed to operate on ArcGIS version 9.3 software, although will automatically update if opened in a newer version of ArcGIS software. The map document has not been tested on earlier versions of the software, so it may open but could have reduced functionality.

3.9 The map document has been designed to allow easy viewing and interrogation of the project datasets. The map document is referenced to the WGS 1984 geographic coordinate system, with units of decimal degrees. The user has full ability to zoom and pan as required, and an overview map is provided to give a spatial context, and to allow the user to quickly locate the position of the main map (when zoomed in) with relation to the complete SAC boundary.

3.10 The habitats polygon feature class has been systematically represented using defined standard colours for each class. The polygon feature class has been organised within the Table of Contents of the map document in a hierarchical structure, enabling the user to choose which features and sub-features to view at any one time, simply by turning on or off the features, found within the 'SAC Features' group in the Table of Contents. This structure has been derived from the specification in the project tender documents, and can be viewed in Table 1.

3.11 A layer representing the full habitats polygon feature class has also been added to allow the user to interrogate and analyse the data without having to disrupt the hierarchical structure detailed above. This layer can be found within the 'Full Habitats Layer' group in the Table of Contents.

3.12 The extracted raw GIS feature classes for each report can be found within the 'Raw GIS Data' group in the Table of Contents. The data for each report can be found in a sub-group labelled with the author and year of the report (e.g. Dyer and Worsfold 1998), and the feature classes have been represented with different colours based on their source report, to enable the user to view multiple raw datasets simultaneously whilst being able to differentiate visually between sources. Any report maps that were georeferenced for the purpose of creating raw GIS data have also been included within the relevant project sub-group.

3.13 The classified raw data is also available to view in the map document, and can be found within the 'Data Analysis & Assessment' group in the Table of Contents. Each dataset has been represented with the colour of the sub-feature, as defined by the habitats polygon dataset. This

enables the user to visually compare data which may conflict or confirm the sub-feature classification of other raw data, or the habitats features polygon dataset.

3.14 Additional mapping data can be found, or loaded into, the 'Basemapping' group, within the Table of Contents. Due to the size of the individual basemapping datasets used for this project, only the admiralty datasets (raster charts and vector bathymetry data) are included with the project data. It is recommended that recent aerial photography and OS Mastermap data be loaded into the map document when interrogating the datasets, as these resources were frequently used during the classification of the raw data and subsequent creation of the habitats polygon feature class.

3.15 GIS polygon data can be analysed and summarised in numerous ways, and the construction and display of the habitats data has been designed to facilitate any future analytical work. Figure 3 is a demonstration of a simple visual summary of the data - choosing to display only two sub-feature groups (live maerl and eelgrass beds) within a defined area of interest. This map could be used, for example, to direct potentially damaging activities away from these relatively fragile and important ecosystems.

4. OBSERVATIONS

Data Coverage

4.1 As specified in paragraph 3.6, the habitats polygon dataset accounts for over 90% of the total area of the SAC. There have been numerous reports and studies undertaken throughout the region, and several studies, such as Curtis 2011, Moore et al 1999, Moore, Smith and Northern 1999 and Davies and Sotheran 1995, have classified the habitats over large portions of the SAC. These studies provided a reliable baseline from which other studies could be used to augment and improve the classification and extent of each polygon.

4.2 Many areas within the SAC have benefited from numerous and/or detailed studies, and these areas are likely to have a greater degree of accuracy in terms of habitat classification than those that have received less attention. Figure 5 displays the complete set of raw data for all sources. It shows areas where the sampling has been more intense, and also where there is a relative lack of data. Areas which may benefit from further studies in order to define their habitat type more accurately are:

- Southern Falmouth Bay, towards Manacle Point, especially the coast around Porthallow
- Falmouth Bay coast between Rosemullion Head and Pennance Point
- Northern Falmouth Bay, area south of Pendennis Point and St. Anthony Head
- Penryn River and Inner Falmouth Docks
- Northern stretch of Carrick Roads

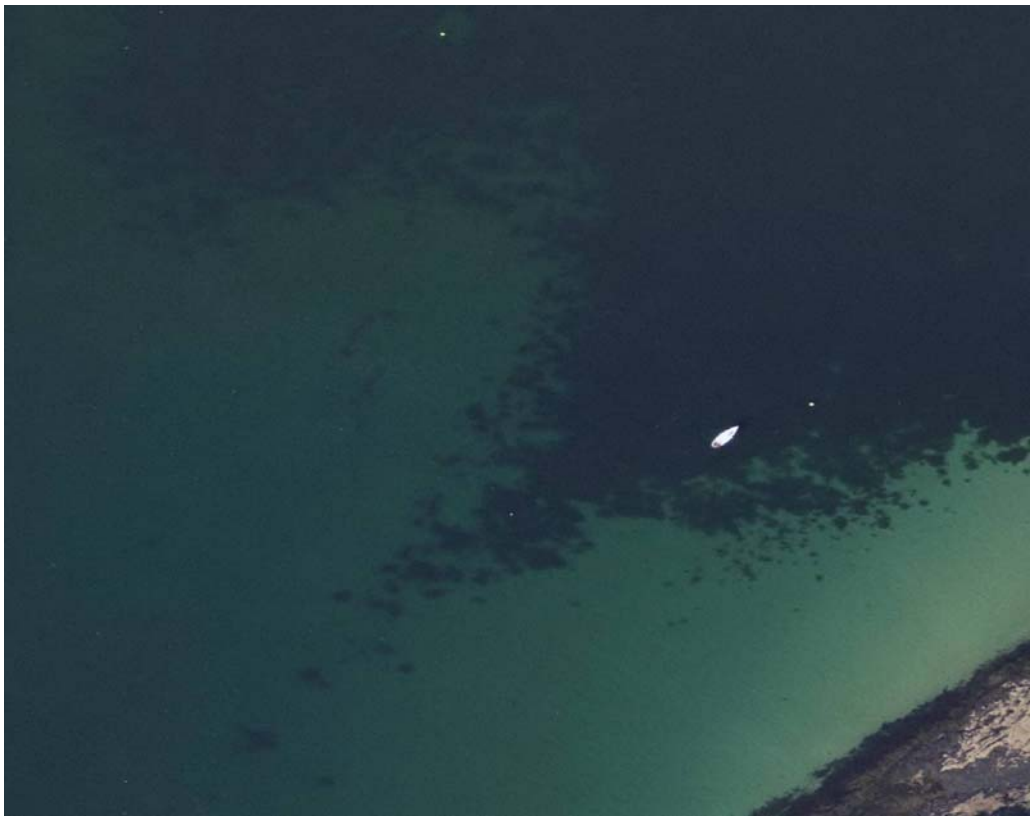
Aerial Photography as a Classification Tool

4.3 The UK perspectives aerial photography data, flown in 2009, proved an extremely useful source of information when confirming and mapping the extent of intertidal habitat communities. Curtis (2011) made excellent use of this resource when carrying out the study into intertidal biotopes and condition assessments of habitats, by pre-classifying aerial photography by habitat, and then using ground control points to confirm and improve the classification system.

4.4 This technique is a fast and reliable method of collecting large areas of habitat data, and could be well used in future studies of the intertidal habitats of the SAC. In addition, during the project, it became clear that in some circumstances (usually sheltered water less than 10m deep) the aerial photography clearly showed changes in sub-tidal habitats. It could, therefore, be possible to carry out a similar study to the intertidal survey carried out by Curtis (2011) but on shallow sub-tidal habitats.

4.5 Recent advances in aerial imagery, especially the use of unmanned aerial vehicles (UAVs), which can be deployed flexibly on a small scale project and provide very high resolution imagery (up to 1cm spatial resolution), would contribute significantly in helping to produce clear imaging data that could be used to this end, though with increased computational overheads. Figure 4.1 illustrates the potential use of aerial imagery, showing a clear boundary between at least two sub-tidal habitats.

Figure 4.1 Aerial Photography Showing Sub-tidal Habitats in St Mawes Harbour



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6. ABBREVIATIONS

EUNIS	European Nature Information System
GIS	Geographic Information Systems
OS	Ordnance Survey
PAA	Penny Anderson Associates Ltd
SAC	Special Area of Conservation
UAVs	Unmanned Aerial Vehicles
WGS	World Geodetic System

TABLES

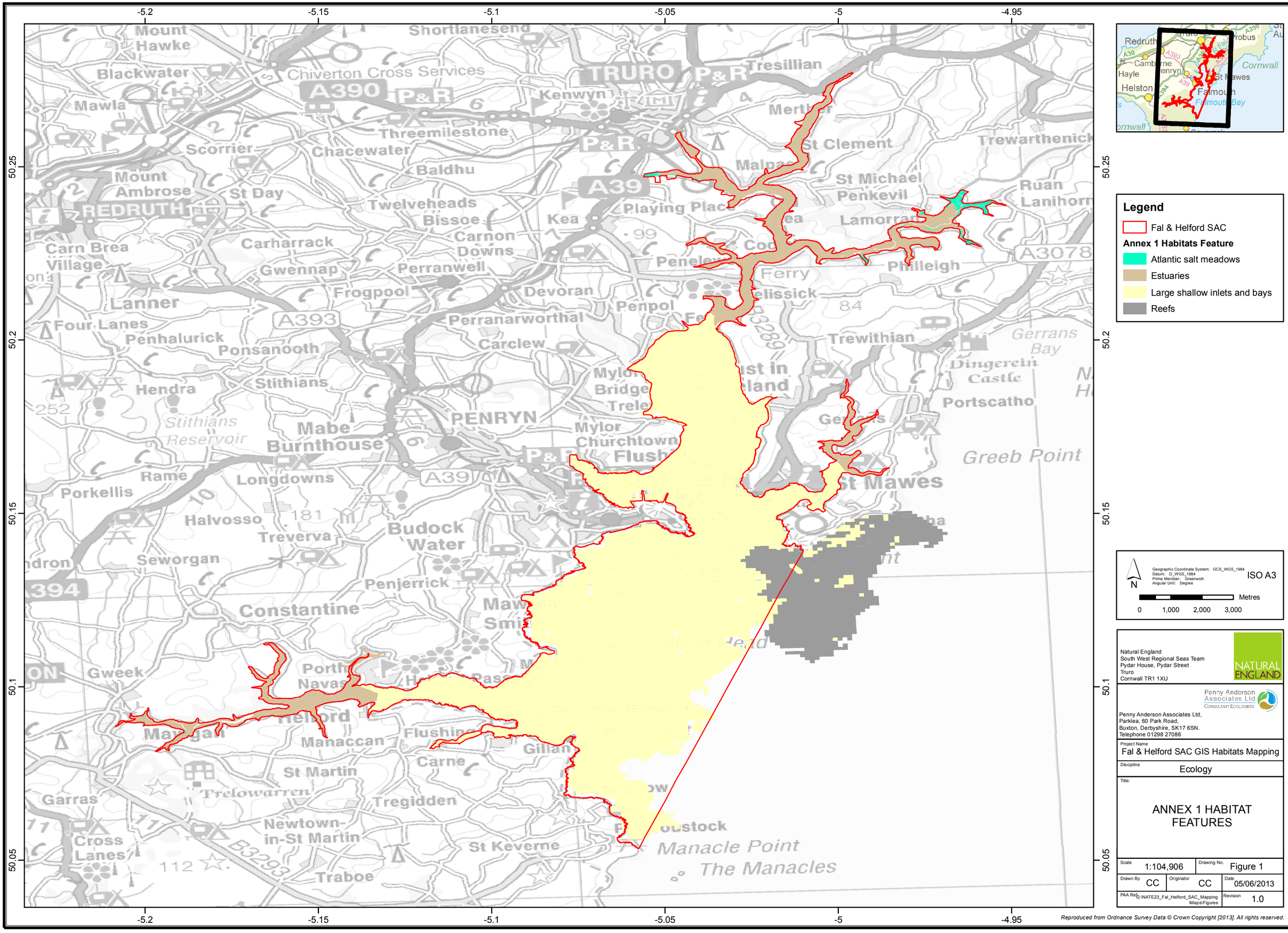
Table 1 Annex 1 Features and Sub-features of the Fal and Helford SAC

Feature	Sub-feature 1	Sub-feature 2	Sub-feature 3	Sub-feature 4
Atlantic Salt Meadows	Low marsh communities			
	Mid-marsh communities			
	Upper marsh communities			
	Uncategorised			
Estuaries	Estuarine bedrock, boulder and cobble communities			
	Intertidal mud communities and intertidal mixed muddy sediment communities			
	Sub-tidal mixed muddy sediments			
	Sub-tidal sandbank communities/sandbanks which are slightly covered by seawater all the time	Eelgrass bed communities		
		Gravel and sand communities		
		Maerl bed communities	Dead maerl	Dead maerl bed
				Dead maerl bed with live maerl covering
				Other substratum with dead maerl covering
			Live maerl	Live maerl bed
				Other substratum with live maerl covering
			Uncategorised	
		Mixed sediment communities		
		Uncategorised		
Large shallow inlets and bays	Atlantic salt meadows	Low marsh communities		
		Mid-marsh communities		
		Upper marsh communities		
		Uncategorised		
	Intertidal mudflat and sandflat communities/mudflats and sandflats not covered by seawater at low tide	Mud communities		
		Muddy sand communities		
		Sand and gravel communities		
		Uncategorised		
	Kelp forest communities			
	Rocky shore communities			
	Sub-tidal mud communities			
	Sub-tidal rock and boulder communities			
	Sub-tidal sandbank communities/sandbanks which are slightly covered by seawater all the time	Eelgrass bed communities		
		Gravel and sand communities		
		Maerl bed communities	Dead maerl	Dead maerl bed
				Dead maerl bed with live maerl covering
				Other substratum with dead maerl covering
			Live maerl	Live maerl bed
				Other substratum with live maerl covering
			Uncategorised	
		Mixed sediment communities		
		Uncategorised		
Reefs	Estuarine bedrock, boulder and cobble communities			
	Kelp forest communities			
	Rocky shore communities			
	Sub-tidal rock and boulder communities			

Table 2 Annex 1 Features and Sub-Features - Areas

Feature	Area m2	% of SAC
Atlantic Salt Meadows	**377838.2**	**0.61**
Low marsh communities	47999.1	0.08
Mid-marsh communities	11551.1	0.02
Upper marsh communities	318288	0.51
Uncategorisec	0	0.00
Estuaries	**7670370.1**	**12.41**
Estuarine bedrock, boulder and cobble communities	527025.8	0.85
Intertidal mud communities and intertidal mixed muddy sediment communities	5054179.6	8.17
Sub-tidal mixed muddy sediments	1502827.5	2.43
Sub-tidal sandbank communities/sandbanks which are slightly covered by seawater all the time	586337.2	0.95
Eelgrass bed communities	21276	0.03
Gravel and sand communities	3162.2	0.01
Maerl bed communities	34340.9	0.06
Dead maerl	0	0.00
Dead maerl bed	0	0.00
Dead maerl bed with live maerl covering	0	0.00
Other substratum with dead maerl covering	0	0.00
Live maerl	34340.9	0.06
Live maerl bed	0	0.00
Other substratum with live maerl covering	34340.9	0.06
Uncategorised	0	0.00
Mixed sediment communities	527558.1	0.85
Uncategorised	0	0.00
Large Shallow Inlets and Bays	**48037844.6**	**77.70**
Atlantic salt meadows	0	0.00
Low marsh communities	0	0.00
Mid-marsh communities	0	0.00
Upper marsh communities	0	0.00
Uncategorised	0	0.00
Intertidal mudflat and sandflat communities/mudflats and sandflats not covered by seawater at low t	581072.8	0.94
Mud communities	246053.8	0.40
Muddy sand communities	191338.6	0.31
Sand and gravel communities	143680.3	0.23
Uncategorised	0	0.00
Kelp forest communities	1756793.7	2.84
Rocky shore communities	717832.1	1.16
Sub-tidal mud communities	2722617.8	4.40
Sub-tidal rock and boulder communities	13313073.2	21.53
Sub-tidal sandbank communities/sandbanks which are slightly covered by seawater all the time	28946455	46.82
Eelgrass bed communities	653448.6	1.06
Gravel and sand communities	6061114.1	9.80
Maerl bed communities	14007239.4	22.66
Dead maerl	12398688	20.05
Dead maerl bed	8787060.3	14.21
Dead maerl bed with live maerl covering	2042542.8	3.30
Other substratum with dead maerl covering	1569084.8	2.54
Live maerl	1608551.4	2.60
Live maerl bed	1234479.7	2.00
Other substratum with live maerl covering	374071.7	0.61
Uncategorised	0	0.00
Mixed sediment communities	8224653	13.30
Uncategorised	0	0.00
Reefs	**1117495.8**	**1.81**
Estuarine bedrock, boulder and cobble communities	0	0.00
Kelp forest communities	7223.2	0.01
Rocky shore communities	0	0.00
Sub-tidal rock and boulder communities	1110272.7	1.80

FIGURES



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Project Name: Fal & Helford SAC GIS Habitats Mapping

Discipline: Ecology

Title:

ANNEX 1 HABITAT FEATURES

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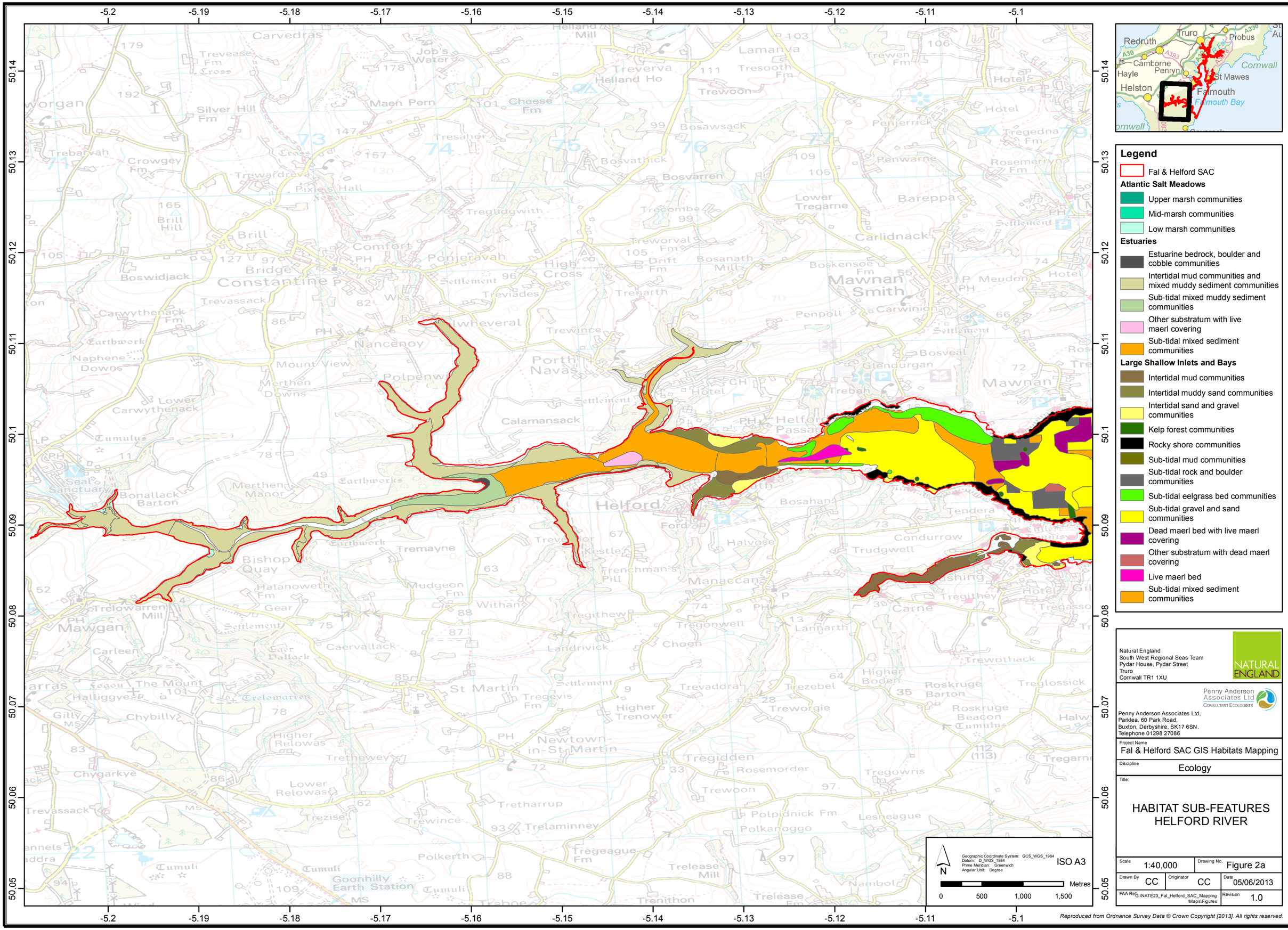

Legend

- Fal & Helford SAC

Atlantic Salt Meadows

- Upper marsh communities
- Mid-marsh communities
- Low marsh communities

Estuaries

- Estuarine bedrock, boulder and cobble communities
- Intertidal mud communities and mixed muddy sediment communities
- Sub-tidal mixed muddy sediment communities
- Other substratum with live maerl covering
- Sub-tidal mixed sediment communities

Large Shallow Inlets and Bays

- Intertidal mud communities
- Intertidal muddy sand communities
- Intertidal sand and gravel communities
- Kelp forest communities
- Rocky shore communities
- Sub-tidal mud communities
- Sub-tidal rock and boulder communities
- Sub-tidal eelgrass bed communities
- Sub-tidal gravel and sand communities
- Dead maerl bed with live maerl covering
- Other substratum with dead maerl covering
- Live maerl bed
- Sub-tidal mixed sediment communities

N

Geographic Coordinate System: GCS_WGS_1984
Datum: D_WGS_1984
Prime Meridian: Greenwich
Angular Unit: Degree

ISO A3

0 500 1,000 1,500 Metres

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HABITAT SUB-FEATURES HELFORD RIVER

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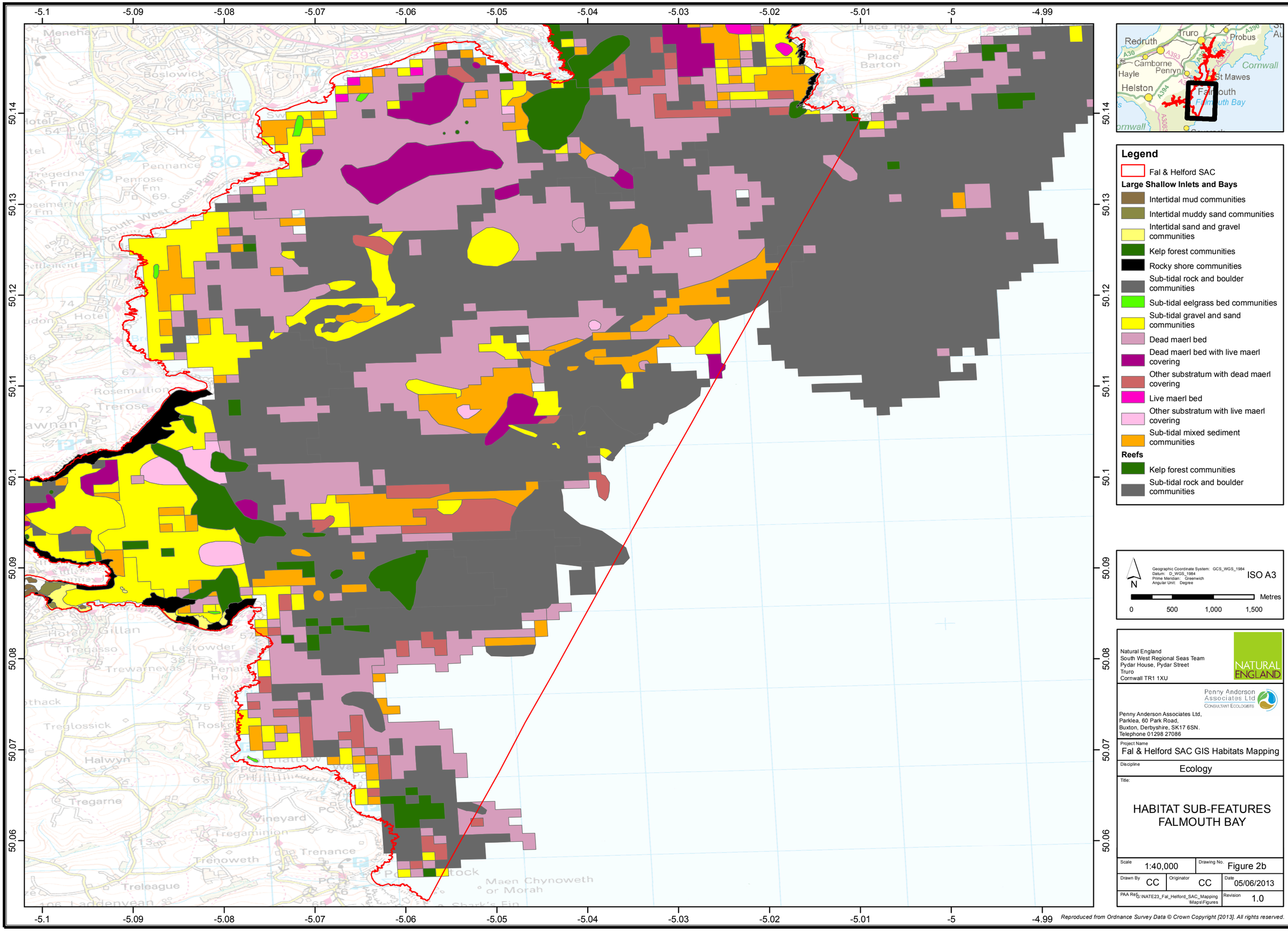

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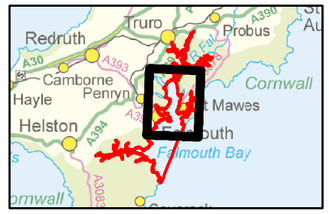

Legend

Fal & Helford SAC

Estuaries

- Estuarine bedrock, boulder and cobble communities
- Intertidal mud communities and mixed muddy sediment communities
- Sub-tidal mixed muddy sediment communities
- Sub-tidal eelgrass bed communities

Large Shallow Inlets and Bays

- Intertidal mud communities
- Intertidal muddy sand communities
- Intertidal sand and gravel communities
- Kelp forest communities
- Rocky shore communities
- Sub-tidal mud communities
- Sub-tidal rock and boulder communities
- Sub-tidal eelgrass bed communities
- Sub-tidal gravel and sand communities
- Dead maerl bed
- Dead maerl bed with live maerl covering
- Other substratum with dead maerl covering
- Live maerl bed
- Other substratum with live maerl covering
- Sub-tidal mixed sediment communities

Feature, Sub_feature_1

- Kelp forest communities
- Sub-tidal rock and boulder communities

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HABITAT SUB-FEATURES CARRICK ROADS & PERCUIL RIVER

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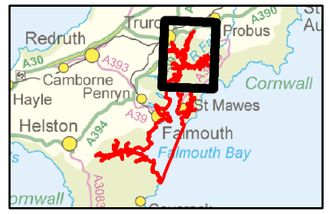

Legend

- Fal & Helford SAC

Atlantic Salt Meadows

- Upper marsh communities
- Mid-marsh communities
- Low marsh communities

Estuaries

- Estuarine bedrock, boulder and cobble communities
- Intertidal mud communities and mixed muddy sediment communities
- Sub-tidal mixed muddy sediment communities
- *Sub-tidal gravel and sand communities*

Large shallow inlets and bays

- Kelp forest communities
- Rocky shore communities
- Sub-tidal mud communities
- Sub-tidal mixed sediment communities

N

Geographic Coordinate System: GCS_WGS_1984
Datum: D_WGS_1984
Prime Meridian: Greenwich
Angular Unit: Degree

ISO A3

Metres

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Title:

HABITAT SUB-FEATURES RIVER FAL, TRURO RIVER & TRESILIAN RIVER

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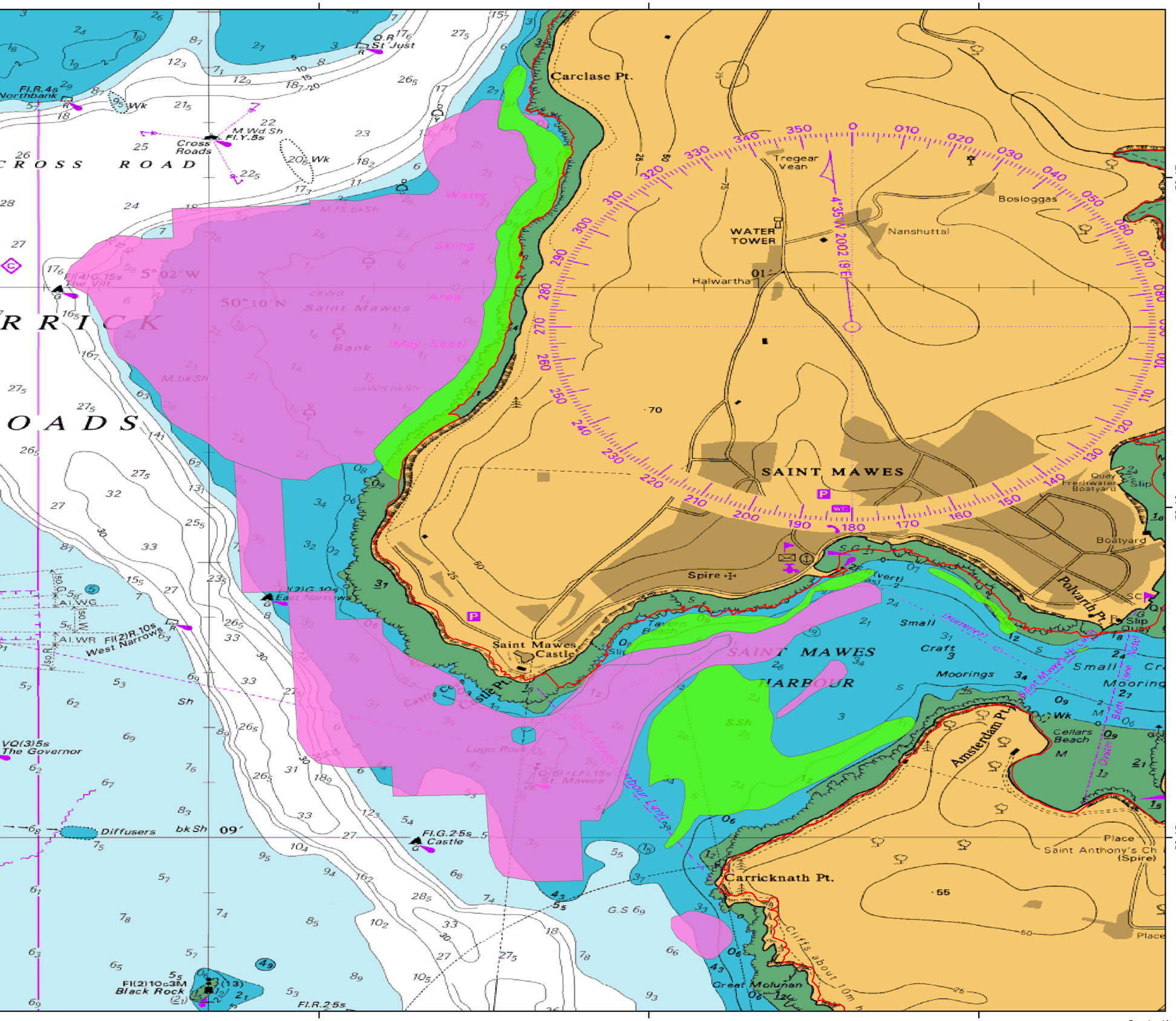

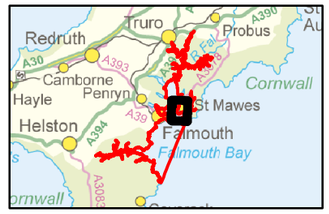

Legend

- Fal & Helford SAC
- Eelgrass bed communities
- Live maerl

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Datum: D_WGS_1984
Prime Meridian: Greenwich
Angular Unit: Degree

ISO A3

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0 100 200 300 400 Metres

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Discipline: Ecology

Title:

LIVE MAERL & EELGRASS BEDS ST. MAWES BANK & ST. MAWES HARBOUR

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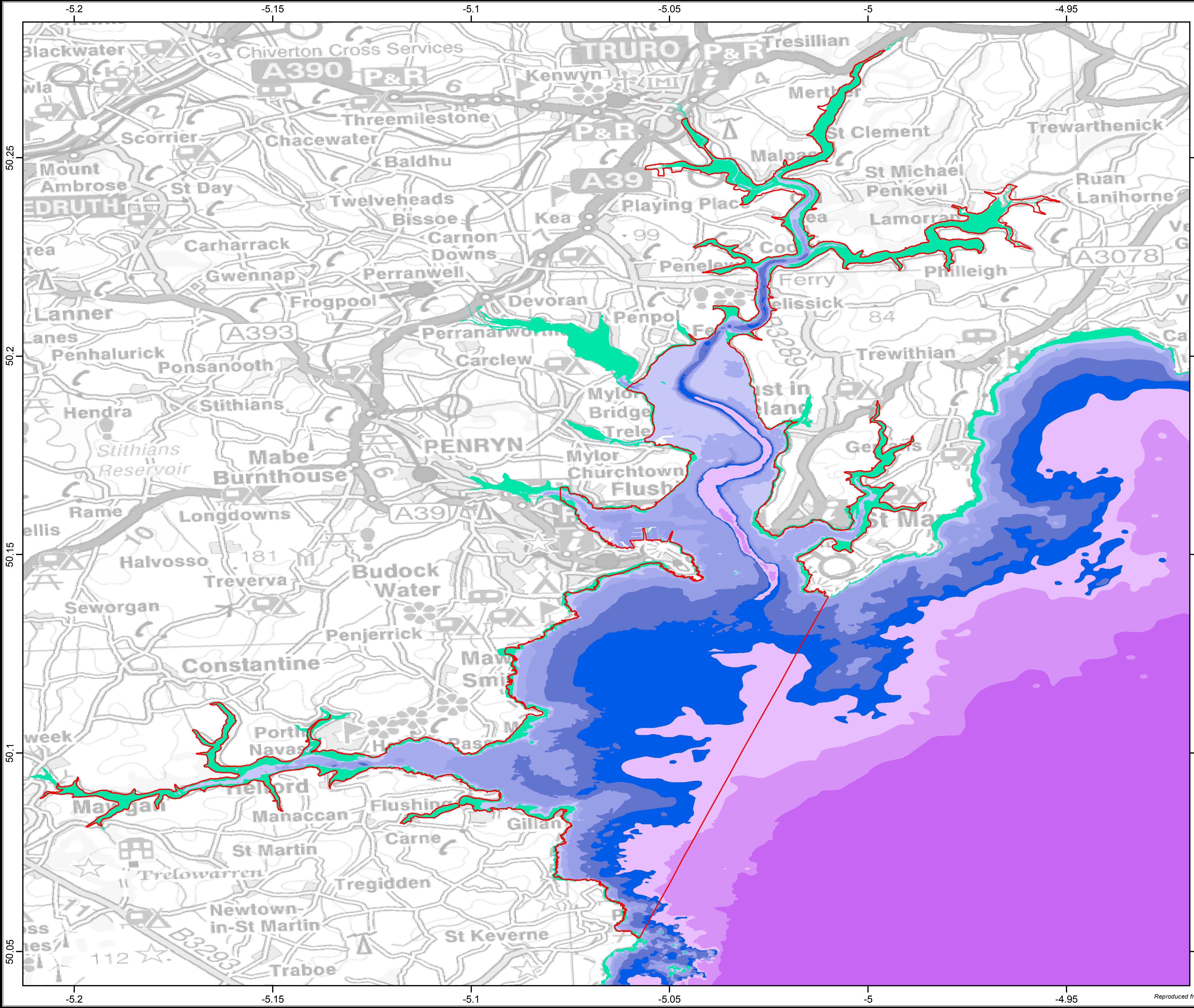

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Chiverton Cross Services
TRURO
Tresillian
A390
Kenwyn
Threemilestone
Merther
Scorrier
Chacewater
St Clement
Baldhu
Trewarthenick
Mount Ambrose
St Day
A39
St Michael Penkevil
Ruan Lanihorne
Twelveheads
Playing Place
Bissoe
Kea
Lamorran
Carharrack
Carnon Downs
A3078
Gwennap
Perranwell
Philleigh
Frogpool
Devoran
Lanner
Penpol
A393
Perranarworthal
Trewithian
Penhalurick
Ponsanooth
Carclew
Hendra
Stithians
Stithians Reservoir
PENRYN
Mabe Burnthouse
Mylor
Churchtown
Rame
Longdowns
Halvosso
Treverva
Budock Water
Seworgan
Penjerrick
Constantine
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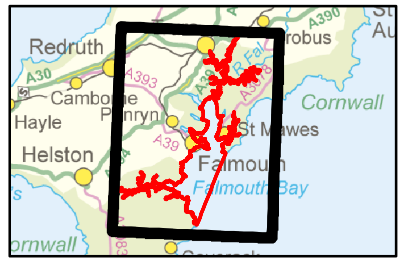

Legend

- Fal & Helford SAC

Depth (m below ordnance datum)

- <0m (intertidal)
- 0-1m
- 1-2m
- 2-5m
- 5-7m
- 7-10m
- 10-15m
- 15-20m
- 20-30m
- 30-40m
- 40-50m
- >50m

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N

Geographic Coordinate System: GCS_WGS_1984
Datum: D_WGS_1984
Prime Meridian: Greenwich
Angular Unit: Degree

ISO A3

Metres
0 1,000 2,000 3,000 4,000

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Title:

FAL & HELFORD SAC BATHYMETRY

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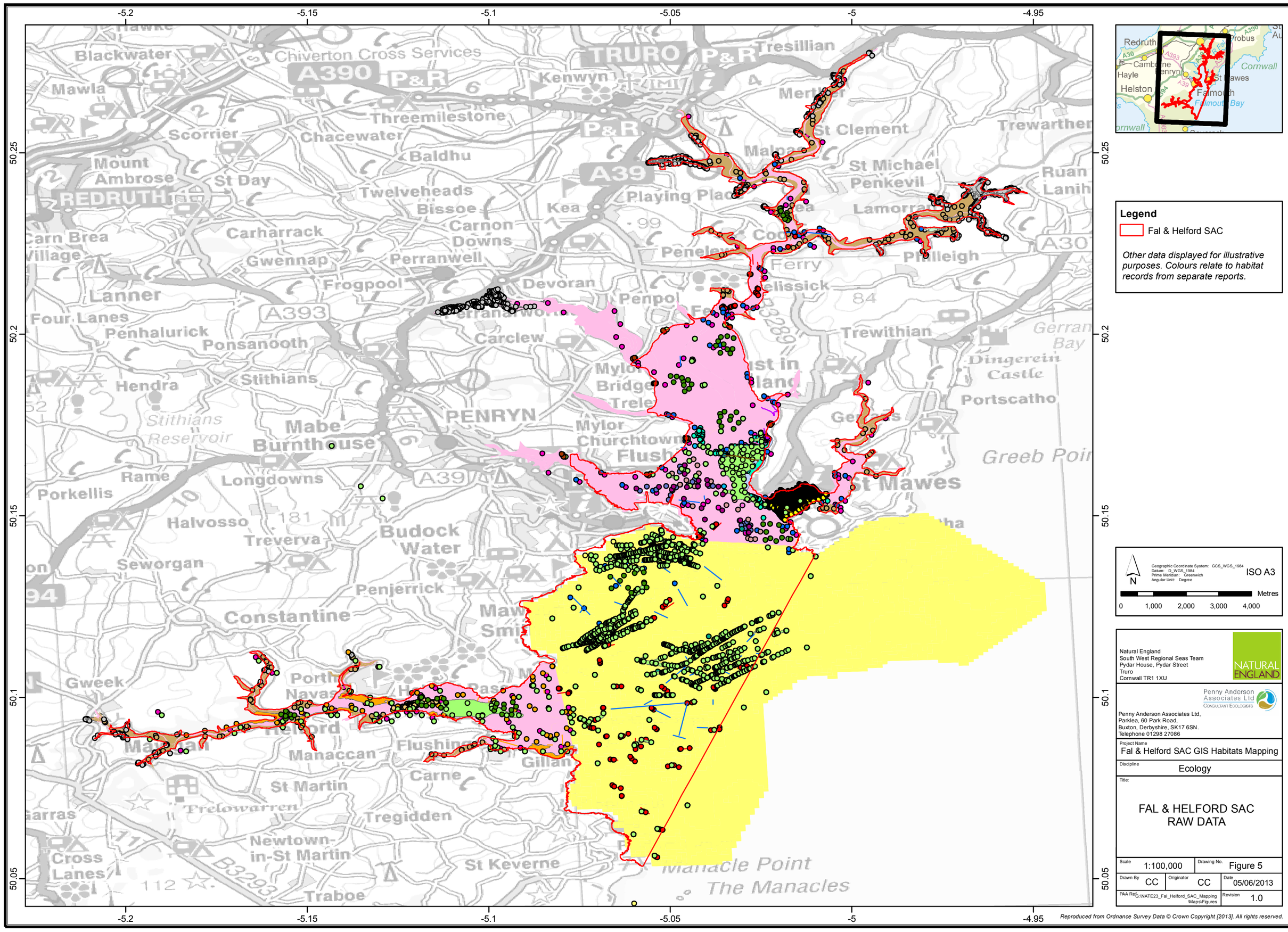

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Project Name: Fal & Helford SAC GIS Habitats Mapping

Discipline: Ecology

Title:

FAL & HELFORD SAC RAW DATA

Scale	1:100,000	Drawing No.	Figure 5
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APPENDICES

APPENDIX I

Data Sources

Appendix I Data Sources

Reference Title	Author	Year	Report Description	GI Status
Surveys of Harbours, Rias and Estuaries in Southern Britain, Falmouth. Volume 1.	Rostron, D.	1985	Detailed survey of habitats of the Fal and Helford. Good detail and surveys. Comprehensive species data. Surveys performed May-July. Relevant to the features/subfeatures: • Estuaries • Estuarine bedrock, boulder and cobble communities • Intertidal mud communities and intertidal mixed muddy sediment communities • Large shallow inlets and bays • Intertidal mudflat and sandflat communities • Kelp forest communities • Rocky shore communities • Subtidal mud communities • Sub-tidal rock and boulder communities • Subtidal sandbank communities/ Sandbanks which are slightly covered by sea water all the time • Mudflats and sand flats not covered by seawater at low tide • Mud communities • Muddy sand communities • Sand and gravel communities • Reefs • Eelgrass bed communities • Gravel and sand communities •	Data from report extracted by Natural England into Excel format. Currently extracted information available for viewing on Excel file 'Rostron_1985.xls'. Preliminary GIS available. Habitat information would also need assigning to SAC features/subfeatures by contractor and developing into GIS. GIS would then need incorporating with any other feature/subfeature information to produce overall habitat polygons for the SAC.
Monitoring of Fal and Helford SAC 2011	Ware, S. and Meadows, B.	2011	Survey to assess the status of estuarine bedrock, boulder & cobble, and sub-tidal rock and boulder habitat features. Surveys carried out in River Fal and Falmouth Bay, October 2011. Relevant to the features/subfeatures: • Estuaries	Report available with accompanying GIS. GIS would need incorporating with any other feature/subfeature

			• Estuarine bedrock, boulder and cobble communities • Large shallow inlets and bays • Sub-tidal rock and boulder communities • Reefs	information to produce overall habitat polygons for the SAC.
Inlets in the western English Channel: area summaries - Carrick Roads and the River Fal.	Moore, J.J., Smith, J., Dalkin, M., Hill, T. and Northen, K.	1999	Report compiling 5 surveys results from 1977-1994. Relevant to the features/subfeatures: • Estuaries • Estuarine bedrock, boulder and cobble communities • Subtidal mixed muddy sediment communities • Subtidal mud communities • Large shallow inlets and bays • Kelp forest communities • Rocky shore communities • Subtidal mud communities • Sub-tidal rock and boulder communities • Mudflats and sand flats not covered by seawater at low tide • Muddy sand communities • Reefs • Estuarine bedrock, boulder and cobble communities • Sandbanks which are slightly covered by sea water all the time • Eelgrass bed communities • Gravel and sand communities • Maerl bed communities • Mixed sediment communities	Report available with accompanying GIS. Habitat information would need assigning to SAC features/subfeatures by contractor. GIS would need incorporating with any other feature/subfeature information to produce overall habitat polygons for the SAC.
Surveys of Harbours, Rias and Estuaries in Southern Britain, The Helford River. Volume 1.	Rostron, D.	1987	Detailed survey of habitats of the Helford. Good detail and surveys. Comprehensive species data. Surveys performed in July. Preliminary analysis of report indicates that it is likely relevant to the features/subfeatures: • Estuaries • Intertidal mud communities and intertidal mixed muddy sediment communities	Report available. Data from report needs extracting. Habitat information would also need assigning to SAC features/subfeatures by contractor and developing

			• Large shallow inlets and bays • Intertidal mudflat and sandflat communities • Kelp forest communities • Rocky shore communities • Subtidal mud communities • Sub-tidal rock and boulder communities • Subtidal sandbank communities/ Sandbanks which are slightly covered by sea water all the time • Mudflats and sand flats not covered by seawater at low tide • Muddy sand communities • Sand and gravel communities • Reefs • Eelgrass bed communities • Gravel and sand communities • Maerl bed communities	into GIS. GIS would then need incorporating with any other feature/subfeature information to produce overall habitat polygons for the SAC.
Inlets in the western English Channel: area summaries - Helford River.	Moore, J.J., Smith, J. and Northen, K.O.	1999	Report compiling 4 surveys results from 1978-1992. Relevant to the features/subfeatures: • Estuaries • Intertidal mud communities and intertidal mixed muddy sediment communities • Subtidal sandbank communities/ Sandbanks which are slightly covered by sea water all the time • Intertidal mudflat and sandflat communities • Rocky shore communities • Subtidal mud communities • Intertidal mixed muddy sediment communities • Mud communities • Muddy sand communities • Sand and gravel communities • Reefs • Eelgrass bed communities • Gravel and sand communities • Maerl bed communities • Mixed sediment communities	Report available with accompanying GIS. Habitat information would need assigning to SAC features/subfeatures by contractor. GIS would need incorporating with any other feature/subfeature information to produce overall habitat polygons for the SAC.

Intertidal monitoring of flora and fauna in the Fal Estuary	CBRU	1992	A report of 11 intertidal transect surveys conducted in Spring 1992 and repeated in Autumn 1992. Relevant to the features/subfeatures: • Intertidal mud communities and intertidal mixed • Rocky shore communities • Mudflats and sand flats not covered by seawater at low tide • Intertidal mixed muddy sediment communities • Reefs	Data from report extracted by Natural England into Excel format. Currently extracted information available for viewing on Excel file 'CBRU, 1992.xls'. Preliminary GIS available. Habitat information would also need assigning to SAC features/subfeatures by contractor and developing into GIS. GIS would then need incorporating with any other feature/subfeature information to produce overall habitat polygons for the SAC.
The Sedimentary Shore Fauna of the Helford River at Helford Passage, Cornwall	Lange, M.	1994	Results of a transect at Bar Beach, Helford Passage in May. Relevant to the features/subfeatures: • Intertidal mud communities and intertidal mixed • Intertidal mudflat and sandflat communities/Mudflats and sand flats not covered by seawater at low tide • Muddy sand communities • Sand and gravel communities	Report available. Data from report needs extracting. Habitat information would also need assigning to SAC features/subfeatures by contractor and developing into GIS. GIS would then need incorporating with any other feature/subfeature information to produce overall habitat polygons for

				the SAC.
Falmouth Bay and Estuaries - A Nature Conservation Overview. Volume 1. A report to the Falmouth Bay & Estuaries Initiative.	Roberts, N. and Edwards, T.	1996	Extensive overview of the habitats within Falmouth Bay and estuaries. Detail lacking for marine habitats however. Relevant to the features/subfeatures: • Saltmarsh communities/Atlantic Salt Meadows Maps 5a, 5b, and 5c (P. 32 – 35) show the reported distribution of Saltmarsh in the study area. This is the only habitat that would require digitisation. All other habitats are terrestrial, and the habitat type in the report of 'Intertidal habitat' does not provide any additional useful information for the purposes of this tender.	Report available. Data from report needs extracting. Habitat information would also need developing into GIS. GIS would then need incorporating with any other feature/subfeature information to produce overall habitat polygons for the SAC.
Condition monitoring of the Intertidal Mudflats and Sandflats Feature at Fal and Helford Marine Sites: 2011	Curtis, L.	2011	Survey of distribution/extent of intertidal biotopes, interest features, and representative/notable species using aerial photographs with ground-truthing field survey. Also detailed biotope assessment, with faunal and sediment sampling. Nov - Dec. Relevant to the features/subfeatures: • Intertidal mud communities and intertidal mixed muddy sediment communities • Intertidal mudflat and sandflat communities/ Mudflats and sand flats not covered by seawater at low tide • Intertidal mixed muddy sediment communities • Mud communities • Muddy sand communities • Sand and gravel communities	Report available with accompanying GIS. Biotope information would need assigning to SAC features/subfeatures by contractor. GIS would need incorporating with any other feature/subfeature information to produce overall habitat polygons for the SAC.
Fal Helford GIS Habitat Map	CEFAS	2009	GIS Map - biotope/feature map produced from known existing data sources. However, metadata behind map is very limited on occasion and therefore not clear what confidence can be placed on data source.	No report available for the work. GIS would need

			Relevant to the features/subfeatures: • Intertidal mud communities and intertidal mixed muddy sediment communities • Subtidal sandbank communities • Intertidal mudflat and sandflat communities	incorporating with any other feature/subfeature information to produce overall habitat polygons for the SAC.
Intertidal Biotope Map of Fal and Helford	Spalding Associates (Environmental) Ltd.	2004	Detailed habitat and biotope map of the intertidal of the Fal & Helford. Relevant to the features/subfeatures: • Intertidal mud communities and intertidal mixed muddy sediment communities • Intertidal mudflat and sandflat communities/ Mudflats and sand flats not covered by seawater at low tide • Rocky shore communities • Intertidal mixed muddy sediment communities • Mud communities • Muddy sand communities • Sand and gravel communities • Reefs	No report available for the work. Biotope information would need assigning to SAC features/subfeatures by contractor. GIS would need incorporating with any other feature/subfeature information to produce overall habitat polygons for the SAC.
Saltmarsh mapping	Unknown	Unknown	GIS Map - biotope/feature map produced. However, metadata behind map is very limited and therefore not clear what confidence can be placed on data source. Relevant to the features/subfeatures: • Saltmarsh communities/Atlantic Salt Meadows This GIS map also includes woodland information, which will <u>not</u> need including in the overall layers that are a product of this tender.	No report available for the work. GIS would need incorporating with any other feature/subfeature information to produce overall habitat polygons for the SAC.
Survey of the St. Mawes (Vilt) Bank of the Fal Estuary	Howell, B.R.,	1968	Dredges and dives performed within the St. Mawes region. Survey locations extensive within the St. Mawes region. Relevant to the features/subfeatures: • Subtidal sandbank communities/Sandbanks which are	Report available. Data from report needs extracting. Habitat information would

			slightly covered by sea water all the time • Maerl bed communities • Mixed sediment communities	also need developing into GIS. GIS would then need incorporating with any other feature/subfeature information to produce overall habitat polygons for the SAC.
Survey of the Fal Estuary, Cornwall	Farnham, W.F. and Bishop, G.M.	1985	2 transects performed within the St. Mawes region providing detail of Maerl species and associated organisms. Survey techniques are good, although not extensive. Publication source very reliable. Relevant to the features/subfeatures: • Subtidal sandbank communities/Sandbanks which are slightly covered by sea water all the time • Maerl bed communities • Eelgrass bed communities • Mixed sediment communities This reports primary output would be two transect lines shown in Figure 1 which can potentially be digitised to indicate where the above listed features/subfeatures are present. Details of species and habitats associated with the transect line are found in the report.	Report available. Data from report needs extracting. Habitat information would also need developing into GIS. GIS would then need incorporating with any other feature/subfeature information to produce overall habitat polygons for the SAC.
A comparison of the maerl beds of the Fal estuary between 1982 and 1992.	Perrins, J., Bunker, F. and Bishop, G.	1995	A comparison of the maerl beds of the Fal estuary between 1982 and 1992. Relevant to the features/subfeatures: • Subtidal sandbank communities/Sandbanks which are slightly covered by sea water all the time • Gravel and sand communities • Maerl bed communities • Mixed sediment communities This reports primary output would be one transect line shown in	Report available. Data from report extracted by Natural England into Excel format. Currently extracted information available for viewing on Excel file 'Perrins et al_1995.xls'. Preliminary GIS available.

			Figure 1 which can potentially be digitised to indicate where the above listed features/subfeatures are present. Details of species and habitats associated with the transect line are found in the report.	Habitat information would also need developing into GIS. GIS would then need incorporating with any other feature/subfeature information to produce overall habitat polygons for the SAC.
Comparative Maerl Surveys in Falmouth Bay.	Dyer, M. and Worsfold, T.	1998	Report of a benthic study undertaken in the Fal in September 1997 in order to investigate the effect of maerl extraction on the benthos. 3 stations investigated. Relevant to the features/subfeatures: • Sandbanks which are slightly covered by sea water all the time/Subtidal sandbank communities • Maerl bed communities Primary information in this report is 3 survey locations which indicate maerl to be present. This report contains a lot of detailed information which is not necessary for the outputs of this tender. The key information has already been extracted into an Excel file and preliminary GIS outputs produced.	Report available. Data from report extracted by Natural England into Excel format. Currently extracted information available for viewing on Excel file 'Dyer & Worsfold_1998.xls'. Preliminary GIS available. Habitat information would also need developing into GIS. GIS would then need incorporating with any other feature/subfeature information to produce overall habitat polygons for the SAC.
Helford River Survey: Eelgrass (Zostera spp.) Project 1995-1998	Sutton, A. and Tompsett, P.E.	2000	Dive surveys of the Helford performed in the months of March to December from 1995-1998. Good detail. Relevant to the features/subfeatures:	Report needs sourcing from either DASSH or the Helford Marine Conservation Group:

			• Sandbanks which are slightly covered by sea water all the time • Eelgrass bed communities	HMCG Website: http://helfordmarineconservation.co.uk/publications/reports/ DASSH page: http://portal.oceannet.org/search/full/catalogue/dassh.ac.uk_MEDIN_2.3_MRMLN0040000009F.xml Data from report needs extracting. Habitat information would also need developing into GIS. GIS would then need incorporating with any other feature/subfeature information to produce overall habitat polygons for the SAC.
Marine Ecological Survey of the Fal Estuary: Effects of Maerl Extraction.	Royal Haskoning	2004a	Report to investigate the effects of dead maerl extraction via dredging on the infaunal communities of the maerl beds. Sampling in July. Table 5.2 provides descriptions of the habitat type found at each survey location. Table 5.1 provides site locations for station numbers. Relevant to the features/subfeatures: • Sandbanks which are slightly covered by sea water all the time. • Maerl bed communities	Report available. Data from report needs extracting. Habitat information would also need developing into GIS. GIS would then need incorporating with any other feature/subfeature information to produce overall habitat polygons for

				the SAC.
Monitoring survey of the Fal estuary: Effects of maerl extraction .	Royal Haskoning	2004b	Report to investigate the effects of dead maerl extraction via dredging on the infaunal communities and depth of the maerl beds. Sampling in July and August. Table 3.1 provides descriptions of the habitat type found at each survey location which could be used to provide habitat information for GI. Relevant to the features/subfeatures: • Sandbanks which are slightly covered by sea water all the time. • Maerl bed communities	Report available. Data from report needs extracting. Habitat information would also need developing into GIS. GIS would then need incorporating with any other feature/subfeature information to produce overall habitat polygons for the SAC.
Falmouth Cruise Project EIA - Marine Ecological Survey.	Axelsson, M., Bamber, R., Dewey S., Duke, S. and Hollies, R.	2008	Report of survey results carried out for Royal Haskoning and FHC regarding the marine ecological impacts of a cruise terminal dredge in the Fal, with particular regard to the maerl beds. Survey carried out in August and September. Table F4 provides key information which could be used to provide habitat information for GI. Relevant to the features/subfeatures: • Sandbanks which are slightly covered by sea water all the time. • Maerl bed communities	Report available. Data from report needs extracting. Habitat information would also need developing into GIS. GIS would then need incorporating with any other feature/subfeature information to produce overall habitat polygons for the SAC.
The Location & Conservation of Eelgrass Beds in Cornwall and the Isles of Scilly. Volume 1 - Report.	Hocking, S. and Tompsett, P.	2002	Desk and field work study to map the eelgrass beds around Cornwall and the Isles of Scilly. Targeted surveys carried out in September 1999. Good compilation of historical data and targeted surveys.	Report available. Data from report needs extracting (only known locations of eelgrass beds,

			Relevant to the features/subfeatures: • Sandbanks which are slightly covered by sea water all the time • Eelgrass bed communities	not historical). Habitat information would also need developing into GIS. GIS would then need incorporating with any other feature/subfeature information to produce overall habitat polygons for the SAC.
Monitoring Subtidal Sandbanks of the Isles of Scilly and the Fal and Helford Special Areas of Conservation	Allen, J.H. and Proctor, N.V.	2003	Survey of the subtidal sandbanks of the Fal, Helford, and Isles of Scilly. Grab samples used to characterise the sediment and identify the dominant organisms. Report targeted at Reg. 33 biotopes and attributes. Relevant to the features/subfeatures: • Sandbanks which are slightly covered by sea water all the time	Report available. Data from report needs extracting. Habitat information would also need developing into GIS. GIS would then need incorporating with any other feature/subfeature information to produce overall habitat polygons for the SAC.
Helford Dive Survey	JNCC	2012	Dive survey of the Helford River focussing on a local maerl bed. Preliminary outputs consist of an excel sheet of observation and preliminary GI. Most relevant part of GI and Excel sheet are the 'Observations' tab and layer. Relevant to the features/subfeatures:	Preliminary GI available. No accompanying report. GI would need incorporating with any other feature/subfeature information to produce

			• Sandbanks which are slightly covered by sea water all the time. • Maerl bed communities	overall habitat polygons for the SAC.
Mapping the distribution of benthic biotopes in Falmouth Bay and the lower Fal Ruan Estuary	Davies, J. and Sotheran, I.	1995	Acoustic profiling of Falmouth Bay and Estuary peformed in July 1994. Biotopes identified with video footage and grabs. Good SAC profiles generated. Relevant to the features/subfeatures: • Estuaries • Large shallow inlets and bays • Reefs • Sandbanks which are slightly covered by sea water all the time. • Kelp forest communities • Subtidal rock and boulder communities • Mixed sediment communities • Maerl bed communities	Report available. Data from report extracted by Natural England into Excel format. Currently extracted information available for viewing on Excel file 'Davies & Sotheran_1995.xls'. Preliminary GIS available. Habitat information would also need developing into GIS. GIS would then need incorporating with any other feature/subfeature information to produce overall habitat polygons for the SAC.
Helford River Survey: Monitoring Report No. 6. Intertidal transect monitoring review incorporating data from 1986 to 1999.	Tompsett, P.E.	2011	The full reports of the earlier surveys have been published as the Helford River Survey Monitoring Reports Nos 1, 2, 3, 4 and 5 (Hocking, 1989, Turk, 1990, Tompsett, 1991,1994,1997). This 2011 review of the 1986-1999 surveys includes hitherto unpublished 1999 data.. Consistent survey techniques and good timeline data. Relevant to the features/subfeatures: • Mudflats and sandflats not covered by seawater at low tide/Intertidal mudflat and sandflat communities • Large shallow inlets and bays • Reefs	Report available. Data from report needs extracting. Habitat information would also need developing into GIS. GIS would then need incorporating with any other feature/subfeature

			• Sandbanks which are slightly covered by sea water all the time. • Kelp forest communities • Rocky shore communities • Muddy sand communities • Eelgrass bed communiies • Subtidal rock and boulder communities • Mixed sediment communities Transect lines and descriptions can be used to assign a 'habitat type'/feature/subfeature to the area, and then mapped into GI.	information to produce overall habitat polygons for the SAC.
A Survey of the Hexacoralline Anthozoans (Sea Anemones & Corals) of the Helford Estuary.	Gainey, P.A.	1997	Intertidal and subtidal survey of the sea anemones and corals found within the Helford Estuary.	Report available. Data from report needs extracting. Habitat information would also need developing into GIS. GIS would then need incorporating with any other feature/subfeature information to produce overall habitat polygons for the SAC.
Fal and Helford European Marine Site Sublittoral Monitoring 2002	Howson, C., Bunker, F., and Mercer, T.	2004	Results of a dive and video survey of Falmouth Bay and the outer Helford River to determine the key biotopes. Focussing largely on Kelp forest, subtidal rock and boulder, maerl bed, and mixed sed. communities. Surveys performed in May and October. Relevant to the features/subfeatures: • Large shallow inlets and bays • Reefs • Sandbanks which are slightly covered by sea water all the time. • Mixed sediment communities	Report available. Data from report extracted by Natural England into Excel format. Currently extracted information available for viewing on Excel file 'Howson et al_2004.xls'. Preliminary GIS available.

			• Maerl bed communities • Gravel and sand communities • Subtidal rock and boulder communities • Kelp forest communities	Habitat information would also need developing into GIS. GIS would then need incorporating with any other feature/subfeature information to produce overall habitat polygons for the SAC.
Report of the Coral Cay Conservation Sub-Aqua Club survey of the Fal estuary, August 1999.	Cook, K.J.	2000	Dive survey performed in August 1999 to assess the amount of eelgrass and maerl at St. Mawes bank and harbour. Good detailed survey. Relevant to the features/subfeatures: • Subtidal sandbank communities • Eelgrass bed communities • Maerl bed communities P. 8 – 11 of the report provides transect location information with corresponding habitat descriptions.	Report available. Data from report needs extracting. Habitat information would also need developing into GIS. GIS would then need incorporating with any other feature/subfeature information to produce overall habitat polygons for the SAC.
Survey and Monitoring in the Roseland Voluntary Marine Conservation Area in 1992.	Bunker, F.	1992	Preliminary findings of a dive survey of the maerl and eelgrass habitats in the Roseland Voluntary Marine Conservation Area in April and August 1992. Good species detail provided Relevant to the features/subfeatures: • Sandbanks which are slightly covered by sea water all the time. • Eelgrass bed communities • Maerl bed communities	Report available. Data from report needs extracting. Habitat information would also need developing into GIS. GIS would then need incorporating with any other

				feature/subfeature information to produce overall habitat polygons for the SAC.
Drop-Down Camera Survey Fal Estuary 18th September 2006	Unknown	2006	Drop down camera survey to determine the distribution of the eelgrass beds within the St. Mawes region. Good map produced, but relatively basic information given. Relevant to the features/subfeatures: • Sandbanks which are slightly covered by sea water all the time. • Eelgrass bed communities Appendix 1 provides field notes from which information can be extracted and converted into GI.	Report available. Data from report needs extracting. GIS would then need incorporating with any other feature/subfeature information to produce overall habitat polygons for the SAC.
Fal WFD 2011 Seagrass Surveys	Environment Agency	2011	Data from seagrass surveys undertaken by the EA in 2011 (for WFD monitoring). Provided as shape files. Relevant to the features/subfeatures: • Sandbanks which are slightly covered by sea water all the time. • Eelgrass bed communities	GI available, but no accompanying report. GIS would then need incorporating with any other feature/subfeature information to produce overall habitat polygons for the SAC.
Sublittoral Survey of the Scilly Isles and South Cornwall	Dipper, F.	1981	Short dive survey in July to characterise the subtidal habitats of the IoS. Dives also performed within the Fal. Good habitat descriptions offered and species present. Relevant to the features/subfeatures: • Sandbanks which are slightly covered by sea water all the time. • Maerl bed communities Only site relevant to the Fal & Helford SAC is site number 5 (St. Mawes Bank). Site location is found on Table 1, and a brief site description, with habitats and species on P. 3 of the report.	Report available. Data from report needs extracting. Habitat information would also need developing into GIS. GIS would then need incorporating with any other feature/subfeature

				information to produce overall habitat polygons for the SAC.
Falmouth Bay Maerl community benthic survey	Ruiz-Frau, A., Rees, E.I.S., Hinz, H. and Kaiser, M.J.	2007	April video survey to assess the photic zone transition of maerl to other habitats. Detailed survey of western side of Falmouth Bay. Relevant to the features/subfeatures: • Sandbanks which are slightly covered by sea water all the time. • Maerl bed communities	Report available. Data from report extracted by Natural England into Excel format. Currently extracted information available for viewing on Excel file 'Ruiz-Frau et al_2007.xls'. Preliminary GIS available. Habitat information would also need developing into GIS. GIS would then need incorporating with any other feature/subfeature information to produce overall habitat polygons for the SAC.
Biotope mapping of Helford using Remote Operated Vehicle (ROV)	ERCCIS	2012	Mapping by Helford Marine Conservation Group with Plymouth University, map from ERCCIS. Relevant to the features/subfeatures: • Sandbanks which are slightly covered by sea water all the time. • Maerl bed communities	Pdf of biotope map available. GI files will need requesting from ERCCIS, and any costs in their access should be included in the overall quotation. GIS would then need incorporating with any other feature/subfeature information to produce overall habitat polygons for

				the SAC.
The location and extent of live and dead maerl beds in Falmouth Harbour, Southwest UK	Sheehan, E.V., Cousens, S. and Attrill, M.J.	2012	Results of a HD video survey (Nov 2011) aimed at identifying the location and extent of live and dead maerl in Falmouth Harbour. Relevant to the features/subfeatures: • Sandbanks which are slightly covered by sea water all the time. • Maerl bed communities	Report available. Data from report needs extracting, but is not easily available in current format. Contractor or NE will be required to follow up accessing the original GI information from either the author or Falmouth Harbour Commissioners. GIS would then need incorporating with any other feature/subfeature information to produce overall habitat polygons for the SAC.
The ecology of the rocky shore at Pedn Billy, Helford River, Cornwall - Community Structure, Zonation and Diversity	Pyatt, S. C.	1994	Results of a student survey carried out on exposed and sheltered sides of the rocky headland, Pedn Billy (west of Bar Beach) on the Helford River in May.	Report available. Data from report needs extracting. Habitat information would also need developing into GIS. GIS would then need incorporating with any other feature/subfeature information to produce overall habitat polygons for the SAC.
St. Mawes Habitat Study	St. Mawes Harbour	2012	The St Mawes Marine Habitats Survey was being conducted around St Mawes Harbour over a two-year period, from 2010-11.	Authors would need contacting for access to the

	Conservation Trust and Dr. Miles Hoskin		The study aims to understand more about the nationally-important marine habitats that exist in St Mawes. Primarily, these habitats are maerl and sea-grass.	data/report. Survey webpage: http://www.stmawes-harbour-conservation-trust.org/survey.html Data from report needs extracting. Habitat information would also need developing into GIS. GIS would then need incorporating with any other feature/subfeature information to produce overall habitat polygons for the SAC.
The Fal recommended reference area, Cornwall. Seasearch Site Surveys 2012	The Marine Conservation Society and Seasearch	2012	This report summarises the results of surveys carried out in the recommended reference by Seasearch divers during 2012. The aim of the surveys was to add detail of the habitats and species found within the area to support the designation process. Particular attention was paid to the maerl and seagrass beds identified as the primary reason for the proposed designation.	Report available. Data from report needs extracting. Habitat information would also need developing into GIS. GIS would then need incorporating with any other feature/subfeature information to produce overall habitat polygons for the SAC.

APPENDIX II

Report Summaries

APPENDIX II REPORT SUMMARIES

Monitoring Subtidal Sandbanks of the Isles of Scilly and the Fal and Helford Special Areas of Conservation

Authors: Allen, J.H, and Proctor, N.V.

Published: 2003

Raw data label: Allen_2003_Point

Abbreviation in habitats polygon dataset: Allen (2003)

Summary: Sediment survey from grab samples. Point locations digitized from georeferenced copies of Maps 3, 4 and 5. Attributes populated from the sedimentary parameters raw values tables displayed in text. Spatial accuracy of resultant dataset very good.

Falmouth Cruise Project EIA – Marine Ecological Survey

Authors: Axelsson M., Bamber R., Dewey S., Duke S., Hollies R.

Published: 2008

Raw data label: Axelsson_2008_Point

Abbreviation in habitats polygon dataset: Axelsson (2008)

Summary: Diver video transects, in-situ observations and diver sediment coring. Survey sites digitized to point feature class using a georeferenced copy of Figure 1, with sample site labels extracted from Figure 1a. Attributes populated from Table F4. No report appendices were available for the purpose of this study.

Survey and Monitoring in the Roseland Voluntary Marine Conservation Area in 1992

Author: Bunker, F.

Published: 1993

Raw data label: Bunker_1992

Abbreviation in habitats polygon dataset: Bunker (1992)

Summary: Diver quadrats, grid surveys and seabed imaging (stills and video). No specific spatial data located for sites other than the transect survey lines. Transect locations derived from georeferenced copies of Figure 5, which is a hand-drawn map and therefore likely to be locally inaccurate due to difficulties in performing accurate georeferencing. Some values for transect T1 (derived from Table 7) may be incorrect due to difficulty interpreting the small type of the table.

Fal Helford GIS Habitat Map

Author: CEFAS

Published: 2009

Raw data labels: No raw data created (see below)

Abbreviation in habitats polygon dataset: CWEFAS (2009)

Summary: Points and polygon GIS data detailing habitats in Fal and Helford. Data is an exact duplicate of Spalding Assoc. (2004), so not used for the purpose of this project.

Intertidal monitoring of flora and fauna in the Fal Estuary

Author: Cornish Biological Records Unit (CBRU)

Published: 1992

Raw data labels: CBRU_1992_Linear and CBRU_1992_Point

Abbreviation in habitats polygon dataset: CBRU (1992)

Summary: Intertidal transects with quadrats. Transects split into zones of similar habitats, Full description (or first 500 characters) provided in two fields within the linear feature class. Quadrat positions provided in the point feature class with the accompanying short description. Percentage cover data not included in point feature class.

Report of the Coral Cay Conservation Sub-Aqua Club survey of the Fal estuary, August 1999.

Author: Cook, K.J.

Published: 2000

Raw data labels: Cook_2000_Point and Cook_2000_Polygon

Abbreviation in habitats polygon dataset: Cook (2000)

Summary: Diver transect observation surveys for maerl and eelgrass. St Mawes Bank and St Mawes Harbour points extracted from transect positions detailed in text. Points for Penarrow Point taken from georeferenced copy of map shown in Figure 4, and as such may be locally inaccurate due to the difficulties encountered during the georeferencing of the map. The polygon feature class was digitized using the map shown in Figure 3 as a guide.

Condition Monitoring of the Intertidal Mudflats and Sandflats Feature at Fal and Helford Marine Sites 2011

Author: Curtis, L.

Published: 2011

Raw data labels: Curtis_2011_Point_Ph1, Curtis_2011_Point_Ph2 and Curtis_2011_Polygon

Abbreviation in habitats polygon dataset: Curtis (2011)

Summary: Intertidal phase I and ph ase II habitat s survey. Areas classified by aeri al photograph interpretation with ground control transects and points. Data extracted directly from shapefiles provided with the report. Only dat a containing relevant habitat informatio n has been inc luded, and has been condensed into one polygon feature class and two point feature classes. There are some overlaps within the polygon dataset, as t his has been formed from several separate sha pefiles with no existing topological relationships. These overl aps have been rectified in the re sulting SAC habi tat features polygon.

Mapping the distribution of benthic biotopes in Falmouth Bay and the lower Fal Ruan Estuary

Authors: Davies, J. and Sotheran, I.

Published: 1995

Raw data labels: Davies_1995_point and Davies_1995_polygon

Abbreviation in habitats polygon dataset: Davies (1995)

Summary: Acoustic biotope profiling survey of sea floor with video and sediment samples for g round truthing. P oint data tran sferred from preliminary GIS data created by Natural England. P olygon data created using georeferenced predicted biotope distribution maps (Figures 10, 11 and 12). A GIS grid of 100 metre squares (the pixel resolution of the bio tope distribution map) was place d over the area of interest, with each pixel then being classified by biotope from the underlying georeferenced map. There was some difficult in interpreting the colours on the scanned versions of the biotope p rediction maps. Specifically difficulties we re encountered differentiating between 'infralittoral stones' and 'd ead maerl, stones and shells' and between 'sediment with faunal turf' and 'sediment with laminaria'.

Sublittoral Survey of the Scilly Isles and South Cornwall

Author: Dipper, F.

Published: 1981

Raw data labels: Dipper_1981_Point

Abbreviation in habitats polygon dataset: Dipper (1981)

Summary: Dive survey on St Ma wes Bank. One coordinate location given, digitized to point feature class. Habitat notes and species notes extracted to attribute table.

Comparative Maerl Surveys in Falmouth Bay

Author: Dyer, M. and Worsfold, T.

Published: 1998

Raw data labels: Dyer_1998_point

Abbreviation in habitats polygon dataset: Dyer (1998)

Summary: Sediment cores taken from three stations in Falmouth Bay. Station locations digitized to point feature class (Table 1), and summary stats for each station (Table 2) used to populate the attribute table, including sediment information and presence of live and dead maerl.

Fal WFD 2011 Seagrass Surveys

Author: Environment Agency

Published: 2011

Raw data labels: EA_2011_Polygon

Abbreviation in habitats polygon dataset: EA (2011)

Summary: Intertidal Zostera beds mapped in the River Fal. Data extracted directly from provided shapefile. Intertidal Zostera doesn't fit into the (sub-tidal) eelgrass bed category, so is classified as intertidal mud community.

Biotope Mapping of Helford using Remote Operated Vehicle (ROV)

Author: Environmental Records Centre for Cornwall and the Isles of Scilly (ERCCIS)

Published: 2012

Raw data labels: no raw data created (see below)

Abbreviation in habitats polygon dataset: ERCCIS (2012)

Summary: GI data not available for use during this project. Map of biotopes provided as a georeferenced map, available in the project map document, and used to inform habitat mapping in the River Helford where appropriate.

Survey of the Fal Estuary, Cornwall

Author: Farnham, W.F. and Bishop, G.M.

Published: 1985

Raw data labels: Farnham_1985

Abbreviation in habitats polygon dataset: Farnham (1985)

Summary: Sub-tidal diver transect survey of St Mawes Bank maerl bed using quadrats to determine percentage cover of maerl species, sediment and other species. Georeferenced map used to define transect positions. Transects were unlabelled, so transect 1 assumed to be the southerly transect, as its length (800m) corresponded with the diagram displayed in Figure 2. Figure 2 was then used to divide the transect and define the composition of maerl.

A survey of the Hexacoralline Anthozoans (Sea Anemones and Corals) of the Helford Estuary

Author: Gainey, P.A.

Published: 1997

Raw data labels: Gainey_1997_Point and Gainey_1997_Polygon

Abbreviation in habitats polygon dataset: Gainey (1987)

Summary: Dive and trawl/dredge surveys with descriptive account of survey areas. Trawl/dredge site locations extracted from text body and digitized to create point feature class, with the attribute table populated from the accompanying text. Intertidal area features digitized using description of site location with the intertidal zone on OS Mastermap data used as a guide. Site description of substratum used to populate attribute table of resulting polygon feature class.

Marine Ecological survey of the Fal Estuary: Effects of Maerl Extraction

Author: Royal Haskoning

Published: 2004

Raw data labels: Haskoning_2004a_Point

Abbreviation in habitats polygon dataset: Haskoning (2004a)

Summary: Sediment sample and analysis with specific reference to maerl. Sample station locations were extracted from table 5.1 to create a point feature class, and the attribute table was populated using seabed descriptions and maerl depth in Table 5.2 and sediment analysis found in Appendix 2.

Monitoring survey of the Fal Estuary: Effects of Maerl Extraction

Author: Royal Haskoning

Published: 2004

Raw data labels: Haskoning_2004b_Point

Abbreviation in habitats polygon dataset: Haskoning (2004b)

Summary: Sediment sample and analysis with specific reference to maerl. Sample station locations were extracted using geographic coordinates (where available) from tables 2.1 and 3.2. The remaining sample site locations were created using a georeferenced copy of Figure 2.1. The attribute table of the resulting point feature class was populated using seabed descriptions and maerl depth in Tables 3.1 and 3.2. The location of site B3 could not be found in either the text or on any maps.

The Location & Conservation of Eelgrass Beds in Cornwall and the Isles of Scilly

Author: Hocking, S. and Tompsett, P.

Published: 2002

Raw data labels: Hocking_2002_Point and Hocking_2002_Polygon

Abbreviation in habitats polygon dataset: Hocking (2002)

Summary: Series of dive surveys detailing presence of Zostera marina. Locations and attributes of sites and findings extracted from Table 1 as a point feature class. Site maps found in Appendix 1 used to create a polygon feature class detailing the spatial extent of eelgrass beds. Only those mapped as being 'present' (rather than 'past') were digitized.

St Mawes Marine Habitats Survey 2010/2011

Author: Hoskin, M.

Published: Unpublished

Raw data labels: Hoskin_2012_Point

Abbreviation in habitats polygon dataset: Hoskin (2012)

Summary: Intensive seabed imaging survey of St Mawes Harbour along 12 transects. Large data set comprising over 13,000 data points detailing a wide variety of sediment, habitat and species data including detail on live maerl and eelgrass cover. Data provided in shapefile point feature class and copied to project dataset, retaining all the attributes. Data released from St. Mawes Harbour Conservation Trust for use on the project with the condition of being fully referenced when used in the public domain. See Appendix III for details of data acquisition correspondence.

Survey of the St Mawes (Vilt) Bank of the Fal Estuary

Author: Howell, B.R.

Published: 1968

Raw data labels: Howell_1968_Point and Howell_1968_Polygon

Abbreviation in habitats polygon dataset: Howell (1968)

Summary: Extensive dredges and dive surveys carried out on St Mawes Bank, including detail on live maerl. Survey stations detailing the seabed materials, and areas detailing the distribution of 'Lithothamnion sp' were digitized from georeferenced copies of maps shown in Figures 1 and 2 respectively. The local accuracy of these datasets is variable due to the use of a hand-drawn map during the georeferencing process.

Fal and Helford European Marine Site Sublittoral Monitoring 2002

Authors: Howson, C., Bunker, F. and Mercer, T.

Published: 2004

Raw data labels: Howson_2002_diver_Point, Howson_2002_Point and Howson_2002_Reanalysed_Davies_1995_Point

Abbreviation in habitats polygon dataset: Howson (2002)

Summary: Video and diver quadrat survey with specific reference to a number of key biotopes. Data exported directly from preliminary GIS data created by Natural England prior to this study.

Helford Dive Survey

Authors: JNCC

Published: Unpublished

Raw data labels: JNCC_2012_Point

Abbreviation in habitats polygon dataset: JNCC (2012)

Summary: Results from diver observation survey as a series of spreadsheets. Only the results containing habitat information were exported into a point feature class. An inconsistent approach to the labelling of some fields has introduced a degree of uncertainty over the presence and amount of live and dead maerl.

Fal Eelgrass Bed Drop-Down Video Survey

Author: Kendal, M.

Published: 2006

Raw data labels: Kendal_2006_Point

Abbreviation in habitats polygon dataset: Kendal (2006)

Summary: Basic presence/absence survey of eelgrass in St Mawes Harbour with some detail on sediment type. Survey stations data shown in Appendix 1 used to create a point feature class.

The Sedimentary Shore Fauna of the Helford River at Helford Passage, Cornwall

Author: Lange, M.

Published: 1994

Raw data labels: Lange_1994_Point

Abbreviation in habitats polygon dataset: Lange (1994)

Summary: Intertidal transect with quadrats detailing fauna and sediment character. There are no specific geographic quadrat or transect locations given in the report, so only a single point was digitized. The substrate was fairly similar in character across the quadrats (pebbles/gravel/sand, black mud present under surface).

Maerl in Cornwall 2012 Survey Report

Authors: Marine Conservation Society & Seasearch

Published: 2012

Raw data labels: MCS_2012_Linear, Seasearch_2012_Point and Seasearch_2012_Polygon

Abbreviation in habitats polygon dataset: MCS (2012) and Seasearch (2012)

Summary: Reports the results from a series of dives focussing on live maerl beds on St Mawes Bank and in the Helford River. Overview of surveys only, so the resultant data is descriptive rather than specific in terms of sediment and maerl presence and extent. Two reports published, shown as MCS (2012) for St Mawes Bank and Seasearch (2012) for Helford River surveys. MCS_2012_Linear feature class digitized from georeferenced report map showing locations of transects, and then subdivided into zones to show approximate changes in habitats based on descriptions in text body. Seasearch_2012_Polygon feature class digitized from Helford River maerl bed map.

Inlets in the western English channel: area summaries – Carrick Roads and the River Fal[1] & Inlets in the western English channel: area summaries – Helford River[2]

Authors: [1]Moore, J.J., Smith, J., Dalkin, M., Hill, T. and Northern, K. &

[2]Moore, J.J., Smith, J., and Northern, K

Published: 1999

Raw data labels: Moore_1999_Point and Moore_1999_Polygon

Abbreviation in habitats polygon dataset: Moore (1999)

Summary: Two individual reports summarising survey results relating to marine habitats in the area between 1974 and 1994 that have been combined for the purposes of this project. Preliminary GIS data provided by Natural England exported into point and polygon feature classes. Spatial accuracy of some of the points looks questionable, so care should be taken when using these records in the future, although the polygon features appear to be more accurate (if somewhat spatially generalized).

Mapping a sample site of eelgrass/seagrass, using low cost equipment in the Fal Estuary

Author: Morley, R.

Published: 2012

Raw data labels: Morley_2012_Linear, Morley_2012_Point and Morley_2012_polygon

Abbreviation in habitats polygon dataset: Morley (2012)

Summary: Basic pilot survey for presence/absence of eelgrass using seabed imaging equipment. Quadrat positions and eelgrass data extracted from Table 2 into a point feature class. Transects and eelgrass cover digitized using a georeferenced copy of the map shown in figure 3 to linear and polygon feature classes respectively. No indication was given on the methodology used to create the eelgrass bed polygon, so should be used with caution. The survey was carried out in winter, and is therefore likely to underestimate the cover of eelgrass in this region.

A comparison of the maerl beds of the Fal estuary between 1982 and 1992.

Authors: Perrins, J., Bunker, F., and Bishop, G.

Published: 1995

Raw data labels: Perrins_1995_Point

Abbreviation in habitats polygon dataset: Perrins (1995)

Summary: Diver quadrats taken along transect line on St Mawes Bank. Coordinates of start and end point of transect appear to be suspect (incorrect positioning compared to the map shown in Figure 2), so transect digitized from a georeferenced copy of the map shown in Figure 2, and then quadrat locations predicted by dividing the transect into portions of exactly 10m and exported to a point feature class. The attribute table was then populated using data from Quadrat 1 only (Appendix 10.1), as the combined quadrat data was deemed suspect.

Falmouth Bay and Estuaries – A Nature Conservation Overview

Authors: Roberts, N. and Edwards, T.

Published: 1996

Raw data labels: Roberts_1996_Polygon

Abbreviation in habitats polygon dataset: Roberts (1996)

Summary: Habitat extents mapped, mostly terrestrial, although saltmarsh communities defined. Polygon data was created using the Maps 5a and 5b as a base, and using OS Mastermap and aerial photography to define the extent of the habitats.

Surveys of Harbours, Rias and Estuaries in southern Britain, Falmouth[1] & Surveys of Harbours, Rias and Estuaries in southern Britain, The Helford River[2]

Author: Rostron, D.

Published: 1985[1] and 1987[2]

Raw data labels: Rostron_1985_Point[1] and Rostron_1985_Linear[1] and Rostron_1987_Point[2] and Rostron_1987_Linear[2]

Abbreviation in habitats polygon dataset: Rostron (1985)[1] and Rostron (1987)[2]

Summary: Intertidal and sub-tidal dive transect surveys detailing habitats and species. Descriptions given a single coordinate, but clearly describe a larger area – no indication given as to extent of area described. Sediment samples and trawls taken but these only contain information on fauna. Point and linear feature classes created from survey locations shown in text, with attributes populated from corresponding descriptions within the body of the text. This study was used extensively by Moore (1999) to create habitat polygons.

Falmouth Bay Maerl community benthic survey

Authors: Ruiz-Frau, a., Rees, E.I.S., Hinz, H. and Kaiser, M.J.

Published: 2007

Raw data labels: Ruiz_Frau_2007_Linear, Ruiz_Frau_Linear_CSFC and Ruiz_Frau_2007_Point

Abbreviation in habitats polygon dataset: Ruiz-Frau (2007)

Summary: Seabed imaging survey aimed at assessing the transition from maerl gravel to other habitats. Video transects containing descriptions of seabed habitat were used to create linear a feature class, with sediment samples used to create a point feature class. The transect data was available in GIS format as start and end points; this was converted to linear data. The sediment sample data was exported to a point feature class.

The location and extent of live and dead maerl beds in Falmouth harbour, Southwest UK

Authors: Sheehan, E.V., Cousens, S. and Attrill, M.J.

Published: 2012

Raw data labels: No raw data created

Abbreviation in habitats polygon dataset: Sheehan (2012)

Summary: Data unavailable for use in this project as it is not yet in the public domain. Should be available for use late 2013. See Appendix III for data acquisition correspondence.

Intertidal Biotope Map of Fal and Helford

Authors: Spalding Associates (Environmental) Ltd.

Published: 2004

Raw data labels: Spalding_Assoc_2004_Point and Spalding_Assoc_2004_Polygon

Abbreviation in habitats polygon dataset: Spalding Assoc. (2004)

Summary: Habitat and biotope GIS data available as point and polygon data. Data duplicated by CEFAS (2009), which for this reason has been omitted from this project. Mixture of new dive survey data and re-analysed existing data (Davies 1995 and Howson 2004). Data exported directly into project database. Method used to extrapolate points to habitat polygons not defined, so polygon dataset was not used for the purposes of this project.

Helford River Survey: Eelgrass (Zostera spp.) Project 1995-1998

Author: Sutton, A. and Tompsett, P.E.

Published: 2000

Raw data labels: No raw data created (see below)

Abbreviation in habitats polygon dataset: Sutton (2000)

Summary: Report requested from Helford Marine Conservation Group, but not received in time to be included in this project. See Appendix III for details of data acquisition correspondence.

Helford River Survey Monitoring Report No. 6. Intertidal transect monitoring review incorporating data from 1986 to 1999

Author: Tompsett, P.E.

Published: 2011

Raw data labels: Tompsett_2011_Linear

Abbreviation in habitats polygon dataset: Tompsett (2011)

Summary: Series of intertidal transects with detailed description of habitats and individual species in zones along transect. Linear feature class created from the transect start and end coordinates as defined in the text. The linear features were then subdivided based upon the descriptions given.

Monitoring of Fal and Helford SAC 2011

Author: Ware, S. and Meadows, B.

Published: 2011

Raw data labels: Ware_2011_Linear and Ware_2011_Point

Abbreviation in habitats polygon dataset: Ware (2011)

Summary: Series of seabed stills and video imaging transects, analysed to characterise biotopes. Table 8.3 was used to create a series of video transect start and end points, which were then converted to linear features. Table 8.4 was used to create a series of point features, which represent the locations of the still imaging data. Attributes were automatically populated with the EUNIS code, and MNCR description and key. Two video transects (STN27 & STN28) resulted in a length of zero, so were treated as point features.

Saltmarsh Mapping Project

Authors: Unknown

Published: Unknown

Raw data labels: Saltmarsh_Mapping_Point and Saltmarsh_Mapping_Polygon

Abbreviation in habitats polygon dataset: Saltmarsh Mapping Project (Unknown)

Summary: GIS data with no accompanying report, detailing the results of a saltmarsh mapping project across the Fal and Helford SAC region. Target notes available as point feature class and area features with National Vegetation Classification (NVC) categories available as polygon feature class, both of which were exported directly into the project database.

APPENDIX III

Data Acquisition Correspondence

Heather Davidson

From: Chris Chapman
Sent: 20 March 2013 12:23
To: 'Miles Hoskin'
Cc: 'Marshall, David (NE)'; 'Marshall, Charlotte (NE)'; Heather Davidson
Subject: RE: St Mawes Harbour Habitats Survey

Hi Miles,

Thanks very much for sending your data over for use in the Fal & Helford SAC Habitats Mapping project – we can definitely use it to build a GIS layer of habitats for the St Mawes Harbour area.

With regards data usage, as the project is funded by Natural England, and the habitats data will be under their management when complete, it is probably best to liaise directly with David Marshall or Charlotte Marshall (both at the NE offices in Truro) to negotiate data access.

Many thanks,
Chris

Chris Chapman
GIS Consultant

For and on behalf of
Penny Anderson Associates Ltd
Park Lea
60 Park Road
Buxton
Derbyshire SK17 6SN

Tel: 01298 27086
Mob: 07899 898409
Fax: 01298 23776
email: chris.chapman@pennyanderson.com
web: www.pennyanderson.com

From: Miles Hoskin [mailto:miles.hoskin@cmer.co.uk]
Sent: 18 March 2013 15:44
To: Chris Chapman
Cc: david.marshall@naturalengland.org.uk
Subject: Re: St Mawes Harbour Habitats Survey

Hi Chris

Further to your request via Philip Marsden for information from our St Mawes Marine Habitats Survey, please find attached an excel file containing the raw ecological and positional data and a map of the broad habitat-

types based on this data. Notes explaining the nature of the data are provided in the first worksheet. The key point is that the data were only semi-quantitative owing to the large number of variables and very large number of samples.

I don't know what, if any thing, Philip has said to you about using this data. As I understand it the St Mawes Harbour Conservation Trust is happy for this data to be used for the purpose you've described, but asks that it be properly accredited in any report or other end-product and that it be provided with a copy of any such report, etc.

Since we don't have the budget to do much in the way of GIS ourselves, we would also be grateful to receive copies of any maps or spatial analyses that you generate for St Mawes Harbour using our data.

Please don't hesitate to contact me should you wish to discuss any of this further.

Kind regards,

Miles

Dr Miles Hoskin
Coastal & Marine Environmental Research (CMER)
2 Raleigh Place
Falmouth
Cornwall TR11 3QJ

Tel: 01326 219 498
Mob: 07976 437 463
Email: miles.hoskin@cmer.co.uk

----- Original Message -----

From: Philip Marsden
To: Miles Hoskin
Sent: Wednesday, March 13, 2013 4:06 PM
Subject: Fw: St Mawes Harbour Habitats Survey

Hi Miles - wonder how the report's going this week.....this below sounds interesting - could you liaise with him please?
best Philip

From: Chris Chapman
Sent: Wednesday, March 13, 2013 1:15 PM
To: info@stmawes-harbour-conservation-trust.org
Subject: St Mawes Harbour Habitats Survey

Hello,

My name is Chris Chapman, and I am working on a contracted project for Natural England to map the habitats of the Fal and Helford Special Area of Conservation (SAC). My aim is to extract relevant habitat data from numerous reports and studies carried out within the SAC boundary, from which I will create a GIS map of all the habitat features relevant to the SAC designation criteria. The map and data will then be used by Natural England to inform management and planning decisions within the SAC.

The surveys carried out by the St Mawes Harbour Conservation Trust in 2010/2011 would be a valuable addition to the project, and will help to accurately define the habitat types around St Mawes Harbour for future use in helping Natural England to maintain and conserve the SAC. Would you be able to send over any data or reports that would be relevant to this work? Or point me in the right direction for acquiring any data resulting from your surveys?

If you have any questions about the project, please feel free to contact either myself or the Natural England Project Officer David Marshall (david.marshall@naturalengland.org.uk), who is based in the NE Truro Offices.

Many thanks,

Chris Chapman
GIS Consultant

For and on behalf of
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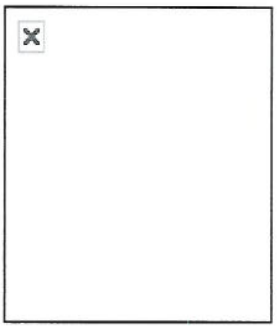
Mob: 07899 898409
Fax: 01298 23776
email: chris.chapman@pennyanderson.com
web: www.pennyanderson.com



Heather Davidson

From: RICHARD MORLEY [rpmorley@btinternet.com]
Sent: 25 April 2013 16:30
To: Chris Chapman
Subject: Re: Fal Estuary Eelgrass Survey 2012

Hi Chris

I am happy to give permission for my data to be used in your survey. If you require any further information about my study please feel free to contact me.
Regards...Richard Morley.

From: Chris Chapman <Chris.Chapman@pennyanderson.com>
To: "rpmorley@btinternet.com" <rpmorley@btinternet.com>
Cc: "Marshall, Charlotte (NE)" <Charlotte.Marshall@naturalengland.org.uk>; Heather Davidson <Heather.Davidson@pennyanderson.com>
Sent: Thursday, 25 April 2013, 15:35
Subject: Fal Estuary Eelgrass Survey 2012

Dear Richard,

My name is Chris Chapman, and I am working on a contracted project for Natural England to map the habitats of the Fal and Helford Special Area of Conservation (SAC). My aim is to extract relevant habitat data from numerous reports and studies carried out within the SAC boundary, from which I will create a GIS map of all the habitat features relevant to the SAC designation criteria. The map and data will then be used by Natural England to inform management and planning decisions within the SAC.

One of the reports I am looking at was authored by yourself, namely 'Mapping a sample site of eelgrass/seagrass, using low cost equipment in the Fal Estuary, Cornwall, UK', 2012. I found your full report online, and it contains all the information I would need to use your results as part of my study. I am writing to obtain permission to use the data in the above study.

If you have any questions about the project, feel free to contact either myself or the Natural England project officer Charlotte Marshall (charlotte.marshall@naturalengland.org.uk), who is based in the Natural England Truro office.

Yours faithfully,

Chris Chapman
GIS Consultant

For and on behalf of
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Heather Davidson

From: Chris Chapman
Sent: 08 April 2013 16:42
To: 'Harriet Knowles'
Cc: 'Marshall, David (NE)'; 'Marshall, Charlotte (NE)'; Heather Davidson
Subject: RE: Maerl Bed Survey, Falmouth Harbour 2012

Dear Harriet,

Many thanks for your response to my request for the Falmouth Harbour maerl bed survey data from 2012 for inclusion into the creation of a GIS habitats map for the Fal and Helford SAC, on behalf of Natural England. I fully appreciate that the data is not available at this time, but I'm sure it would make a valuable addition to the project when it becomes publicly available.

I will have completed my contract with Natural England for this project by late 2013, but the output will be a map that is designed to be amended and updated with new data, so I'm sure that one of the marine team at Natural England will be in contact when the data does become available.

Thanks once again,
Chris

Chris Chapman
GIS Consultant

For and on behalf of
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web: www.pennyanderson.com

-----Original Message-----
From: Harriet Knowles [mailto:msdo@falmouthport.co.uk]
Sent: 08 April 2013 15:55
To: Chris Chapman
Cc: Emma Sheehan
Subject: RE: Maerl Bed Survey, Falmouth Harbour 2012

Dear Chris,

Thank you for your interest. Unfortunately the data produced through Emma Sheehan's survey research forms part of wider work which is not yet completed and not yet available to the public. I would advise that if the timescales suit your contract with Natural England that this data would be available in late 2013 to the general public. You or Natural England are very welcome to contact myself or Emma Sheehan at that time and we would be happy to hand over the publically available data and information.

Best wishes,
Harriet

Harriet Knowles
Maritime Sustainable Development Officer
Falmouth Harbour Commissioners
44 Arwenack Street
Falmouth
TR11 3JQ

Tel: 01326 213 538
Email: msdo@falmouthport.co.uk
www.falmouthport.co.uk

-----Original Message-----
From: Emma Sheehan [mailto:emma.sheehan@plymouth.ac.uk]
Sent: 03 April 2013 09:50
To: Chris Chapman
Cc: Harriet Knowles
Subject: RE: Maerl Bed Survey, Falmouth Harbour 2012

Dear Chris,

So sorry that I didn't get back to you. The data and the report were funded by Falmouth Harbour Commission and so it is their permission that you would need.

I have copied in Harriet Knowles from FHC into this email.

Hello Harriet, Chris Chapman is after maerl data from the surveys that we did in 2011 and 2012. I think that some of the data will be part of the experimental sites and so the data might not be ready for the public domain yet. Let us know. See email correspondence below.

Cheers
Emma

Dr Emma Sheehan

Marine Institute
Marine Biology and Ecology Research Centre Marine Building University of Plymouth Plymouth
PL4 8AA

emma.sheehan@plymouth.ac.uk
01752 584699
07718 696112

http://www.plymouth.ac.uk/marine
http://www.plymouth.ac.uk/staff/esheehan

-----Original Message-----
From: Chris Chapman [mailto:Chris.Chapman@pennyanderson.com]
Sent: 03 April 2013 09:18
To: Emma Sheehan
Subject: RE: Maerl Bed Survey, Falmouth Harbour 2012

Hi Emma,

I've just got round to this project again - would you be able to help me with my request for survey data, as described in my email below?

Many thanks,
Chris

Chris Chapman
GIS Consultant

For and on behalf of
Penny Anderson Associates Ltd
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web: www.pennyanderson.com<http://www.pennyanderson.com/>

<http://twitter.com/PAA_Ecology>

Directors: Mrs P Anderson Mr P Worrall Mr C Anglish

From: Emma Sheehan [emma.sheehan@plymouth.ac.uk]
Sent: 12 March 2013 22:21
To: Chris Chapman
Subject: RE: Maerl Bed Survey, Falmouth Harbour 2012

Hello, sorry for delay, i'm currently on a first aid course.

I'll get back to you on Thursday, if i dont, please feel free to prompt!

Cheers
Emma

.....

Dr Emma Sheehan
Marine Institute Fellow

Marine Biology and Ecology Research Centre Marine Institute Plymouth University Plymouth
PL4 8AA

Tel: 01752 584699
07718 696112

emma.sheehan@plymouth.ac.uk
http://www.plymouth.ac.uk/marine

From: Chris Chapman [Chris.Chapman@pennyanderson.com]
Sent: 11 March 2013 10:40
To: Emma Sheehan
Subject: Maerl Bed Survey, Falmouth Harbour 2012

Dear Dr Sheehan,

My name is Chris Chapman, and I am working on a contracted project for Natural England to map the habitats of the Fal and Helford Special Area of Conservation (SAC). My aim is to extract relevant habitat data from numerous reports and studies carried out within the SAC boundary, from which I will create a GIS map of all the habitat features relevant to the SAC designation criteria. The map and data will then be used by Natural England to inform management and planning decisions within the SAC.

One of the reports I am looking at was authored by yourself, namely 'The location and extent of live and dead maerl beds in Falmouth Harbour', 2012. Would you be able to make available the point quadrat data as shown in the maps in Figures 4-8? Or point me in the right direction if you do not currently have access to this data?

If you have any questions about the project, please feel free to contact either myself or the Natural England Project Officer David Marshall (david.marshall@naturalengland.org.uk), who is based in the NE Truro Offices.

Many thanks,

Chris Chapman
GIS Consultant

For and on behalf of
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web: www.pennyanderson.com<http://www.pennyanderson.com/>

<http://twitter.com/PAA_Ecology>

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Heather Davidson

From: Chris Chapman
Sent: 03 April 2013 09:25
To: Becky Seeley
Cc: Heather Davidson
Subject: RE: Helford report

Hi Becky,

Thanks very much for your response, and also for your help with providing the data for use in the habitats mapping project in such a busy period. I look forward to receiving the report in due course. In addition I would very grateful on behalf of the project to receive any extra information or data on eelgrass beds provided by Pamela Thompsett.

Best regards,
Chris

Chris Chapman
GIS Consultant

For and on behalf of
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Tel: 01298 27086
Mob: 07899 898409
Fax: 01298 23776
email: chris.chapman@pennyanderson.com
web: www.pennyanderson.com

From: Becky Seeley [bese@MBA.ac.uk]
Sent: 02 April 2013 18:35
To: Chris Chapman
Subject: Helford report

Hi Chris

Thasnk you for your request for the Helford and Fal seagrass report 1995-1998

We have permission to pass this on from the data provider but we only have this as a paper copy of the report. We are in the process of digitizing this for you but have been extremely busy with end of year

contract work. Pamela Tompsett also I has been observing the intertidal (ELWS) Helford eelgrass in recent years where it has returned and is about to put some notes together and she asked me to let you know this.

Best Wishes

Becky

Becky Seeley
Data manager
Marine Biological Association

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Further information

Natural England evidence can be downloaded from our **Access to Evidence Catalogue**. For more information about Natural England and our work see **Gov.UK**. For any queries contact the Natural England Enquiry Service on 0300 060 3900 or e-mail **enquiries@naturalengland.org.uk** .

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