Hydromorphology of Transitional and Coastal Waters

Task 7 Data

Technical Note MAR3693/04

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Contents

1. Purpose of report 1
1.1 Summary of data 1

2. The Ribble Estuary 2
2.1 Defining the Estuary Boundary 2
2.2 Defining the Coastline 2
2.3 % Habitat Loss 3
2.4 Proportion of Frontage Defended 4
2.5 Area Influenced by Structures 5
2.6 Changes in Forces: Tides (Artificial Barrages) 5
2.7 Changes in Forces: River Flow 5

3. Sea Lochs 6
3.1 Changes in Sea Loch Stratification and Flushing 6

4. References 6

Tables

Table 1 Datasets used in the Ribble Estuary and Sea Loch studies 1

Figures

Figure 1 Transitional Water Body Coastline at Banks Marsh 3
Figure 2 Sequence of Land Claim in the Ribble Estuary (source: EMPHASYS Consortium, 2000)) 3
Figure 3 Sequence of Land Claim within the Ribble Estuary (GIS Layer derived from Figure 2 source) 4
Figure 4 Defences Snapped to Coastline 4

1. Purpose of report

This report is prepared as a supporting document to the metadata database produced for Work Package 7 of the project.

1.1 SUMMARY OF DATA

The datasets used in the Ribble and Sea Loch studies are listed in Table 1, below. A separate metadata database has been prepared in Microsoft Access format and supplied as part of the project. Where a dataset is marked (GIS) it was processed in an ESRI ArcGIS environment as a polyline, point or polygon shape file. Other supporting GIS datasets (e.g. OS maps) are available as raster images. UK GIS datasets use the British National Grid coordinate system and worldwide datasets WGS 84 UTM. Datasets marked (D) are available in other digital forms (e.g. spreadsheet or website) and (P) Physical datasets are on paper.

Table 1 Datasets used in the Ribble Estuary and Sea Loch studies

Metrics / **Datasets**	% Habitat Loss	Proportion of Frontage Defended	Area Influenced by Structures	Changes in Forces: Tides (Artificial Barages)	Changes in Forces: River Flow	Changes in Sea Loch Stratification and Flushing
NFCDD 2005 (GIS)		Y		Y		
World Vector Shoreline (UK 250k) (GIS)	Y	Y	Y			
Admiralty Chart 1981 (P)	Y		Y			
Transitional Waterbodies (GIS)		Y	Y			
Long Term Morphological Change in the Ribble Estuary, North West England (P)	Y					
Regulation 33 Data (GIS)		Y				
Coastal Waterbodies (GIS)		Y				
Anton Edwards' Sea Loch Catalogue (D)						Y
Flow Data (Ribble) (D/GIS)					Y	
Crown Estate Website (D)			Y	Y		
HMWB Project Data (GIS)		Y	Y	Y		

(GIS) – GIS digital data; (D) – Digital data other than GIS; (P) – Physical data

2. The Ribble Estuary

Prior to the derivation and analysis of individual metrics in the Ribble Estuary it was necessary to define a consistent seaward boundary and shoreline. These alterations resulted in a derived dataset, "Estuary_Area".

2.1 DEFINING THE ESTUARY BOUNDARY

The Ribble Estuary study boundary was principally defined by its Transitional Water Body polygon shapefile. A number of alterations were made to this polygon based on the requirements of certain metrics and data from other sources.

- The Transitional Water Body continues down the Ribble river to the west of Preston and for 14km down the tributary river Douglas finishing at apparently arbitrary places. Although this may reflect the correct official waterbody boundary, to include these stretches would (in our view) skew the Frontage and Structures metrics applied to Transitional Water. Accordingly, the World Vector 250k UK Shoreline limits were used along inland stretches.
- Data from the OS 250k and 50k Rasters and Admiralty Chart 1981 indicated that the Ribble Estuary, defined by it's subtidal morphology, stretched further out to sea than the area defined by the seawards boundary of the Transitional Water Body. However, in the absence of another consistent, formal boundary it was not feasible nor desirable to create an alternative.

2.2 DEFINING THE COASTLINE

A number of digital datasets are available detailing the UK Coastline. These include the World Vector 250k UK Shoreline, Ordnance Survey 250k and 50k Rasters, EA Coastal and Transitional Water Bodies and also Regulation 33 data held by English Nature covering some stretches. These datasets are broadly in agreement regarding the position of the UK coastline but they differ at higher resolution.

The World Vector 250k UK Shoreline, which covers the whole of the British Isles including Eire, was used as the main data source for the Ribble study area giving reliable and consistent area and distance measurements. The EA Transitional Water Body data gives a more precise definition of the coastline but became artificially long at Banks Marsh on the south bank of the estuary due to exploring the marshy inlets in full (See Figure 1 below). Had this data been used to calculate the length of the coastline a very different and less intuitive answer would have been produced. However, the World Vector Shoreline was cut to the Transitional Water Body to give the bounding limits for the coastline.

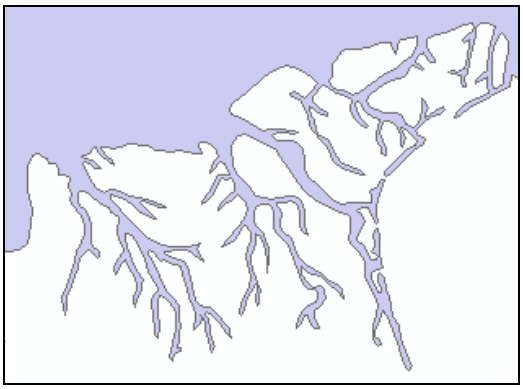

Figure 1 Transitional Water Body Coastline at Banks Marsh

It was possible to use the World Vector Shoreline data to support all of the related metrics. The Ordnance Survey Rasters provided strong support for this base shoreline definition.

2.3 % HABITAT LOSS

A very good and reliable dataset documenting the sequence of land claim in the Ribble Estuary was acquired for calculation of this metric. This document, published by the EMPHASYS Consortium for MAFF in December 2000, entitled Modelling Estuary Morphology and Process – Final Report (EMPHASYS, Consortium, 2000; also published in Van Der Wal et al, 2004), contained a map showing the areas reclaimed since 1854. The figure is reproduced in Figure 2.

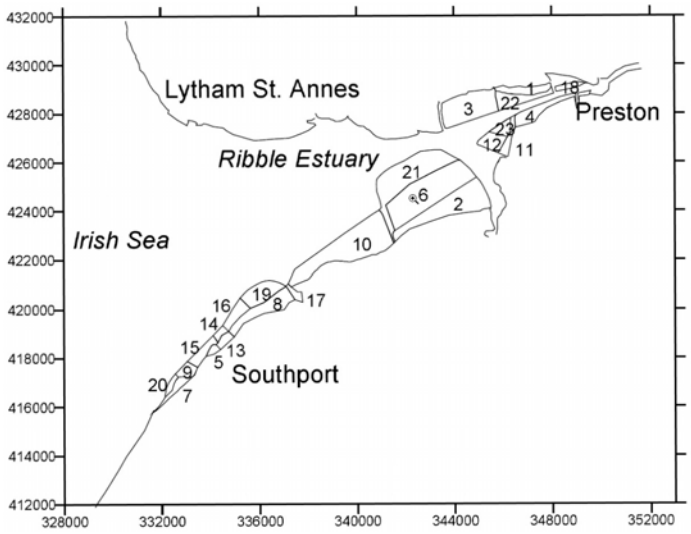

Figure 2 Sequence of Land Claim in the Ribble Estuary (source: EMPHASYS Consortium, 2000))

The figure was added to the project GIS as an image layer and geo-referenced to fit seamlessly with the coastline and OS1:50,000 scale Raster Map. The regions were digitised within ArcGIS and attributed with the date they were reclaimed and the area of reclamation quoted in the data source. The GIS was used to calculate the area of the digitised polygons which were compared with the quoted areas for QA purposes. Figure 3 shows the captured GIS data.

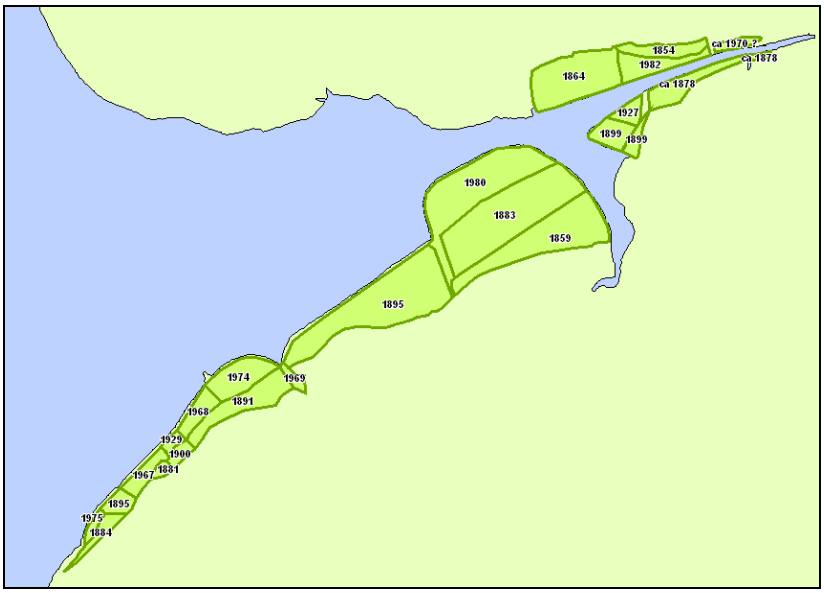

Figure 3 Sequence of Land Claim within the Ribble Estuary (GIS Layer derived from Figure 2 source)

2.4 PROPORTION OF FRONTAGE DEFENDED

The National Flood and Coastal Defence Database (NFCDD) 2005, the prime source of defence data for England and Wales, was used to plot the position of defences in the Ribble Estuary. This database includes areas of high ground and other structures, so it was first necessary to exclude these and any other non defence structure types.

To ascertain the areas of shoreline which were defended by the remaining defences, each defence was 'snapped' onto the nearest shoreline segment. An example of this process is presented in Figure 4.

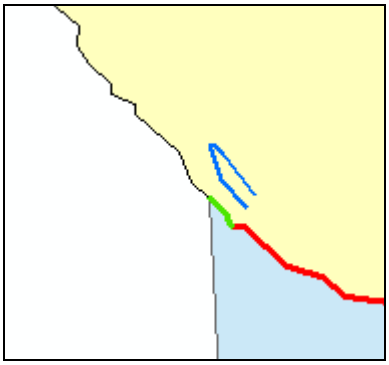

Figure 4 Defences Snapped to Coastline

Two coastal defences at Lytham St. Annes are marked in blue on the figure. They are 'snapped' to the nearest stretch of coastline resulting in a 'defended' stretch plotted as the green colour, whereas the red stretch is undefended. The northern part of the defences, when snapped to the coastline falls outside the water body boundary, blue, estuary area and so is not included in this analysis.

This process requires a number of subjective judgements, which are easy to resolve manually with human intervention, but increase the difficulty of automation. It is recommended that rules be developed for future application:

- How far should a defence be from the coastline for it to be 'defending' the coast? This judgement depends not only on the distance, but also on the buildings and structures between the defence and the coastline.
- Defences perpendicular to the coastline were usually not considered to be defending it. However, exceptions can occur if the positioning of the defence or the defence type indicate otherwise.
- Fluvial defences for rivers close to the coastline were excluded unless they were clearly part of the estuary defence structure.

This process produced a derived dataset "Defended_Estuary".

2.5 AREA INFLUENCED BY STRUCTURES

Structures in the Ribble Estuary were digitised from Admiralty chart 1981, which was the only data source revealing a training wall on each bank of the river channel. Other coastline structures were also included but placed against the shoreline defined by the World Vector 250k UK Shoreline dataset. The area influenced by these structures was insignificant compared to that of the training walls. This metric is relevant to the sediment budget of the estuary as the training walls influence flow patterns and sedimentation.

A subjective judgement was required to define the area influenced by any particular structure (derived dataset "Structures_ClippedBy_Area"):

- A base rule of 10 times the area of the structure was applied for each structure with the exception of the training walls. In the absence of an aerial photograph, the area of each structure was calculated from the digitised chart data.
- The area of influence of the training walls was given to be that confined between the walls. Since they stretched further out to sea than the Transitional Water Body boundary, the training walls were cut to this boundary. No data was available giving the crest height of the training walls. This led to uncertainty as to their degree of influence; clearly training walls which penetrate a short distance above the bed will have a markedly different influence than higher walls.

Other data sources, for example the Crown Estate website (www.crownestate.co.uk), confirmed that there were no other offshore structures in the estuary study area.

2.6 CHANGES IN FORCES: TIDES (ARTIFICIAL BARRAGES)

Examination of the available data sources, an internet search and discussions with the project team and their associates led us to believe that there were no significant tidal barriers in the Ribble system.

2.7 CHANGES IN FORCES: RIVER FLOW

Freshwater flow data is held digitally for the furthest downstream gauging stations in each of the main tributaries flowing into the Ribble Transitional Water Body. The data is held in two forms. The freshwater flow statistics acquired from The National River Flow Archive (http://www.nwl.ac.uk/ih/nrfa/index.htm) comprise mean flows, Q10 and Q95 along with a number of other parameters about the site, the catchment and the river. These data were captured

and prepared as a GIS point data layer. The other dataset held is the mean daily freshwater flow record from beginning of record to 31/12/1998, which is held as a text file for each station, referenced via the gauging station GIS layer.

3. Sea Lochs

3.1 CHANGES IN SEA LOCH STRATIFICATION AND FLUSHING

The primary data source for this metric was the report 'Scottish Sea Lochs - A Catalogue' published in 1986 by the Dunstaffnage Marine Research Laboratory (Edwards and Sharples, 1986). This report was kindly provided to the Project Team by the main author, Dr Anton Edwards. The pages containing tabulated data were processed using optical character recognition software to produce text files of the data. A visual basic routine was developed to cleanse and compile the data into a format that could be converted to a spreadsheet using Microsoft Excel. A further process of data QA was manually undertaken to correct any outstanding errors in the data capture process. The relationships between the various parameters contained within the Excel table were explored for trends, as documented within the metric report for Work Package 6b.

4. References

Edwards, A and Sharples, F. 1986. Scottish Sea Lochs: A Catalogue. Report prepared by Dunstaffanage Marine Research Laboratory of the SMBA with support of the Nature Conservancy Council and the Natural Environment Research Council. March 1986.

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