Archaeological Evaluation of Wetlands in the Planarch Area of North West Europe

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CONTENTS

FIGURES

SUMMARY
This report presents the results of studies carried out as part of the European Planarch 2 project (Action 2A) between 2003 and 2005. This action has been concerned with developing improved methods for the archaeological evaluation of wetlands. It has been taken forward by partners from Essex County Council, Kent County Council, the Flemish Institute and the Dutch State Service for Archaeology with the other Planarch partners from France, Wallonia and Germany contributing to the development of a wetland map for the Planarch area. This report comprises summaries of work undertaken by the Planarch partners in Essex, Kent, Flanders and the Netherlands along with six weeks of joint fieldwork where teams from the partner regions worked together. The evaluation methods reported on include walkover survey, field walking, auger survey, test pitting, geophysical survey, deposit modelling, and deposit monitoring (physical & chemical properties) applied to a range of wetland environments. The report considers the present European context for managing the heritage component of wetlands, the value of the wetland resource and the threats upon it. In conclusion it considers how the work of the Planarch partners has developed methods for evaluating wetlands and where future priorities lie.
The full reports for the work summarised in this report can be found on the Planarch website at www.planarch.org.

RÉSUMÉ
Ce rapport présente les résultats d'études effectuées entre 2003 et 2005 dans le cadre du projet Européen Planarch 2 (Action 2A). Cette action 2A avait pour but de développer des méthodes d'évaluation archéologique améliorées et adaptées aux zones humides. L'action a été prise en charge par les partenaires suivants : Essex County Council, Kent County Council, le 'Vlaams Instituut voor het Onroerend Erfgoed' et le 'Rijksdienst voor Oudheidkundig Bodemonderzoek' en collaboration étroite avec les autres partenaires Planarch comme la France, la Wallonie et l'Allemagne en ce qui concerne l'élaboration d'une carte représentant les zones humides dans l'aire Planarch.
Ce rapport contient les résumés des études effectuées par les partenaires Planarch d'Essex, Kent, Flandres et les Pays-Bas avec les résultats de six semaines de travail commun. Les méthodes d'évaluation présentées sont : la prospection de surface à différentes échelles, la prospection à la tarière, des fouilles-test, la prospection géophysique et l'étude des dépôts sédimentaires concentrée sur les caractéristiques physiques et chimiques. Ces méthodes sont appliquées à une variété d'environnements humides.
Le rapport considère le contexte Européen actuel en relation avec la gestion du patrimoine dans les zones humides, la valeur des zones humides et les menaces sur les zones humides. En guise de conclusion le rapport considère le développement des méthodes d'évaluation archéologique des zones humides par les partenaires Planarch et les priorités futures.
Les rapports entiers- en résumé dans ce rapport - peuvent être consultés sur le site internet suivant : www.planarch.org.

ZUSAMMENFASSUNG
Dieser Bericht präsentiert Arbeitsergebnisse, die als Teil des europäischen Planarch 2 Projektes (Aktion 2A) zwischen 2003 und 2005 erstellt wurden. Die Aktion 2A hatte die Optimierung archäologischer Bewertungsmethoden in Hinblick auf Feuchtgebiete zum Ziel. Involviert waren Partner von Essex County Council und Kent County Council, dem Vlaams Instituut voor het Onroerend Erfgoed aus Belgien und dem Rijksdienst voor Oudheidkundig Bodemonderzoek aus den Niederanden. Planarch Partner aus Frankreich, Wallonie und Deutschland leisteten hierzu Beiträge zur Entwicklung einer Landkarte, die alle Feuchtgebiete innerhalb des Planarch Gebietes aufzeigt. Der Bericht enthält Zusammenfassungen der lokalen Projekte, die von den Planarch Partnern in Essex, Kent, Flandern und den Niederlanden ausgeführt wurden sowie die Ergebnisse einer sechswöchigen gemeinsamen Feldarbeit, bei der die Teams der verschiedenen Partnerregionen zusammenarbeiteten. Die aufgeführten Bewertungsmethoden umfassen Gutachten zu Übersichts- und systematischen Begehungen mit Fundaufsammlung, Bohrungen und „testpits" (kleine Sondagen) sowie einen Bericht über die geophysikalischen Untersuchungen

und eine Studie zu sedimentären Ablagerungen und deren physische und chemische Eigenschaften.
Der Bericht betrachtet die europäische Gesetzgebung in Hinblick auf den Schutz und die Pflege von Feuchtgebieten und diskutiert die Bedeutung derartiger Gebiete als kulturelles Erbe und die Gefahren, denen sie ausgesetzt sind. Zum Schluß wird darauf eingegangen, in welcher Form die Arbeit der Planarch Partner Methoden bereitgestellt hat, um Feuchtgebiete zu beurteilen und wo zukünftige Prioritäten liegen.
Alle ungekürzten Berichte, die hier zusammengefaßt wurden, sind auf der Website von Planarch www.planarch.org zu finden.

SAMENVATTING
Dit rapport stelt de resultaten voor van de tussen 2003 en 2005 in het kader van het Europese Planarch 2 project (Actie 2A) uitgevoerde studies. Actie 2A was gericht op het verder ontwikkelen van aangepaste methoden om natte gebieden archeologisch te evalueren. Het project werd gedragen door Essex County Council, Kent County Council, het Vlaams Instituut voor het Onroerend Erfgoed en de Rijksdienst voor Oudheidkundig Bodemonderzoek samen met partners uit Frankrijk, Wallonië en Duitsland die bijdroegen tot het realiseren van een kaart met de natte gebieden in de Planarch regio.
Dit rapport bevat de samenvattingen van het werk ondernomen door de Planarch partners in Essex, Kent, Vlaanderen en Nederland samen met resultaten van 6 weken gemeenschappelijk veldwerk.
De evaluatiemethoden waarover bericht werd zijn veldkartering in zijn diverse intensiteiten, prospectie via boringen, uitgraven van testputjes, geofysische prospectie en het doorlichten van afzettingen met betrekking tot fysische en chemische eigenschappen toegepast op een variatie aan natte gebieden.
Het rapport brengt de huidige Europese context voor het beheer van de erfgoedcomponenten van natte gebieden in kaart evenals de waarde van en de bedreigingen ten aanzien van natte gebieden. Bij wijze van besluit presenteert het rapport hoe het werk van de Planarch partners methoden heeft ontwikkeld voor de evaluatie van natte gebieden en waar zich de prioriteiten voor de toekomst bevinden.
De integrale teksten van de rapporten samengevat in dit rapport kunnen gevonden worden op de Planarch website op het volgende adres: www.planarch.org.

1. INTRODUCTION

This report presents the results of work undertaken as part of the European Planarch 2 project, Action 2A – ***The Archaeological Evaluation of Wetlands***. Planarch is a European partnership, bringing together 8 organisations across Belgium, France, Germany, the Netherlands and the UK with major involvement in protecting the historic environment and particularly archaeological heritage. The Planarch 2 project partners comprise:
Kent County Council (UK) Lead Partner
Essex County Council (UK)
Rijksdienst voor het Oudheidkundig Bodemonderzoek – ROB (Ne)
Vlaams Instituut voor het Onroerend Erfgoed – VIOE (Be)
Universiteit Gent (Be)
Ministère de la Région Wallonne –Direction du Hainaut - Service de l'Archéologie (Be)
Institut National de Recherches Archeologiques Preventives – INRAP – (Fr)
Landschaftsverband Rheinland - Rheinisches Amt für Bodendenkmalpflege – RAB – (De)
English Heritage (UK) – Associate Partner
EIA Centre, University of Manchester (UK) – Associate Partner
Provincie West-Vlaanderen (Museum Walraversijde) – (Be)

Planarch 2 is co-funded by the European Regional Development fund through INTERREG IIIB North West Europe (NWE), an EU programme running from 2000-2006 and devoted to stimulating co-operation between Member States in the field of spatial planning and territorial development.

European Cultural Heritage

North West Europe has an immensely rich archaeological heritage which stretches from the appearance of man in the area half a million years ago right up to the present day. This is a truly *transnational heritage*, which for the most part does not recognise the boundaries of modern political geography, but, in the words of the Valetta Convention, is a "source of European collective memory". It is important that the true value of the historic environment is recognised, both for itself and for the social and economic benefits which it can bring to society. NWE is one of the most densely populated areas in the world and today's *development pressures* are putting an immense strain on the historic environment, which is vulnerable to insensitive change. Indeed once the heritage resource has been destroyed it can never be replaced and this places the management of the historic environment at the centre of the *sustainability agenda*.

The Planarch 2 project

Planarch is innovative in probably being the first transnational partnership of this scale to address in an operational way the need for common approaches to common issues. The management of the archaeological heritage presents a number of serious issues and challenges. In particular, because it is not always visible, with remains lying buried waiting to be discovered, early stages of development proposals may fail to recognise the constraints and opportunities which this heritage presents. In considering the archaeological heritage in relation to development, therefore, there is a need to develop techniques which firstly aid the identification of the heritage, secondly enable its value to be assessed and then facilitate its management and promotion. It is important to seek to ensure that the legislative frameworks and instruments (international, national and regional) which embrace the management of the historic environment are being effectively utilised.

The Planarch 2 Actions

Understanding, whether at an academic level or rather in terms of a sensitive feeling of attachment or ownership, is the key to developing and applying appropriate approaches to our historic environment. While understanding informs all our actions there is a cycle of identifying, evaluating, managing and promoting which must underpin any strategy.

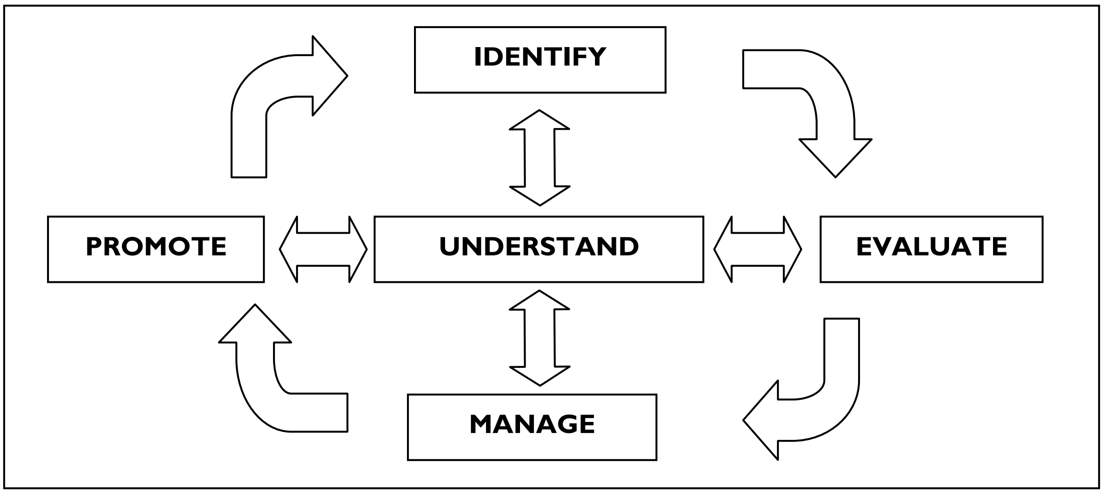

Fig. 1.1: The Planarch Model

Activity Area 2 of the Planarch project concerns the evaluation of the archaeological resource. Evaluation is a key stage in defining the extent, character, condition, sensitivity and value of the historic environment resource. The information obtained through evaluation enhances the ability to effectively manage the historic environment.

The Planarch 2 actions were organised into four Activity Areas.

- *Identifying the archaeological resource* - The partners have been developing common standards, terminology and methodologies for heritage records, which should underpin all decision making
- ***Evaluating the archaeological resource*** **- The partners have been developing cost-effective methodologies for locating archaeological remains and establishing their value. Three pilot projects looked at wetlands (the subject of this report), the use of aerial photographs for evaluating archaeological sites and evaluation strategies for major projects.**
- *Managing the archaeological resource* - The partners have taken forward the integration of archaeology in spatial planning focussing on a review of the historic environment component of Environmental Impact Assessment (EIA) directive. Archaeological and historic environment strategies have been developed for Thames Gateway, Erkenlenz, Mons and Charleroi and a review of the Dutch Belvedere project has been undertaken.
- *Promoting the archaeological resource* - The heritage of the Planarch region and the work of the Planarch project will be communicated via a website in English, French, Dutch/Flemish and German

Planarch 2 Action 2A - The Archaeological Evaluation of Wetlands

Action 2a is focussed on the archaeological evaluation of wetlands, particularly the coastal wetlands of North West Europe (NWE). These extant and former wetlands contain a finite and non-renewable archaeological resource of considerable significance, highly vulnerable to damage and destruction. Wetlands can, however, be difficult to evaluate; archaeological remains may be located below depths of overburden and alluvium (in the case of reclaimed wetlands), deposits may be waterlogged and the physical environment in the intertidal zone is both dynamic and potentially dangerous. The focus of Action 2a has been to develop methodologies to meet these challenges.

Action 2a has involved Planarch partners in Essex (ECC), Flanders (VIOE), Kent (KCC) and the Netherlands (ROB) and has been taken forward primarily through a number of periods of joint fieldworking on projects in the partner regions. The partner teams who have taken part have included a wide range of professional archaeologists with a variety of areas of expertise such as planning archaeologists, field archaeologists, geoarchaeologists, geophysicists and records officers. This has been crucial in stimulating a discussion on the range of techniques utilised by the partners and their implications throughout the evaluation process. The Planarch 2 project has gone a considerable way in developing recommendations for common methodologies in wetland evaluation.

Essex and Kent County Councils are Local Public Authorities with responsibilities for heritage management in their respective counties. The Flemish Institute (VIOE) is responsible for carrying out, amongst other tasks, management orientated research in Flanders and the Dutch State Service (ROB) is presently the National Public Authority with responsibility for heritage management in the Netherlands.

Definition of wetlands

Wetlands have been defined by archaeologists as:
'any area of land covered by water for part of each year, or of each day, or which has been drowned by water at any time in its existence' (Coles, 1984, p1).

Wetland has been defined as land that is predominantly saturated with water. This can include: marshes (active and reclaimed), peatlands, lake margins, river floodplains, estuaries, coastal margins and lagoons. These are primarily depositional landscapes, although subject to erosion. They can be composed of a wide range of deposit types in successive layers, for examples sands, silts, marls, organic mud and peat. (Coles, 2001,1).

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Fig 1.2: The Action 2A Planarch fieldwork Partners

Heritage value of wetlands

"The heritage value of wetlands is outstanding…" (Coles 2001, 1)

The significance of wetland archaeology lies in the preservation of a wide range of organic materials, both natural and cultural, which would not usually be preserved on dry-land sites. Wetlands can contain unique, valuable, and irreplaceable information about environmental and climatic change and which provide a base line from which we may be able to extrapolate the consequences of continuing change in the future. They can also provide information on human activity and its impact on the wider landscape. Wetlands have been valuable resources for human populations throughout history, to be exploited and adapted.

The nature of the resource

The modern coastline does not conform to that of its earlier precursors; dry land once extended into what is now the marine zone and has been submerged as sea level has risen. On a more local scale, soft coastlines change through erosion and deposition of sediments. There are now archaeological sites in the coastal zone which were originally dry-land sites; for example remains of the medieval village of Walraversijde were visible on the beach near Oostende until 1978, and have subsequently been buried below sand as a result of the construction of breakwaters in the area. Other dryland sites include the Neolithic settlement at The Stumble in Essex, now submerged below 2-3m of water every high tide. Conversely, as a result of reclamation, remains associated with wetland exploitation, for example salterns, can be found landward of the modern coastline. Many coastal marshes have been embanked and drained so that former wetlands are now seasonally dry and agriculturally productive allowing soils to develop and wetland characteristics to be masked.

Pressures on the resource

The wetland archaeological resource is vulnerable to a wide range of pressures. These include increasing development in and around the coastal zone associated with industry, tourism and re-generation. Natural erosive processes, coastal squeeze and increased storminess in the North Sea basin can all impact on fragile archaeological remains. The response to these natural pressures, particularly the development of coastal defence strategies, may also impact on the historic environment. In reclaimed areas changes in hydrology can result in the desiccation of deposits containing organic and palaeo-environmental material. An understanding of the wetland archaeological resource, through the process of identification and evaluation, is crucial to allow strategies to be developed to respond to these issues.

Legislative framework

The legislative framework that applies to wetlands is complex and constantly changing, with international, European and national elements, covering a wide range of interconnected subjects. There are a number of treaties that provide for the designation and protection of wetlands that focus on the protection of habitats to ensure the survival of a wide range of values, including archaeological ones. There is also a wide range of legislation relating specifically to the designation and protection of the historic environment, for example the European Convention on the Protection of the Archaeological Heritage (Revised), signed at Valetta in 1992. Legislation and policies within the partner regions also deal with designation and protection at a national level, including the place of the historic environment within the planning framework. Marsden (2001) notes the following:

Directives

- The European Directive 79/409 on the Conservation of Wild Birds, 1979
- The European Directive 85/337 on the Environmental Impact Assessment of Certain Public and Private Projects, 1985 (as amended by Dir. 97/11, 1997)
- The European Directive 92/43 on the Conservation of Natural Habitat and of Flora and Fauna, 1992 (as amended by Commission Decision 97/266/EC and Council Directive 97/62/EC)

Conventions

- The Convention on Wetlands of International Importance, 1971 (Ramsar)
- The Convention for the Protection of the World Cultural and Natural Heritage, 1972 (World Heritage, UNESCO)
- The Convention on the Conservation of European Wildlife and Natural Habitats, 1979 (Berne)
- The Convention on Environmental Impact Assessment in a Transboundary Context, 1991 (Espoo)
- The Convention on the Protection and Use of Transboundary Watercourses and Lakes, 1992 (Helsinki)
- The United Nations Convention on Biological Diversity, 1992 (Rio)
- The European Convention on the Protection of the Archaeological Heritage, 1992 (Valletta)
- The European Landscape Convention, 2000, (Florence)
- The Convention for the protection of the marine environment of the North East Atlantic – OSPAR Convention, 1992 (Paris)

National policy frameworks

In England, English Heritage is the lead national body for the historic environment and the Government's statutory advisor, a remit that now includes English coastal waters. The body is responsible for guardianship of major national monuments and operates the procedures relating to designated sites (Scheduled Monuments and Listed Buildings). Relevant national legislation relating to the historic environment in England includes:

- Ancient Monuments and Archaeological Areas Act 1979
- National Heritage Act 2002

English Heritage has prepared two relevant policy documents: *English Heritage Strategy for Wetlands* (2002) setting out its policies in relation to wetlands and *Coastal Defence and the Historic Environment English Heritage Guidance* (2003)setting out guidance for coastal defence works (see below).

Nationally designated sites make up only a small proportion of recorded sites (English Heritage 2003, 4). Provision for the protection of the remainder has come about through planning and development legislation. The Town and Country Planning Act (1990) is the principal legislation for land-use planning, supported by Planning Policy Guidance notes 15 and 16, which emphasise the need to protect the historic environment, whether designated or not. County Councils generally provide an archaeological service at this level, advising on planning matters and maintaining historic Environment/Sites and Monuments Records (non-statutory inventories). Statutory Authorities undertake 'development' outside the planning system following certain Codes of Practice relating to the historic environment along the lines of PPG 15 and 16.

In Flanders the leading body concerned with managing (including scheduling) historic monuments, landscapes and archaeological sites at the regional level is the 'RO Vlaanderen, entiteit Onroerend Erfgoed' (Flemish Town and Country Planning Heritage body: formerly the Division of Monuments, Landscapes and Archaeology). By government order this body is charged with preparing and implementing policies at an administrative and judicial, as well as other levels. The 'Vlaams Instituut voor het Onroerend Erfgoed' (Flemish Heritage Institute) (formerly the Institute for the Archaeological Heritage) is responsible for the study and the policy underpinning those studies of the so-called immoveable heritage. This comprises historic monuments, landscapes and archaeological sites. The VIOE is also responsible for the systematic safeguarding and diffusion of existing information to the public at all levels (professionals, students (primary schools to universities) and the general public).

In the Netherlands the National Service for Archaeological Heritage (ROB) implements the Monuments and Historic Buildings Act on behalf of the Minister of Education, Culture and Science (OCW). In the case of the Broekpolder, the ROB's task is to define the conditions that the development of the park must meet in order to allow the archaeological remains to survive intact.

Coastal Defence

The issues faced in the coastal zones around the European Union are complex, often affecting more than one country, and are influenced by policies relating to a wide range of subjects such as nature conservation and agriculture. The European Commission's response to this has been the promotion of Integrated Coastal Zone Management (ICZM), which aims to provide a 'joined-up' approach (European Commission 2001). The historic environment should be integrated within this process.

In the UK coastal defence is the responsibility of the Department for Environment, Food and Rural Affairs (Defra), with defence schemes undertaken by the operating authorities. Long term defence strategy is defined in 'Shoreline Management Plans', which set out preferred defence strategies for sections of coastline. In addition to the SMPs there are smaller scale Strategy Plans. National policy guidance emphasises the need for early consultation in the preparation of such plans to consider the implications for the historic environment (English Heritage 2003). The English Heritage Guidance note 'Coastal Defence and the Historic Environment' provides a good background to coastal defence in the UK and is available for download (www.english-heritage.org.uk, navigate to Maritime Archaeology, Publications). The guidance suggests a three-stage approach in response to proposed coastal defence works: desk-based evaluation, field evaluation and mitigation.

A range of coastal defence types are present along the coastlines of the Planarch partners. These include

- Hard defences; engineered structures such as sea walls, breakwaters and flood embankments
- Soft defences; elements which work with nature, such as dune replenishment

Typically combinations of the two are used, depending on the local conditions.

The building and/or maintenance of hard defences as response to the threats of sea level rise and coastal squeeze is expensive. In low lying areas the development of soft defence solutions, such as beach replenishment, are being considered to supplement or replace hard engineering solutions. This technique was used at Oostende, where protection from a thousand year flood event would require raising the level of the beach by some 4m. Although this has not been carried out the beach has been extended 300m (SAIL). Both hard and soft options have impacts on the historic environment resource.

Soft defence options in the UK include 'managed realignment', setting back the line of defence, and thus creating a buffer of salt marsh or mud flats. As part of Planarch 2 the project team visited a managed realignment site on the Blackwater Estuary, Abbotts Hall, where a number of archaeological sites were located such as red hills, and wooden structures (*www.essexwt.org.uk/Abbotts%20Hall%20Farm/default.html*). This demonstrated the potential impacts of these schemes on the historic environment and clearly demonstrated the need for a sound knowledge base.

Nature Conservation and Agriculture

The coastal wetlands of North West Europe are significant areas in terms of nature conservation. Wetland habitats support a diverse range of plants, invertebrates, vertebrates and water birds. They can be of national and international importance. As with the historic environment the natural environment is under pressure from both natural and anthropogenic factors.

There are numerous designated nature conservation sites within the Planarch partner regions for example sites of international importance as set out in criteria defined by the RAMSAR convention on wetlands (www.ramsar.org). The European Habitats Directive (1992) required EU Member States to create a network of protected wildlife areas. These comprise Special Areas of Conservation (SACs) and Special Protection Areas (SPAs). These designations provide protection of habitats from development, and can therefore indirectly protect the historic environment.

Case studies of RAMSAR sites in the UK have shown that the designation of these sites has provided protection, for example the area of the North Kent Marshes (RAMSAR and SPA), and has played a major role in preventing major development in the area (Bull and Coles 2001, 155). Although RAMSAR sites in the UK are of significant archaeological potential this is under-represented in the management plans of individual sites (Bull and Coles 2001,155).

The sustainable management of the natural environment can have an impact on the historic environment, for example through habitat creation schemes, which may require the excavation of channels and lagoons. There can, however, be positive impacts where management strategies are developed that include the historic environment. For example areas currently under plough can revert to grazing marsh, thus reducing the impact of ploughing on sub-surface archaeological remains and extant features can be used to increase the cultural value of the wider landscape. The sustainable and integrated management of the natural and historic environment is only possible with a comprehensive knowledge base established through the identification and evaluation of the resource. This needs to be promoted beyond the historic environment sector,

"*The forging of co-operation with agencies involved in wetland management and other interested groups is a matter of the highest priority*" (English Heritage Wetlands Strategy 2002)

In Essex positive links have been forged with the Royal Society for the Protection of Birds (RSPB) who have undertaken desk-based and walkover surveys of proposed marshland reserves (Medlycott and Gascoyne 2005). The results of these studies have been used when designing reserves, so that infrastructure that would have an adverse impact on the historic environment (for example lagoons) avoids known areas of interest.

Parts of the former wetlands which fringe the coastline of the Planarch partner regions comprise agricultural land. Agricultural activity, particularly that associated with arable cultivation, can have an impact on below ground archaeological remains. This can include disturbance through ploughing, manuring (leading to acidification), desiccation and oxidisation of organic remains. Unlike the impacts of development that are regulated through spatial planning and development control processes, the options to limit the impact of agriculture are more limited.

The Common Agricultural Policy, established in the early 1960s, emphasised production and intensification of farming, including the ploughing up of areas of former wetlands. Successive attempts to reform the CAP since the 1980s have included measures intended to reduce production and, increasingly, to direct resources to environmental land management measures, so-called agri-environment schemes (www.e-a-a.org/wg2.htm; European Association of Archaeologists). As with the natural environment the establishment of a comprehensive knowledge base through identification and evaluation is essential to ensure that the historic environment is protected as these changes take place.

In the UK in recent years this change in attitude has resulted in the development of Countryside Stewardship and now Environmental Stewardship schemes. These provide funding for effective environmental land management. The criteria applied to the scheme are wide ranging and include issues such as public access, biodiversity and landscape character. One of the primary objectives of the scheme is to:
"*Protect the historic environment and natural resources*" (Department for Environment Food and Rural Affairs 2005). This is a major step forward which will be most effective if based on a sound knowledge base.

Wider management context

In 1999 the *Europae Archaeologie Consilium* (European Archaeological Council) was inaugurated. At its first meeting a symposium was held, in conjunction with WARP (Wetland Archaeological Research Project), which reviewed the heritage management issues and practices across Europe. The papers presented to the symposium, published in 2001 (Coles and Olivier 2001) considered a number of issues, including recommendations and priorities for debate.

In addition the EAC set out a strategy for the Heritage Management of Wetlands (EAC 2001, 185). This is based on 4 main principles (reproduced here in full)

- Promoting cultural heritage management of wetlands in the work of international and intergovernmental agencies
- Promoting practical methods of conservation by developing guidance and best practice for the integration of cultural heritage and nature conservation in wetland management
- Promoting applied research to underpin and inform the management of wetlands
- Promoting and disseminating understanding of the cultural heritage of wetlands through continued programmes of survey and excavation as an essential precondition for the development of successful management policies

The work of the Planarch project clearly has direct relevance to these main principles, considering the development of best practice, applied research and carrying out fieldwork programmes.

The *Schéma d'Aménagement Intègre du Littoral* (SAIL) is an Interreg IIIb project which is also looking at issues relating to the coastal zone of north-west Europe. This project comprises a transnational partnership of coastal authorites and maritime agencies that aim to encourage and promote widespread participation in policy formation (www.sailcoast.org). The broad themes of the SAIL project are:

- Raising awareness
- Managing information
- Strategic Planning
- Enhancing Natural Areas

The work of the Planarch project will contribute to these four broad themse by providing an improved knowledge base. The Planarch project team has also continued its links with SAIL, particularly with the Thames Estuary Partnership (www.thamesweb.com), Medway Swale Partnership (www.medway-swale.org.uk) and the Blackwater Project (www.blackwaterproject.co.uk).

The Planarch 2 Action 2A Projects

A range of archaeological evaluation techniques have been applied during the course of Planarch 2, Action 2A. These include

- Rapid Coastal Zone Assessment Survey (walkover survey)
- Fieldwalking
- Auger survey and test pitting
- Geophysical survey
- Deposit modelling (geophysics and boreholes)
- Deposit monitoring (physical & chemical properties)

The work carried out as part of Planarch 2 follows work carried out in Planarch 1 which focussed on the identification of the wetland resource through the use of desk-based assessment and rapid coastal zone assessment survey (eg. Heppell 2001; Wessex Archaeology 2000, 2002).

Some of the techniques utilised by the Action 2a project team are also being studied within the other strands of Planarch 2, particularly the use of fieldwalking (Action 2C: Archaeological Evaluation in a Rural Context). The land-based use of some evaluation techniques was also assessed as part of *Evaluation of Archaeological Decision-making Processes and Sampling Strategies* (Hey and Lacey 2001), a Planarch 1 study that has had a significant impact on the evaluation techniques applied as part of the planning process in the UK.

The results of the studies carried out as part of this action will also be fed into Action 3 of Planarch 2, 'Managing the Archaeological Resource', in particular the strand relating to archaeological management strategies (Actions 3B & 3C). In the Thames Gateway, an area designated by the UK government for regeneration, Kent and Essex County Council archaeologists are developing a strategy that characterises the historic environment and can be utilised to inform the planning process. The Thames Gateway lies on either side of the river and includes areas of both extant and former wetland. The studies carried out as part of Planarch 1 and 2 have contributed to this study by providing data on the archaeological resource in the area.

As part of the Planarch 2 programme fieldwork has been carried out in three areas

- The Stumble, Blackwater Estuary, Essex (ECC)
- The Flemish Polders (VIOE)
- The North Kent Coast (KCC)

The Dutch National Service for Archaeological Heritage (ROB) has also been involved in this action, providing a study on *in situ* monitoring of wetland sites in the Netherlands and taking part in the fieldwork in the other areas.

The project areas represent a range of environments, covering both extant and former wetlands. The evaluation techniques applied have been varied, partially in response to the physical characteristics of the project areas. The variety of evaluation techniques applied also reflects the differing aims and objectives of the specific projects.

The Stumble, Blackwater Estuary, Essex

The Stumble is an area of intertidal mudflats located in the Blackwater Estuary, Essex. The area is the site of prehistoric, particularly Neolithic, activity on an old land surface, areas of which were exposed on the mudflats. Sea level rise now means that The Stumble, the site of former dry land settlements, lies below some 3m of water at each high tide. Previous survey work had been carried out in the 1980s as part of the 'Hullbridge Survey' an extensive survey of the Essex coast (Wilkinson and Murphy 1995). This included fieldwalking (in this instance perhaps better described as mud flat walking), hand auger survey, test pit survey and excavation of selected areas.

Between 2001 and 2004 a number of sites which had been identified in the 1980s, including The Stumble, were the subject of a monitoring survey (Heppell 2004). This survey established that further areas of the old land surface were exposed, with associated artefact scatters, in areas where no material had previously been recovered. A programme of further work at The Stumble was therefore proposed in order to understand better the existing nature of the site and potentially develop more predictive models to identify the most vulnerable areas. It was also an opportunity to assess the potential uses of land based techniques in an intertidal environment. These included grid-based fieldwalking, hand auger survey and test pitting.

The results of the Essex study are presented below (see chapter 3.1)

The Flemish Polders

The VIOE are carrying out extensive non-intrusive survey of the Flemish Polders between Oostende and Nieuwpoort, on the Flemish coast. This area is located partly on the former 'coastal island' Testerep (westerly stretch of land) which runs along the present day coastline. The coastal plain formerly comprised natural wetland, crossed by large tidal channels. Protection from flooding, through the use of dikes, commenced in the 10th century. By the latter part of the 12th century the channels had been dammed and the land reclaimed. Settlement focussed along the tidal gullies, for example Walraversijde, and villages and farmsteads situated on higher ground within the coastal plain itself, for example the terp settlement at Leffinge. The modern polder landscape is primarily agricultural, with portions under arable cultivation. The VIOE is carrying out a long-term project to identify the extent of the archaeological resource in the polders where little previous work has been carried out. The project area is large and as such the evaluation techniques applied needed to be rapid, non-intrusive and cost effective. The project has used a staged approach, starting with non-gridded (linewallking) fieldwalking of ploughed fields and will in time be extended across all of the polders. In the Planarch survey area, this approach has identified areas that are of archaeological interest, along with a preliminary indication of date. This has been followed by grid-based fieldwalking and geophysical surveys in areas of particular interest to define better their extents and character. The results of the Flemish study are presented below (see chapter 3.2).

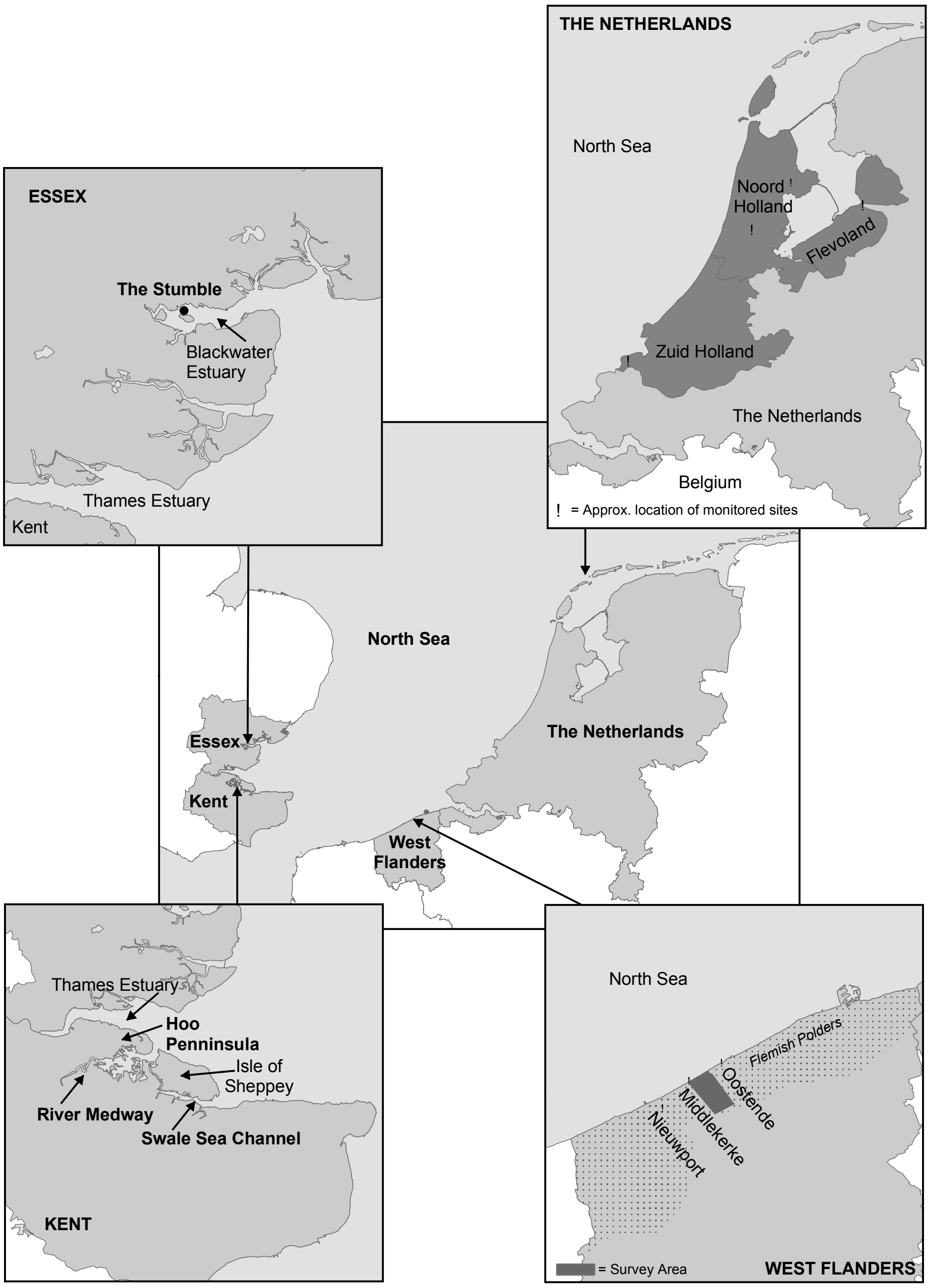


Fig 1.2 The Planarch Action 2A Projects

The North Kent Coast

Two projects are being undertaken on the North Kent Coast: Rapid Coastal Zone Assessment Survey (RCZAS) in the Thames and Medway estuaries and Swale sea channel, and pilot deposit modelling on the Hoo Peninsula.

The north Kent coast stretches from the River Darent in the west to North Foreland in the east. It includes numerous islands and is highly indented. For large sections of the coast, vast areas of intertidal mudflats are exposed at ebb tides. The edges of the Thames and Medway estuaries are fringed with saltmarsh and reclaimed grazing marsh. Maps of the Medway estuary showing the different environments can be found at www.medway-swale.org/pages/atlas.htm.

The north Kent coast is known to be of great archaeological interest; sites and finds of most periods ranging from the prehistoric to the present day have been found in and around the estuaries. The physical nature of the environment has, however, meant that the numerous small islands and most of the intertidal zone have not been subject to systematic archaeological survey. A pilot Rapid Coastal Zone Assessment Survey of the north Kent coast was therefore initiated in 1999, with support from English Heritage and Interreg IIB, and carried out by Wessex Archaeology. A methodology of checking, updating and creating new records digitally in the field was developed in the early years of the survey and refined in subsequent years. A boat based survey methodology was first attempted in 2003 and further improved in 2004, forming an element of the Planarch 2 joint team working.

On the north bank of the River Medway lies the Hoo Peninsula, a spur of land between the Thames and Medway estuaries, with the former Isle of Grain at its tip. Much of the Hoo peninsula is low-lying grazing marsh, with extensive mudflats around its coast. A pilot deposit modelling study has been carried out using data from development-led archaeological work and new fieldwork. The new fieldwork comprised geophysical survey and selective borehole survey at Binney Farm, at the north end of the peninsula. The aim of the study was to understand better the complex Quaternary and Holocene geology of the area in order to improve predictions of where significant archaeological remains might be present. This pilot project has tested the effectiveness of the techniques for developing a deposit model rapidly and cost-effectively.

The results of the Kent studies are presented below (see chapter 3.3)

Monitoring of archaeological wetlands in the Netherlands

Large areas of pre- and protohistoric wetlands in the Netherlands are under both agricultural and urban pressures. Most of these former wetlands are diked, with controlled water levels. In response to a growing awareness of the threats to the archaeological resource the National Service for Archaeological Heritage has been carrying out a series of monitoring projects in the coastal area of the western Netherlands. These have established baseline measurements on a group of manmade landscapes with a long history of human occupation, with a significant organic component. These sites have been monitored using a range of scientific techniques. The projects will assist in developing methods and standards relating quality to preservation potential and burial environment. This will allow archaeologists to provide better advice on a site's future prospects, mitigation measures and preservation *in situ*.

The results of the Dutch study are presented below (see chapter 3.4)

2. WETLAND MAP FOR NORTH WEST EUROPE

K Cousserier

Introduction

As part of the Planarch 2, Action 2A, a digital wetlands map for NWE was developed as one of the common outputs of the project. The map defines the different types of wetlands in the partner regions. The Planarch 2 partners in Essex, Kent, the Netherlands and Flanders have significant wetland areas and it has been recognised, both within the partnership and more widely, that these need approaches tailored to the specific characteristics of these low lying areas. Wetlands constitute significant areas in each of the different partner regions. In Flanders they constitute about 14% of the total area and in the Netherlands over half of the country may be considered as wetlands.

The discussions between the Planarch partners established that the broad definition of wetlands was similar and could in general terms be separated into three main groupings

- Active wetlands (eg coastal marshes)
- Former wetland (reclaimed or drained marshes)
- River related wetlands (eg river floodplains)

It became clear, however, that how such areas were mapped in each of the partner regions differed, with the available data that could be used to define these areas coming from non-archaeological sources, for example nature conservation bodies, planning maps and soil mapping. This made comparisons between the partner regions difficult and hampered the goal of bringing the different criteria into one coherent classification. Following evaluation of the different wetland classifications, it was agreed amongst the partners to divide the wetlands into 3 classes:

- areas below 5m (reclaimed and drained wetland)
- active wetlands
- river-related wetlands.

This classification contains sufficient detail to allow the specifics of the different types of wetland to be taken into account, and allows a synthetic view of the wetlands in the Planarch 2 region to be understood.

Development of the map

Certain technical problems were encountered primarily related to the use of software (Arcview 3.2) and the fact that the project encompassed several countries. As stated above, problems of content resulted mainly from the different ways in which wetlands were classified in the different regions (below 5m, indicative tidal, existing wetlands, active wetlands, polders, foreshore, coast, etc). The solution of dividing the wetlands into 3 main types provides apparent uniformity, but masks differences related to the different sources used to elaborate regional or country specific maps. For example in Flanders, the soil map and the atlas of landscapes were used. As well as issues related to content, Planarch partners experienced various technical issues. Essex, Kent, Rhineland, Wallonia and Flanders have digital information in shapefile format, but this was not the case for Nord/Pas-de-Calais, where a printed soil map was scanned, geo-referenced and transformed into a shapefile. The geo-referencing was difficult and time consuming. As a result the information from Nord/Pas-de-Calais is less detailed. This was also the case in the Netherlands, where there was no digital data for the areas below 5m. Here, data was only available for the 2m and 10m levels. It was decided, following testing that the difference between the 2m and 5m level was relatively small and so the 2m level was put onto the map rather than the geo-referenced but less precise 5m level. There was no shapefile available for active wetlands in the Netherlands either, so it was added by staff at VIOE who scanned the areas seaward of the dikes from soil maps and these were defined as 'active wetlands'.

The different shapefiles were difficult to combine on one map. For each partner a different projection had to be specified to allow the integration of the cartographic data into one document.

This conversion of the different cartographic data to one projection was possible through Arcview, with the exception of the files from the Netherlands. The Dutch co-ordinate system is not at present integrated into the Arcview Projection Utility Manager (the extension to Arcview) and this had to be achieved by using ArcGis 8.3.

One of the problems that could not be resolved, was the difference in detail relating to certain information layers. For example, the river network in Flanders and Wallonia could be mapped with detailed information but for the Netherlands, only the most important branches of the river network were available.

Data per partner

Each partner provided data, an overview of which is presented here along with the classes into which the data were converted. The data was not necessarily readily available from archaeological sources, so information from elsewhere was utilised.

Kent:
- 2002 fluvial → river-related wetlands
- Foreshore → active wetlands
- 2002 tidal → wetlands below 5m

Essex:
- River-floodplains → river-related wetlands
- Existing wetlands → active wetlands
- Below 5m → wetlands below 5m

Flanders:
- Alluvial areas → river-related wetlands
- The Zwin natural reserve → active wetlands
- Polders → wetlands below 5m

The Netherlands:
- River or stream valleys → river-related wetlands
- Areas beyond dikes → active wetlands
- Below 2m (+ rectification) → wetlands below 5m

Wallonia:
- Alluvial areas → river-related wetlands

Rhineland:
- River-related wetlands → river-related wetlands

Nord/Pas-de-Calais:
- Zones along rivers → river-related wetlands
- Polders → wetlands below 5m

Final results

The project has resulted in a series of maps including one general map with data from all the partners and separates detailed local maps for each Action 2a partner on a larger scale: Kent, Essex, Flanders, The Netherlands and Nord/Pas de Calais. The detailed maps have been included in this report (Figs 2.1 to 2.5)

The creation of the wetlands maps, with classes of wetlands that have been applied across the partner regions, has enabled us to calculate the percentage of the regions which can be defined as wetlands:

- Netherlands: 58%
- Kent: 19%
- Essex: 17%
- Flanders: 14.5%
- Nord/Pas-de-Calais: 9.5%
- Wallonia: 4%
- Rhineland: 3%

Conclusions

The work of developing the Planarch North West European wetlands map has been important in recognising a number of issues about working on a trans-national project relating to heritage management and spatial planning. At the level of organisation represented by the Planarch partnership (state heritage bodies, local authorities etc) it has proven difficult to find common definitions and technical specifications for digital data relating to wetlands. This is significant as it is clear from the map finally produced that wetlands constitute a significant amount of the total Planarch 2 area. These are areas of high heritage potential and require detailed management. If this is to be achieved at a European scale where direct comparisons can be made, shared maps of this nature will play an increasingly important role.

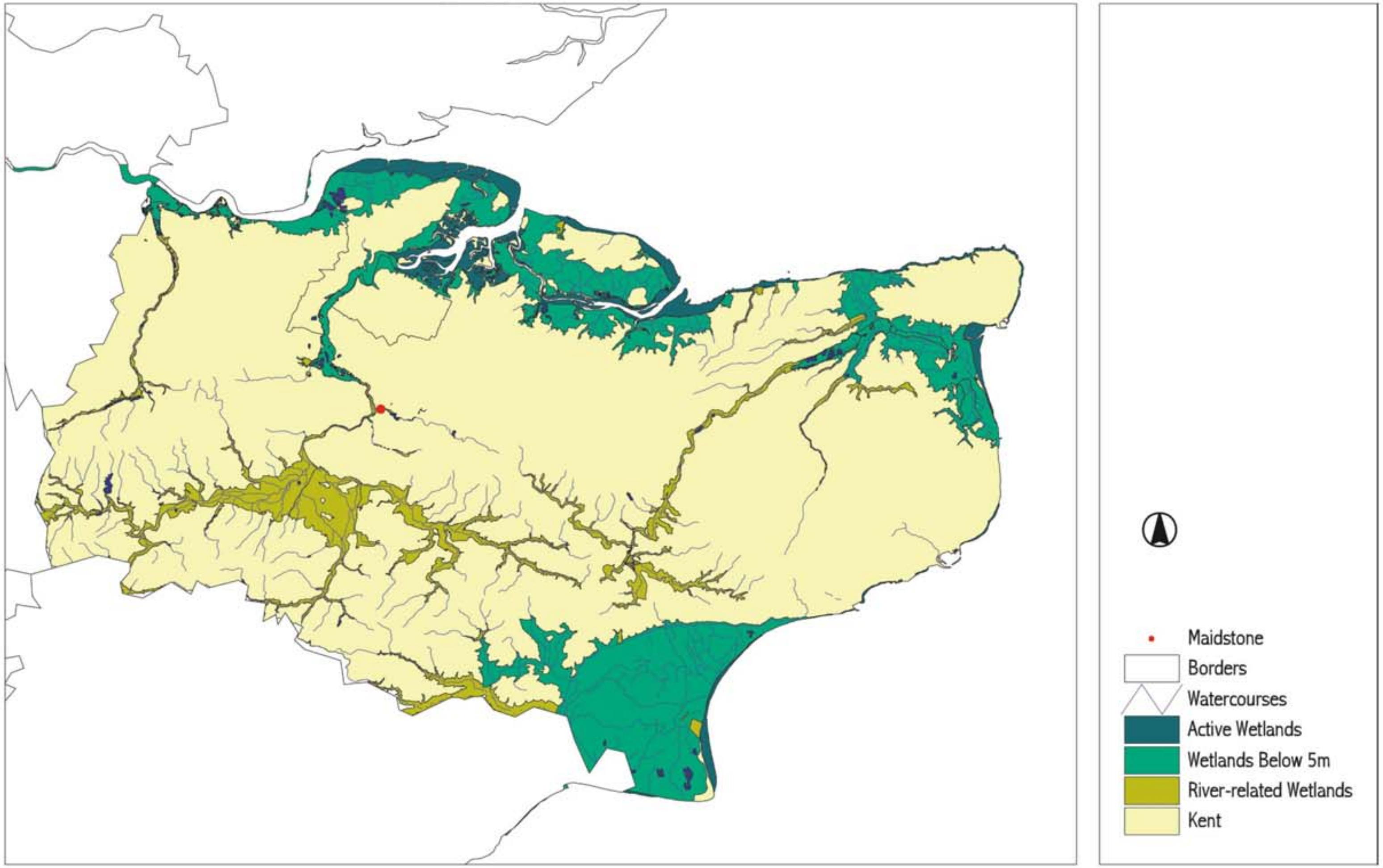


Fig 2.1 Kent wetlands

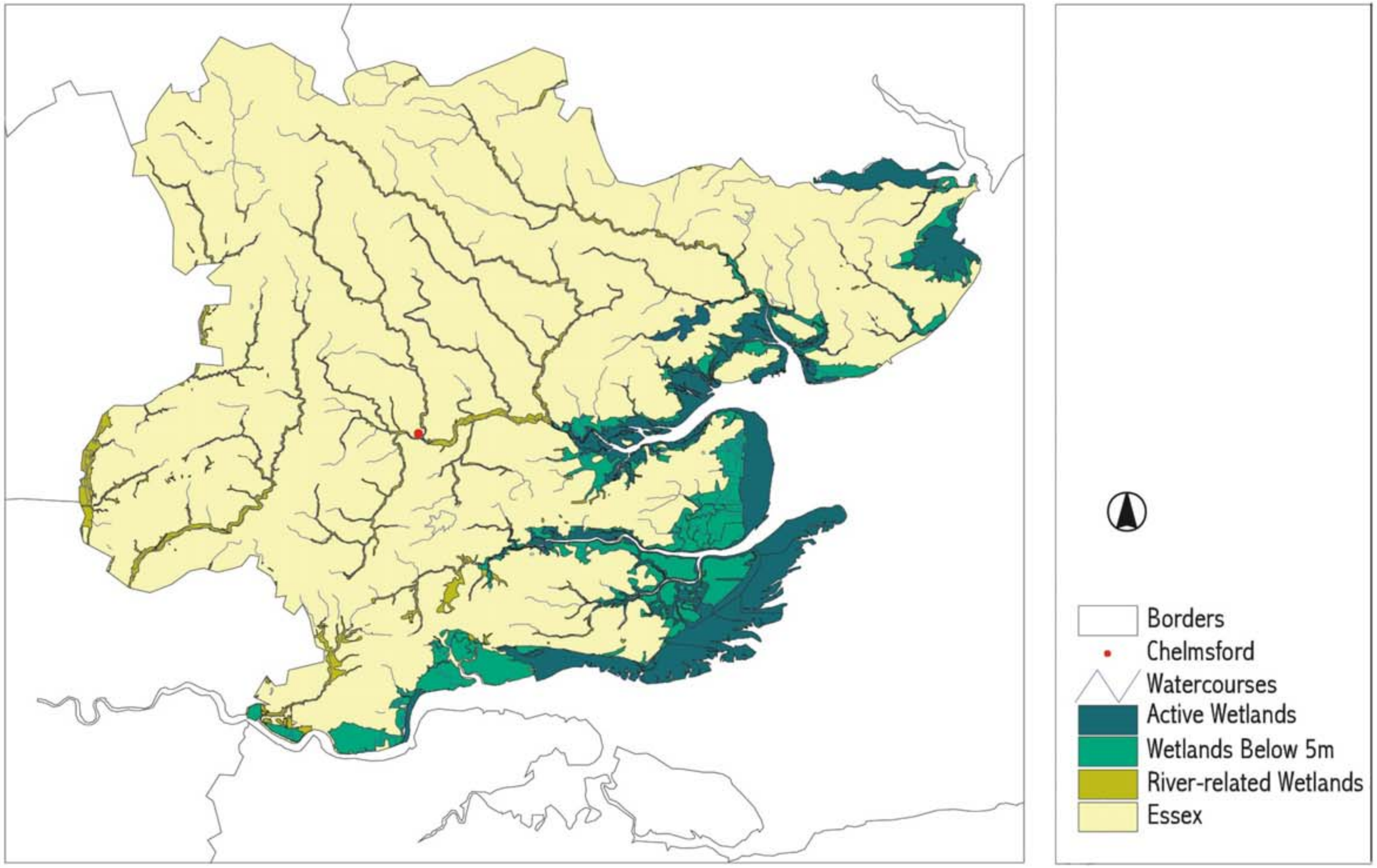


Fig 2.2 Essex wetlands

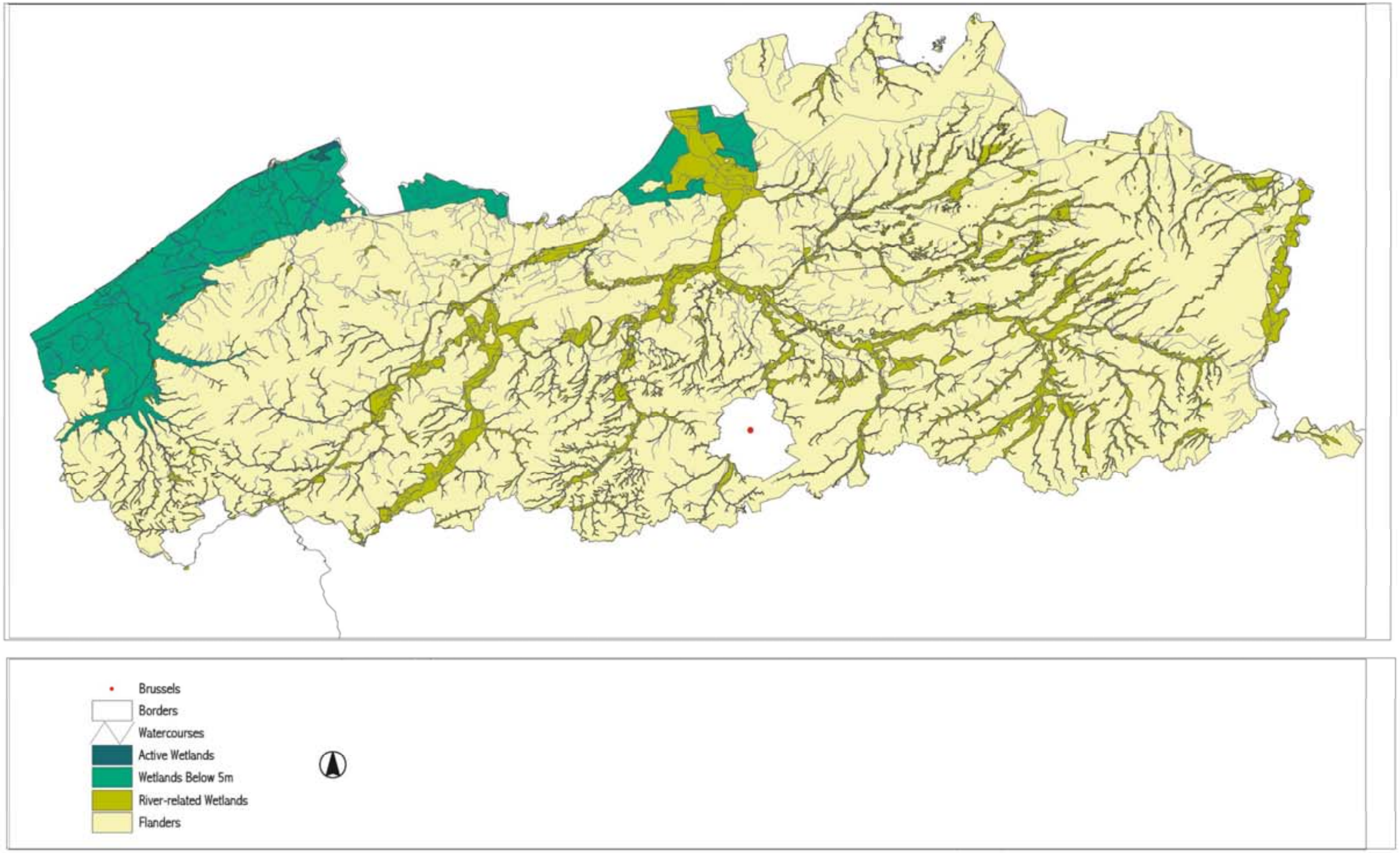


Fig 2.3 Flemish wetlands

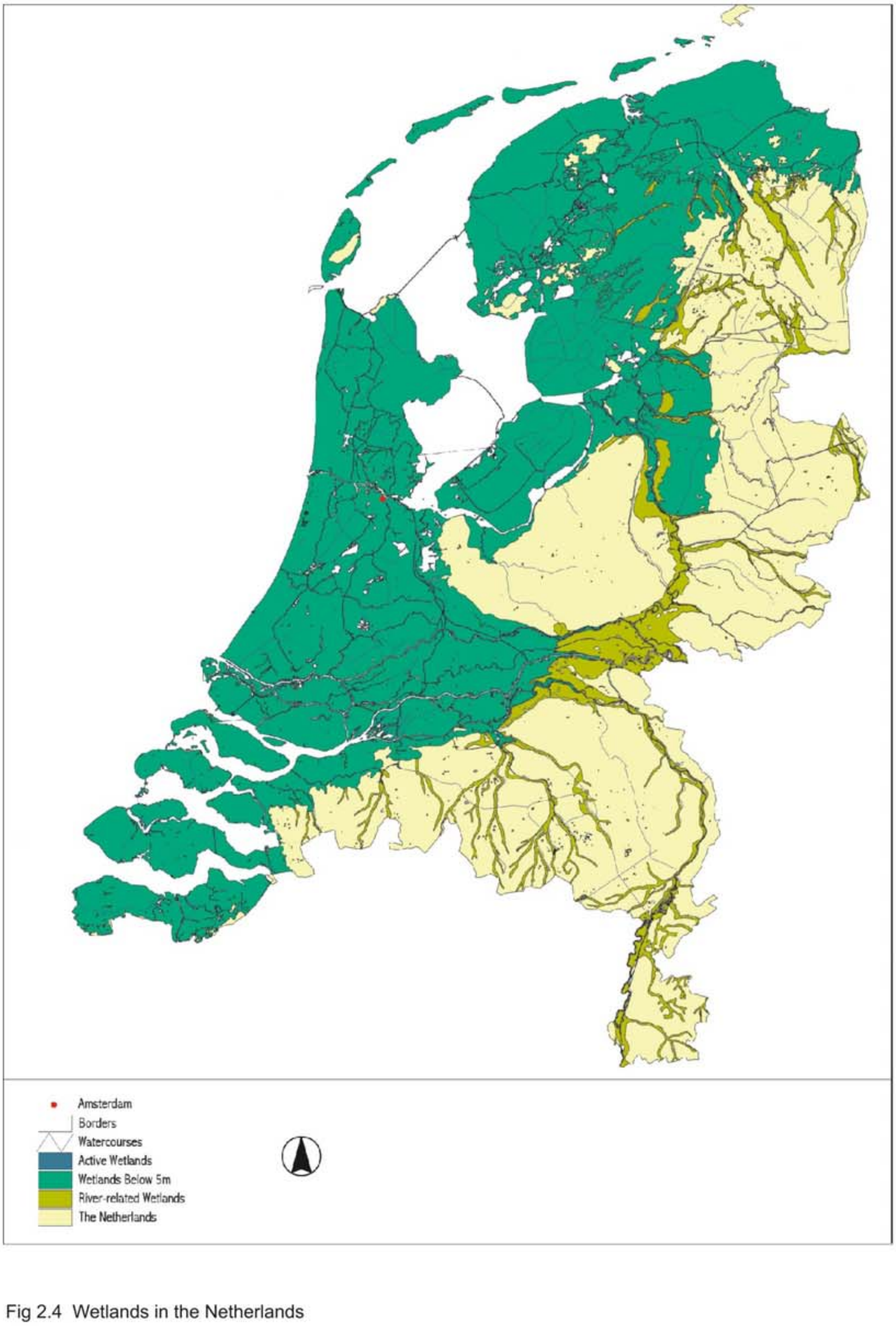


Fig 2.4 Wetlands in the Netherlands

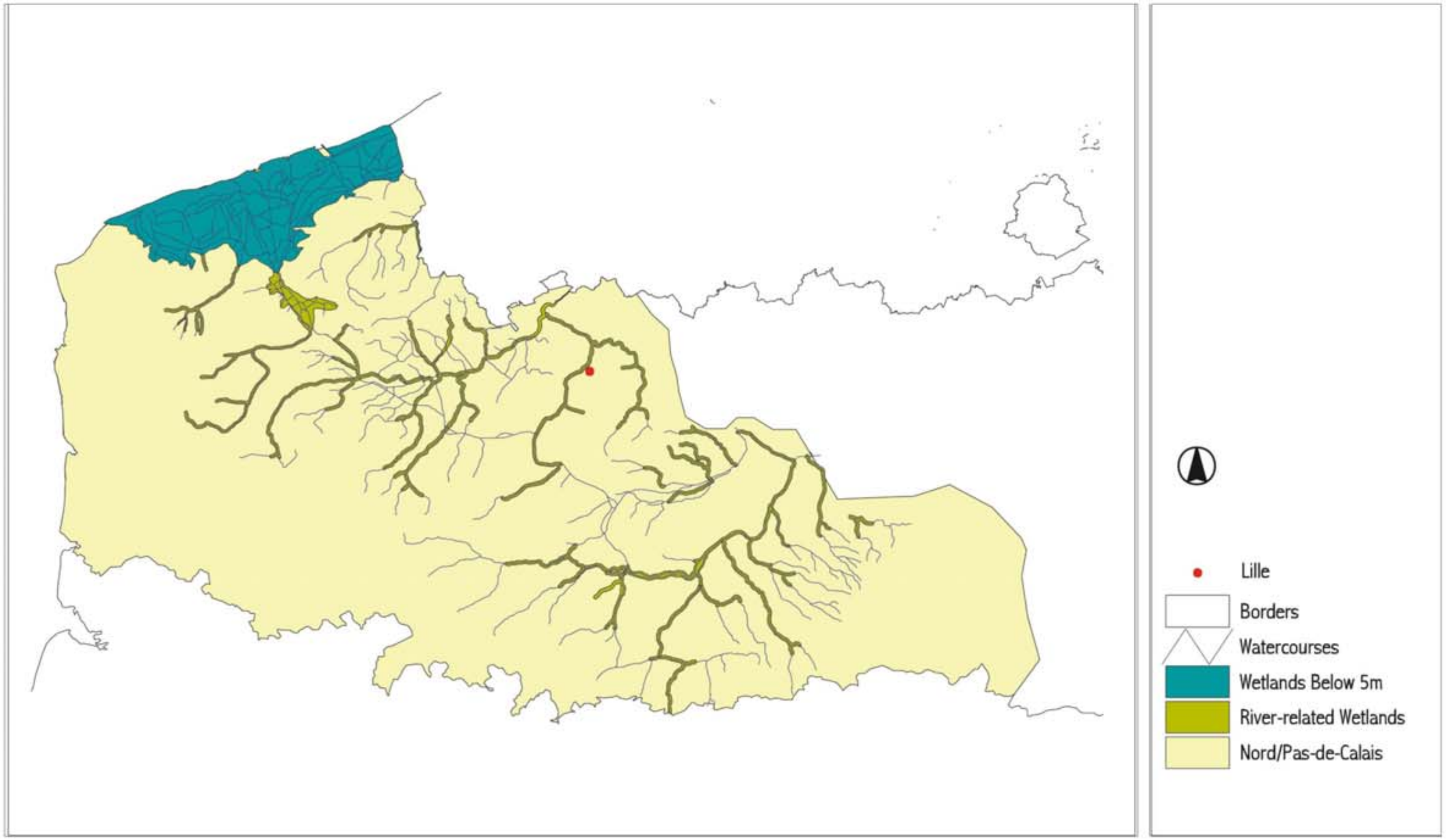


Fig 2.5 Wetlands in Nord/Pas de Calais

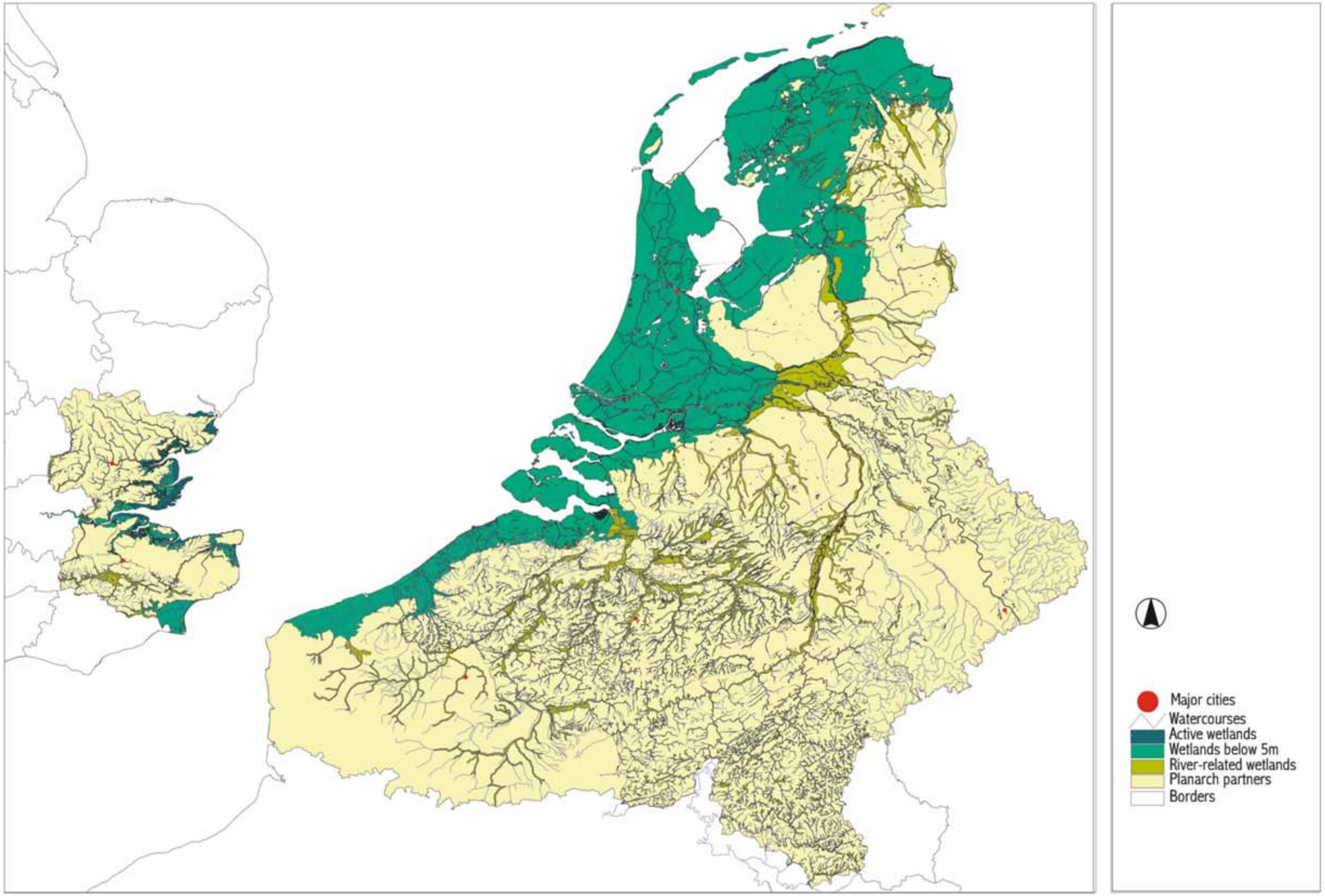


Fig 2.6 Wetlands of the Planarch 2 partners

3. PLANARCH PILOT STUDIES

E Heppell

3.1 THE STUMBLE, ESSEX

The Essex Coast

The Essex coast is some 480km in length; running along the Thames at Purfleet to the Stour estuary in the north. The coast is indented by a series of long tidal estuaries; the Roach, Crouch, the Blackwater and the Colne. These estuaries are tidal for a considerable distance inland, so much so that

"…no point [in Essex] lies more than thirty four miles from tidal water." (Grieve 1959)

The topography of the modern Essex coastline is the result of both natural processes and human intervention. The coastline is low lying, below 5m OD. Much of this low lying land comprises former salt and grazing marsh; embanked from the sea from the medieval to modern periods. The majority of the Essex coast is therefore protected by sea walls. For around 60% of their length these walls in turn are protected by salt marsh. Seaward are extensive tidal flats, sand and shingle banks.

To the rear of the sea walls traces of the former wetland can be identified both above and below ground; in some areas relict salt marsh creeks which have silted up can be seen as cropmarks meandering across grazing marsh. Former creek and river channels, also silted up or deliberately infilled, can also be identified. Thus the area to the rear of the wall can be defined as 'former wetland'. Much of this former wetland was used for grazing, of sheep and later cattle, up until the late 19th and 20th centuries. Much is now arable land. Some areas, particularly along the Thames, have been developed for housing and industry.

The Essex coast is considered one of the most significant in the country for nature conservation, hence much is designated under the RAMSAR convention as being of international importance. Parts of the coastline are recognised as Special Conservation Areas (Flora and Fauna) and Special Protection Areas (Birds) both of which are European designations. National designations include National Nature Reserves and Sites of Special Scientific Interest. These designations apply to the intertidal area and dryland. Much of the coast remains undeveloped and is designated as a Special Landscape Area in recognition of this.

Coastal Archaeology in Essex

Introduction

There has been a long history of archaeological research along the Essex coast from the late 19th century onwards, primarily on the intertidal zone but also inland (eg. Spurrell 1885, 1889). In the early 20th century FW Reader and Hazzeldine Warren published work on an intertidal Mesolithic site at Hullbridge, on the Crouch (Reader 1911 and Warren 1911). Warren went on to carry out extensive studies of the pre-transgression land surface, with associated Mesolithic and Beaker sites, at Walton , Clacton, Jaywick and Dovercourt (Warren *et al* 1936).

A number of local archaeologists have also provided valuable studies on intertidal archaeology. Of particular note is the work of Vincent and George (1980) on prehistoric sites, of de Brisay and the Colchester Archaeology Group on the 'red hills' (Fawn *et al* 1990) and the recognition of extensive fish trap complexes by Ron Hall, Kevin Bruce and Barry Pierce (eg Strachan 1998). Aerial photographic survey and analysis also provided valuable information particularly relating to the post-medieval and modern periods such as decoy ponds, World War II defences and hulks.

The Hullbridge Survey

"In recent decades the archaeology of the Essex coast has not received the attention it deserves, which is unfortunate considering the abundance of information that is to be found along the open coast and within its long ria-like estuaries" (Wilkinson and Murphy 1995, 1).

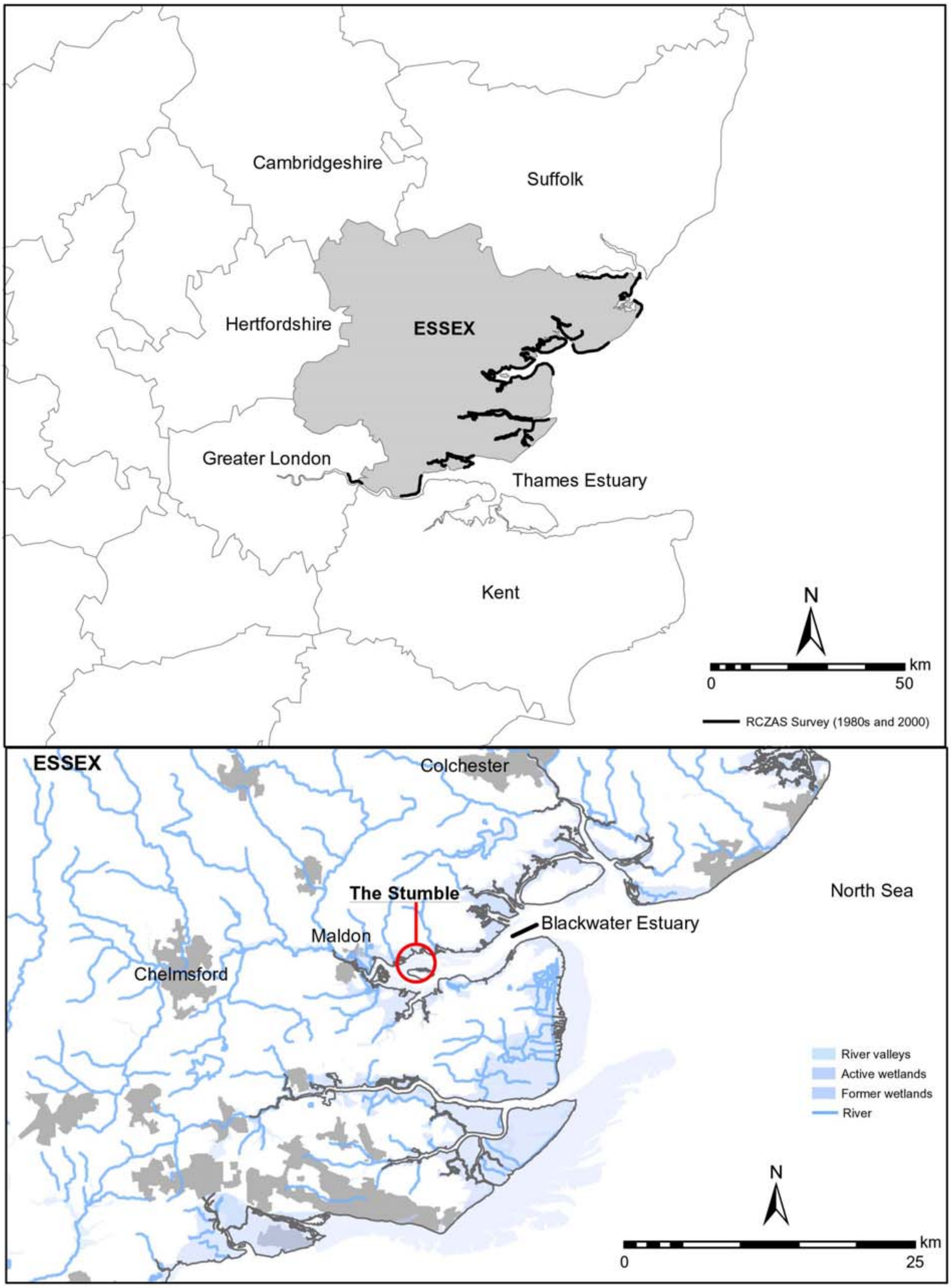


Fig 3.1.1 Location of The Stumble

In 1982 Wilkinson and Murphy began work on a limited area around Hullbridge, to provide further stratigraphic, environmental and dating information about the existing sites, and to identify new sites. The results of the first season of the project were so promising that it was progressively extended. By 1987 some 200km of the coast had been surveyed (Fig 3.1.1). In general this survey comprised reconnaissance and more detailed survey in selected areas. It is this work, which became known as the 'Hullbridge Survey' which identified the Neolithic site at The Stumble where extensive areas of old land surface and associated artefact scatters were located. The area was selected for more intensive survey in 1986, 87 and 1988.

Thus by the 1990s there was an extensive body of knowledge relating to the archaeology of the Essex coast, although it is acknowledged that it is not complete or exhaustive.

The Stumble: Archaeological Background

The Stumble is an active wetland site, being covered by water each high tide. It is an area of around 40ha of intertidal mudflats located in the Blackwater Estuary, between Osea Island and the mainland, to the north of the main river channel. The area is the site of a multi-period complex comprising a Neolithic habitation site and later wooden structures, first located during the 1985 season of the Hullbridge survey. Trial excavation commenced in 1986 (Wilkinson and Murphy, 1995, 76-81 and 150). To the north of the site lay salt marsh with deposits up to 2m deep. These deposits overlay thick layers of estuarine clays. These in turn overlay grey estuarine clay containing some organic remains and a lower peat deposit, of early Bronze Age date. This overlaid a leached silty sandy soil, an old land surface, formed on a silty or sandy clay head deposit.

The initial survey identified an earlier Neolithic site (areas A, B, C and E: Fig 3.1.2). This was initially recognised by a dense concentration of early Neolithic pottery and flint, eroding out of the side of a narrow channel cutting into the old land surface. Further survey showed that this scatter had clearly defined limits. Excavation in this area identified post holes and other shallow irregular features. Remarkably well preserved charred plant remains were recovered from samples and pollen analysis of preserved soils here and at other sites in the Blackwater estuary has provided good evidence for the environmental setting and economy of the site. The Stumble represents one of the most significant Neolithic settlement sites in the Eastern Counties (eg Murphy 1996, Brown and Murphy 2000, Brown *et al* 2000). When occupied the site would have been on dry land, around 2-3m above high water. As a rough indicator the early Neolithic High Water mark may be considered to be around the contemporary low water mark. Osea Island would have formed a low hill connected to the mainland.

The later Neolithic settlement (Area D and contexts 99,117, 118, and 124; Fig 3.1.2) was also identified by finds scatters, although noticeably less dense than the earlier site. Artefacts recovered comprised Grooved Ware, flintwork and concentrations of burnt flint. By this period sea level rise must have meant that the sites were very close indeed to the high tide mark. By the early Bronze Age, the lower peat had been deposited and Osea may have become an island.

The Hullbridge Survey at the Stumble identified a number of wooden structures mainly located to the north-west of the Neolithic settlement areas, closer to the edge of the salt marsh. They were gradually being eroded out of the estuarine clay layers. As this process related to the plan and not the section they were without a good stratigraphic context.

In 2001, as part of the Greater Thames Estuary Essex Zone Monitoring Survey (Heppell 2004), the site was revisited in order to assess the changes which had taken place over the intervening years. Given that the Hullbridge Survey had located the site through the density of finds in the area the initial task was to establish if such finds scatters were still present. Finds scatters were located in the vicinity of the Neolithic site excavated in the 1980s. The scatters, however, also extended a considerable distance west of those previously noted.

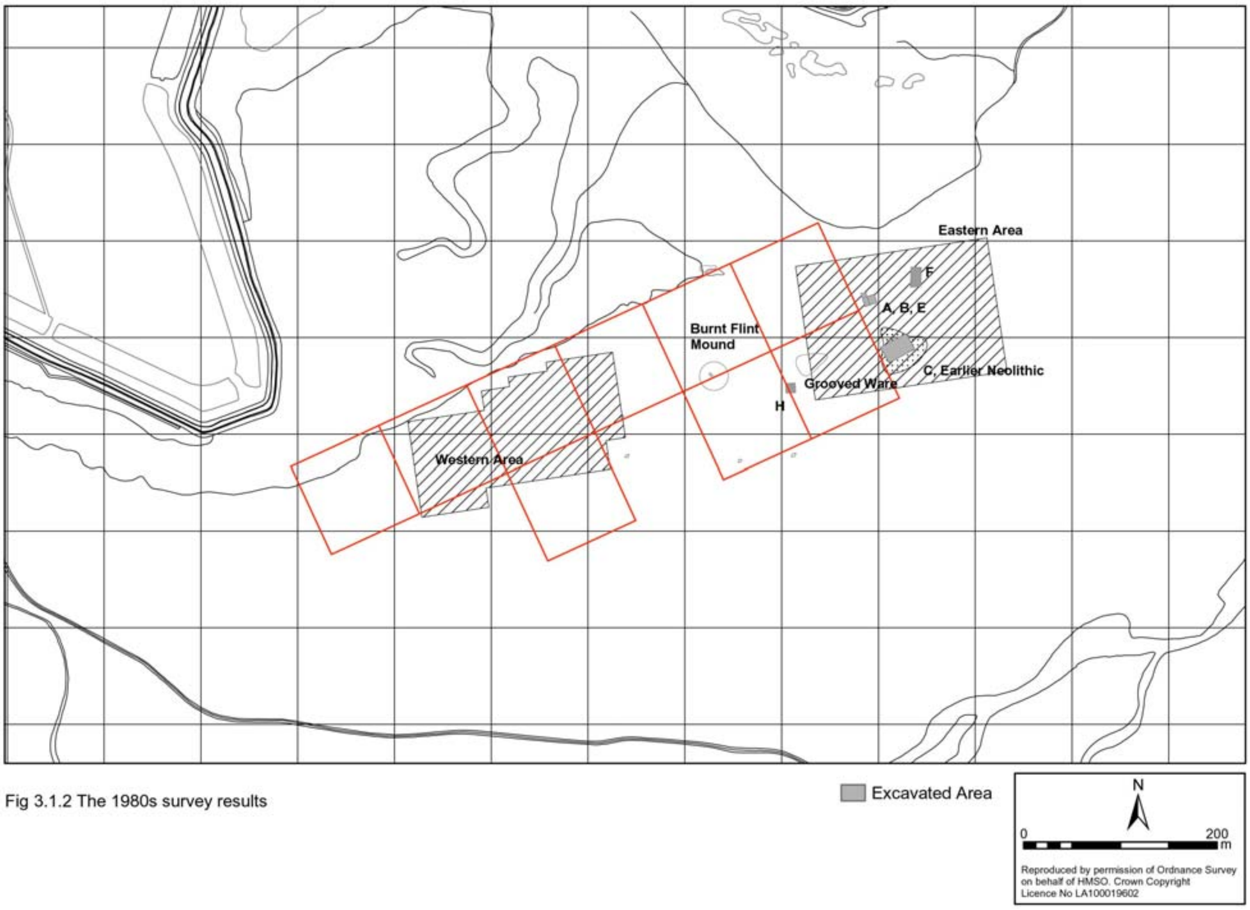


Fig 3.1.2 The 1980s survey results

Fig 3.1.3 The Fieldwalking Grid (showing the unique ID of each 20m square)

The monitoring also identified a number of areas of active erosion, such as vertical erosion of the flats (ie a reduction in height) exposing a greater area of the old land surface. The salt marsh to the north was also retreating, some 10m in places since the Ordnance Survey was last updated.

A combination of factors - significance of the archaeological remains, the poor definition of their extents, difficulty in evaluation and demonstrable threat; meant that when the opportunity arose to develop techniques to evaluate wetland as part of the Planarch 2 programme The Stumble was an ideal candidate for further work.

The Planarch 2 Pilot Studies: Methodology

Introduction

Evaluation techniques on dry land have evolved over the years, particularly with the development and increasing availability of new technologies. The suite of methodologies available offers a range of intrusive and non-intrusive techniques to provide sufficient information to formulate strategies to manage the resource.

Wetland evaluation has similarly evolved, although there are a number of additional factors that need to be considered when choosing an evaluation method for use on intertidal sites. Some of these are discussed below.

Health and Safety

Health and Safety is an issue which needs to be addressed at the conception of any project. There are, however, increased risks working on an intertidal site like that at The Stumble. In short is it safe to carry out evaluation? A risk assessment was carried out as a first step. A method statement was then prepared detailing measures to control those risks.

Access

Physical access to The Stumble has a significant effect on the type of fieldwork that can be carried out. The nearest dryland access is via the causeway to the island, which is a private road. Any equipment has to be carried across the mudflats, negotiating water or silt filled channels and soft spots. Equipment has to be kept to a minimum, and work days planned to minimise the amount of equipment to be carried and the most effective use of time.

As the site is intertidal there is also a limited amount of time available for working. The site can generally be accessed for 2 hours either side of low tide, although this can vary depending on weather conditions.

Nature Conservation

The Stumble, and indeed the wider Blackwater Estuary, is a special site in terms of nature conservation. It is designated as a:

- Site of Special Scientific Interest
- Special Protection Area
- Special Area of Conservation
- RAMSAR site

Work on designated sites has to be agreed with English Nature, the national body who advises, monitors and protects these. Permissions typically have to be in writing. EN may restrict the type of work that can be carried out, or specify methodologies to be applied.

Evaluation techniques at The Stumble therefore need to be tailored to take the above factors into account. The key factors are safety and speed.

Fieldwalking
Fieldwalking is a non-intrusive method of archaeological survey that has been used for many years to assess areas of archaeological potential. It is particularly suited to large areas due to its rapidity. It can provide information as to presence or absence, and better define areas of archaeological interest through the use of statistical and spatial analysis. There are acknowledged weaknesses to fieldwalking techniques; it is usually dependent on the proximity of archaeological remains to the surface, a presence of durable artefacts and the depth of overburden/colluvium/alluvium. It does, however, provide information on general location, presence and date. It is considered effective, particularly when applied in conjunction with other techniques (Medlycott and Germany, M. 1994, Medlycott 2005).

Fieldwalking was chosen as the first technique to be utilised at The Stumble in order to evaluate as much of the area as possible and to enable a comparison with fieldwalking data from the 1980s. It also aimed to consider whether it was practical and effective in an intertidal environment.

In Essex a standardised technique has been applied to all fieldwalking projects since the mid 1990s. This policy was adopted in the post PPG 16 environment of competitive tendering to ensure that the results of any survey, regardless of the organisation carrying it out, would be directly comparable.

Permanent reference points for sites and finds are guaranteed by relating each fieldwalking survey to the Ordnance Survey National Grid. A grid of collection units is established by dividing OS kilometre squares into 100m and 20m squares respectively. The kilometre and 20m squares are labelled from A to Z (excluding O) and the 100m hectare squares from 1 to 100.

Out in the field, the corners of the 20m squares are marked out. A *c*. 10% sample of surface finds is then obtained by fieldwalking a *c*. 2m wide transect along the west side of each 20m box in turn. As each square is walked, the finds from that square are placed into a pre-labelled bag, which clearly records the project name and year, and the kilometre, hectare and 20m square (*e.g.* SOWF97 A14P - **So**uthend, **W**ick **F**arm, 19**97** season, kilometre square **A**, hectare **14**, 20m run **P**).

A fieldwalking record sheet is filled in for each hectare. This records which 20m runs were walked, who walked them, the conditions of the surface and crop (if any), the weather, and the topography of the field. These sheets were utilised in this survey but amended slightly for the intertidal environment.

The finds are washed and marked with their identifying code before being sorted by date and type into the following classes:

Prehistoric pottery	medieval pottery
worked flint	post-medieval pottery
burnt flint	medieval/ post-medieval tile
Roman pottery	daub
Roman tile	brick
Saxon pottery	slag

The finds record sheets capture the number of individual items and their combined weight for each find type by 20m transect. This information is typed into a computer spreadsheet to aid statistical analysis. The weight of each find type is plotted on the grid according to its Standard Deviation from the mean weight for that find type across the whole survey area, with the exception of flintwork which is plotted individually. A record of the statistics for all fieldwalking projects is also available. This allows additional comparisons to be made; for example sites in the same vicinity or of the same period.

A concentration of material is defined as a deviation from the norm for the survey area and the find type. Thus the relative density required fluctuates widely from period to period, and from one survey area to another. For example, in an area producing very few Saxon finds, two Saxon sherds in adjacent runs could be interpreted as a possible site. A post-medieval site, in contrast, would probably be indicated by a dense cluster of runs with more than two Standard Deviations of post-medieval pottery and tile, standing out against a background scatter of similar material. This definition of a site is an essentially statistical one, backed up by professional judgement as to just what kind of past activity may have been responsible for this deviation.

Fieldwalking Results

Introduction

The field survey at The Stumble was carried out using the above technique with some minor variations. The grid was established along the site on a northeast southwest baseline in order to maximise the area covered and minimise time setting out (Fig 3.1.3). It was generally not possible to walk the 20m strip adjacent to the landward edge of the grid due to masking by sands and silts. The 20m adjacent to the low water line was also not walked due to depth of water; although the water was not too deep to walk through doing so stirred up sand and silts, reducing visibility. The survey area therefore covered an area 600m long and 40-80m wide.

DGPS was used to establish an NGR for each corner of a 100m square to ensure the survey related to the OS. This will enable any feature survey work to be compared and enable re-location of concentrations of material in landscape with few points of reference.

Artefact Analysis: Prehistoric Pottery

A total of 107 sherds of prehistoric pottery were recovered during fieldwalking at The Stumble. Statistical analysis shows a significant variation from the countywide statistics and data was therefore treated independently. The pottery has been analysed by Nick Lavender, an independent specialist. The following is summarised from his more detailed report. Although it was not possible to utilise the countywide statistics in the main analysis it has clearly demonstrated the significance of the assemblage from The Stumble

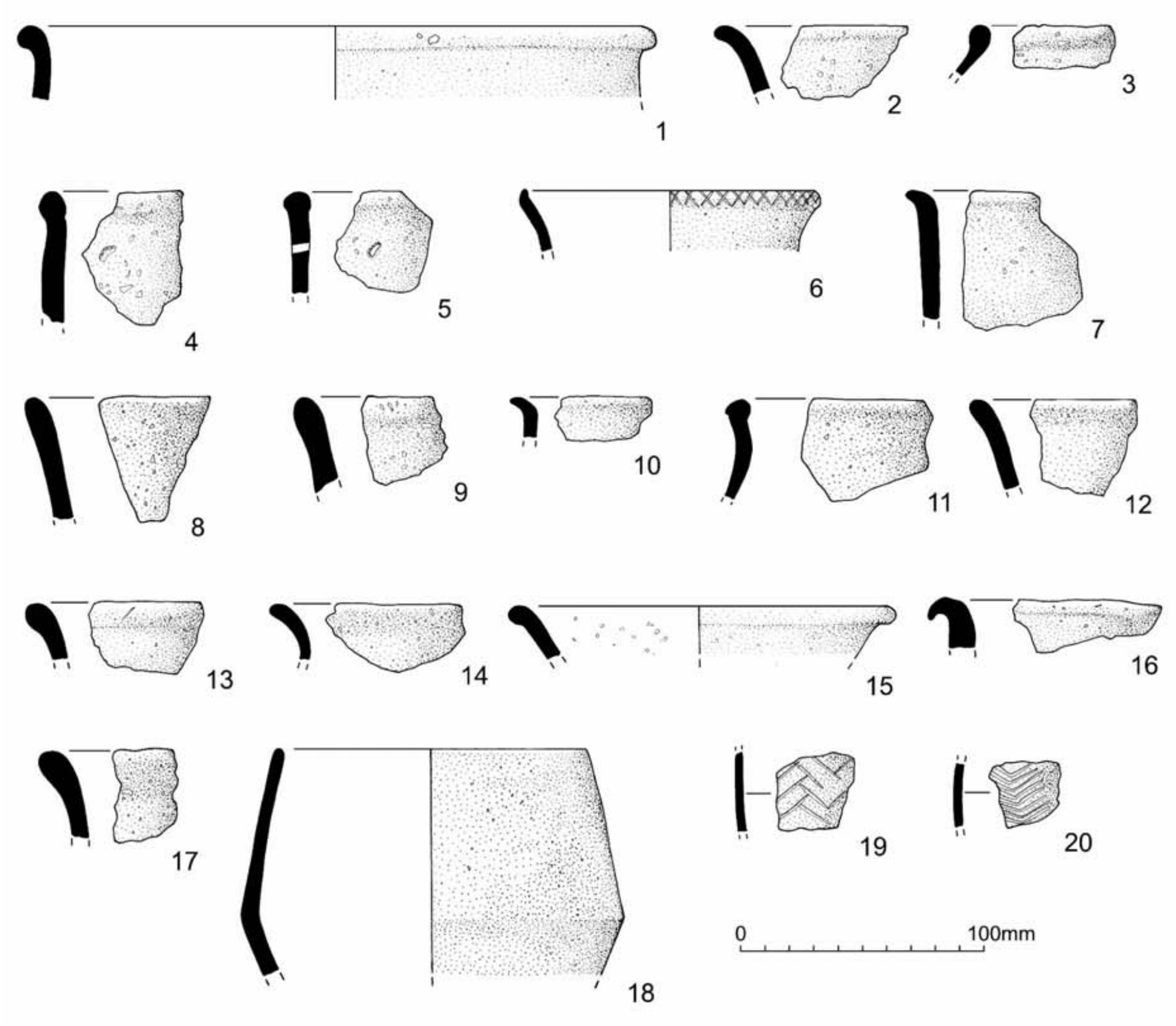
The majority of the assemblage was of early Neolithic date, of the Mildenhall style (Longworth 1960) which corresponds well with the 1980s assemblages (Fig 3.1.4). Much of the material was abraded and, unsurprisingly, covered with barnacles. There were, however, some sherds where decoration could be identified. One sherd also had evidence of vegetable wiping,

Later periods were less well represented. A small quantity of Grooved Ware, dating to the late Neolithic period was recovered. A single middle Bronze Age sherd was identified, still with some blackened residue on the interior.

Flint

Flintwork is particularly difficult to identify on the surface of The Stumble. Additional difficulties arise when trying to assess whether a piece has been worked due encrustation of barnacles. It was also known from previous studies that debitage was present. These factors meant that when carrying out field survey all flint which <u>may</u> have been worked was collected. The material was processed and then examined by a flint specialist, Hazel Martingell and only at this stage were those flints deemed to be natural discarded.

A total of 234 flints were recovered during the fieldwalking exercise: 78 tools, 24 blocks or cores and 132 flakes. The early Neolithic flintwork comprised blades, including microdenticulates (saw edged pieces) that would have been hafted onto handles. These were used to cut cereal crops, evidence of which can be seen as ‘sickle gloss’ on the blades. The Middle to Later Neolithic was better represented in the flintwork assemblage; this included scrapers, the butt of a polished axe (possibly re-used as a scraper), and an oblique arrowhead (Fig 3.1.5). The later Neolithic to early Bronze Age assemblage included an exceptionally fine bifacial knife, and a spearhead or sickle. A majority of the artefacts are indicative of agricultural activity such as harvesting rather than stock rearing.



Early Neolithic Pottery

Fig No.	Context No.	Rim Form	Comments	Fabric
1	A1T	2	Smoothed surfaces, partly abraded.	D
2	A1T	2	Abraded exterior	D
3	A2V	3	Rim from a closed bowl with an unusual short upright neck. Slight traces of heavier abrasion on the rim may result from the use of a lid or being placed upside down.	D
4	A3C	2	Wiped interior. Slightly abraded exterior. Oval or crescent-shaped prefiring perforation does not fully penetrate to the inside	D
5	A3C	2	Probably the same vessel as above, although interior does not seem to be wiped.	D
6	U/SE	5	Fine inturned rim decorated with incised cross-hatching	C
7	U/SE	2	Rim from straight-sided vessel.	D
8	U/SE	3	Rim from a flared(?) open bowl	D
9	U/SE	3	Slightly abraded	D
10	U/SE	2	Rim from an open bowl.	D
11	U/SE	4	Rim from S-profiled vessel.	D
12	U/SE	4	Similar to above, but finer and possibly originally burnished.	C
13	U/SE	3	Rim from an open bowl.	D
14	U/SE	4	Rim from an open bowl. Slight traces of heavier abrasion on the rim may result from the use of a lid or being placed upside down.	D
15	U/SE	2	Abraded on exterior	D
16	U/SW	2	Heavily abraded	D
17	U/SW	3	Heavily abraded	D

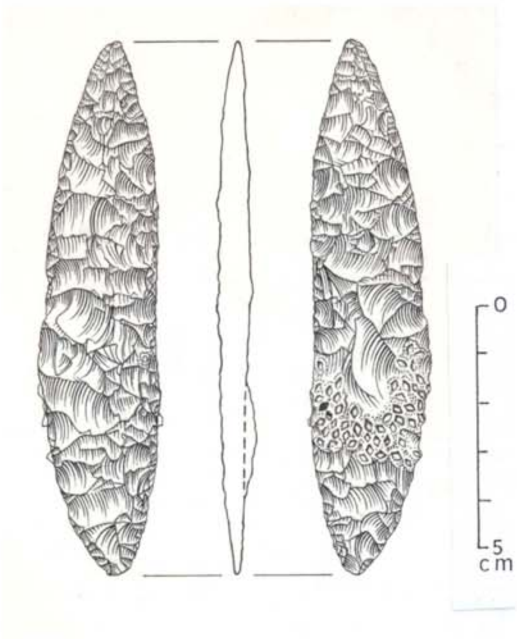
Middle Bronze Age Pottery

Fig No.	Context No.	Comments	Fabric
18	U/SW	Rim and shoulder of globular urn. Patch of abrasion on exterior, sooting on interior	A

Middle Iron Age Pottery

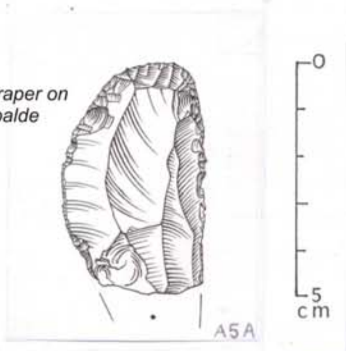
Fig No.	Context No.	Comments	Fabric
19	U/SE	Incised herringbone pattern decoration	J
20	U/SE	Similar to above, but with finer and more intense decoration	J

Fig 3.1.4 Prehistoric Pottery



Late Neolithic: Bifacial knife, spearhead or sickle.

Early Neolithic: Scraper on the distal end of a balde



Middle to Late Neolithic: Scraper

Late Neolithic: Oblique arrowhead

Middle to Late Neolithic: Partially polished axe with bevelled sides

Late Neolithic-Early Bronze Age: Bilaterally re-touched blade (probably a sickle piece)

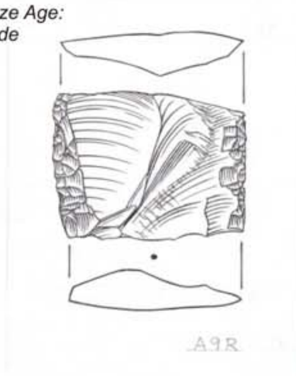


Fig 3.1.5 Flint

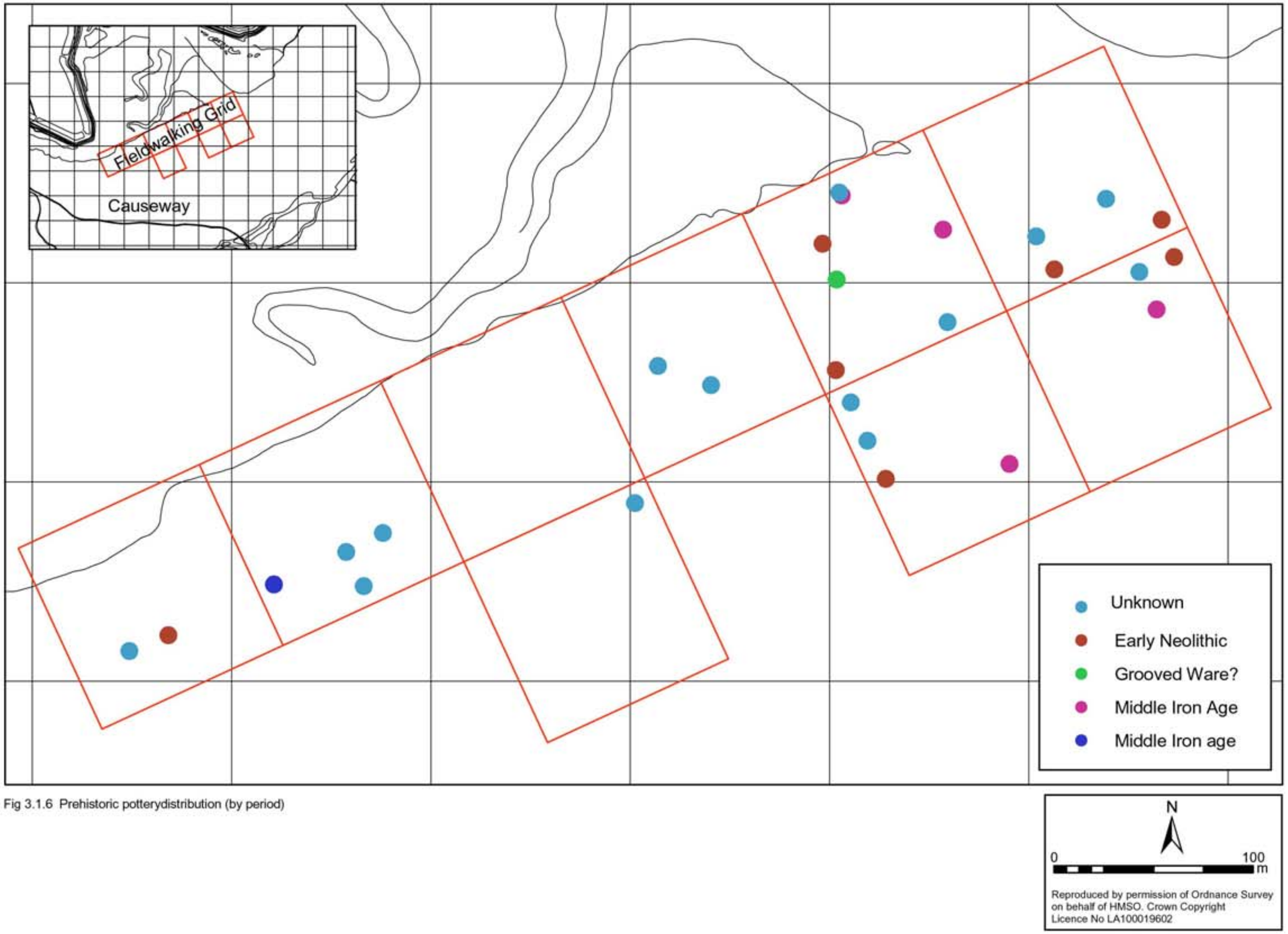


Fig 3.1.6 Prehistoric potterydistribution (by period)

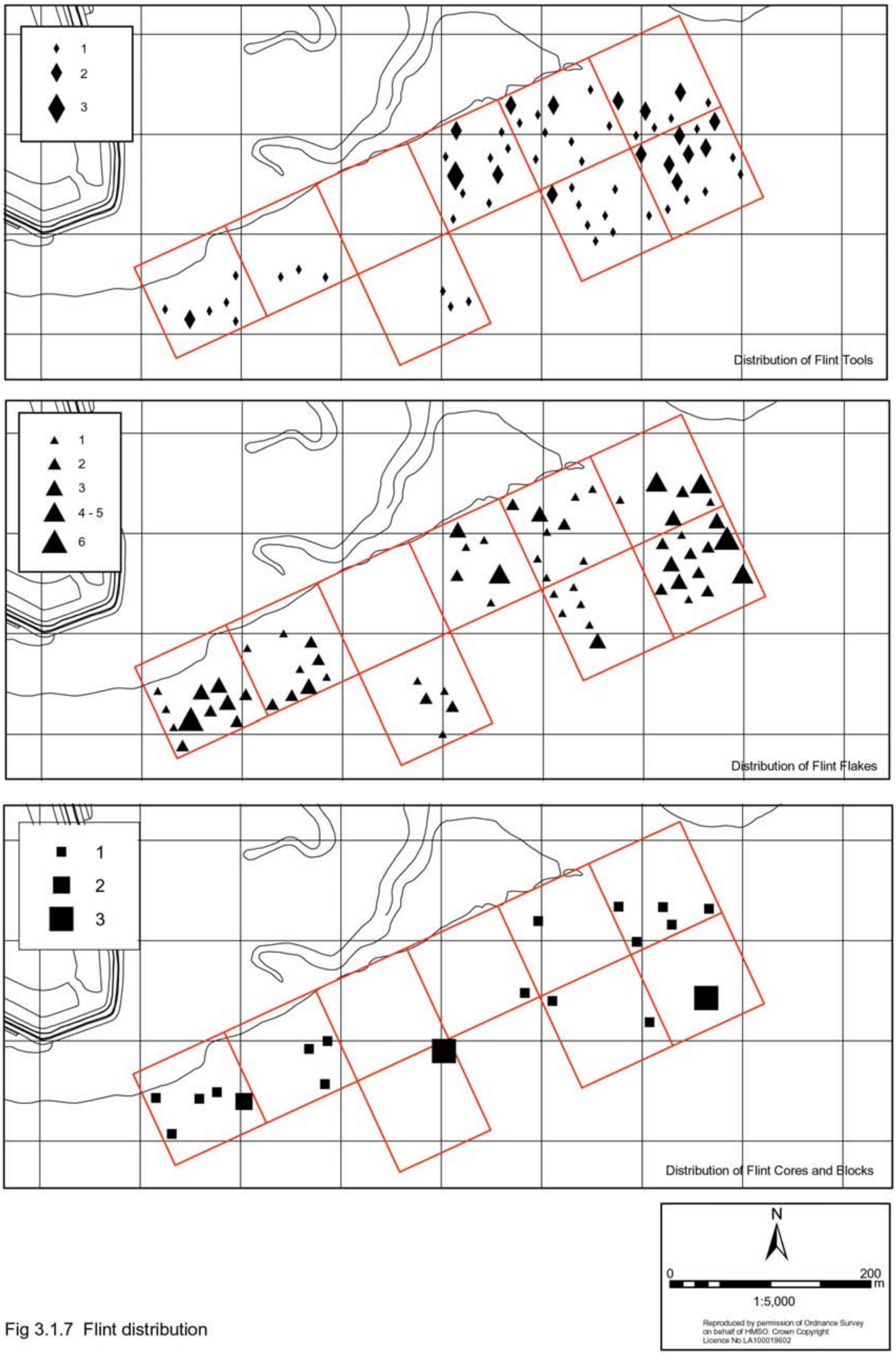


Fig 3.1.7 Flint distribution

Distribution
Prehistoric pottery was concentrated at the eastern end of the fieldwalked area (Fig 3.1.6). This area lay immediately to the west of the main excavation areas from the Hullbridge Survey and had been fieldwalked before. A comparison of the 1980s data and archive drawings from the 1980s survey shows that no concentrations had been previously noted in this area. This would suggest that the erosion in this area has reduced the depth of overburden and exposed parts of the old land surface, and thus the artefacts.

The area defined in the 1980s as Context 124, comprising a scatter of early and later Neolithic material, was blank. This could perhaps be accounted for by a combination of natural erosive processes and perhaps the archaeologists, who had a 100% sampling strategy in this area during the 1980s work. The type of material recovered during the current survey around the periphery of this context contrasted with that of the 1980s, which had been dominated by burnt flint. The recent survey recovered little material of this type.

There is a clear break in the distribution of both flint and pottery at The Stumble (Fig 3.1.8). This is thought to represent the route of a large creek which had been identified in the auger survey. To the west of this channel, towards the causeway, further pottery and flint were recovered. This was the most interesting result of the recent work as prehistoric artefacts had not been identified in this area previously. It was not possible to refine further the distribution patterns of the pottery as much was undiagnostic (although probably Early Neolithic).

The densest concentrations of flint were found to the east of the postulated channel (Fig 3.1.7), and include the material of earlier date. To the west material tends to be later, and contains a higher proportion of blades and cores.

Auger Survey
Hand auger survey was also carried out at The Stumble. This had two main aims:

- To establish depths of later estuarine silts and clays sealing the old land surface
- To establish a soil profile across the flats to compare with the earlier data

The initial project outline had aimed to carry out the auger survey, in those areas with concentrations of finds, as a precursor to the excavation of test pits. Analysis of the artefact distribution, discussed above, did not however identify any particular concentrations, but rather a general background scatter. Following discussions with the Planarch partners during exchange visits, it was decided that, within the limited resources available, the most useful information could be obtained by profiles across the flats, one running south-west to north-east (parallel to the shoreline) and two profiles running from the shoreline to the waterline (Fig 3.1.9). Auger samples were taken every 10m.

Ideally this survey data needed to be related to Ordnance Datum, to allow comparison with other datasets. This proved, however, to be the most difficult element of the survey due to the absence of benchmarks in the vicinity. Instead an estimated height was transferred from the top of the sea wall, across the salt marsh then down onto the flats.

The auger survey provided simple profiles across the flats and confirmed that the gap in the fieldwalking artefact distribution was indeed a channel which had been filled by soft sands and silts (Fig 3.1.9). Comparison of auger data along the grid's baseline to artefact density along the same line showed that the distribution of surface artefacts coincided with those areas where the old land surface was closer to the present surface. Interestingly gaps occurred in more elevated areas where no masking alluvial material was present, and where artefacts had been recovered in the 1980s. This is thought to be the result of the erosion of the artefact-bearing strata.

The data obtained through this auger survey proved useful in the interpretation of the fieldwalking results. It also provided information on strata and topography. It was, however, not detailed enough to provide sufficient information to position the proposed test-pits. This was largely due to the complex pattern of erosion and deposition in the dynamic tidal environment. Discussion with the Planarch partners, particularly the participants from ROB who routinely use augering as a technique, has established that more data would be required to carry out modelling of this type.

Excavation of Test Pits

The excavation of test pits in any intertidal environment presents a number of challenges:

- All equipment has to be carried to site
- Limited time available on site within tidal windows
- Excavated areas fill with water, seeping through loose upper deposits even at low tide
- Any test pit left open will fill at high tide and need to be bailed out before work can be continued

In the 1980s the Hullbridge Survey team were housed on nearby Osea Island, and were working both tidal windows. Larger equipment such as shovels and buckets was stored in a wire cage, tables, chairs and a hatstand pushed into the mud. Other equipment was carried in either on foot or using a light dingy. The test pitting was carried out using sawn-off oil drums that were driven into the foreshore acting as mini 'coffer dams'.

The Planarch work had to take a slightly different approach as a result of a number of considerations. The use of a boat was considered but not used in the end as T.J. Wilkinson had noted that their use ' considerably extended the working day' (Wilkinson nd). This would have had implications for the cost effectiveness of the limited work proposed as part of Planarch 2. Thus a method of excluding water from excavated areas that was more lightweight than an oil drum was devised. Sheets of perspex were cut that could be driven into the foreshore using a rubber mallet. These flat sheets were lightweight and could be carried flat in a rucksack.

The preliminary project outline had aimed to excavate test pits, using the bin sampling method, in those areas where the fieldwalking and auger survey had indicated that there were areas of significant archaeological potential. The auger survey data was, however, as discussed above, not dense enough for this to be feasible. It was therefore decided that it would be most appropriate to test the technique in the best understood area, that is the area close to the original excavation.

A total of eight test pits were excavated using the technique described above. Water seepage into the excavated pits did occur, but could be minimised by taping the corners. Excavation within the pits was practical, although the thinner (6mm) perspex sheets did begin to crack and bend when used more than once. Although the test pits excavated were small, larger areas could have been excavated using multiple sheets.

The archaeological results of the test pits were limited by their positioning. The excavations showed that a number were within what is thought to have been a small channel that had not been identified during the auger survey. In one test pit a sub-surface feature, possibly the edge of a pit or post hole, was identified.

It was considered that the technique was practical. It was, however, not particularly rapid, which may have implications in other intertidal environments with a shorter working window. The targeting of the test pits was also a problem, though it is considered that this could be improved by more intensive auger survey.

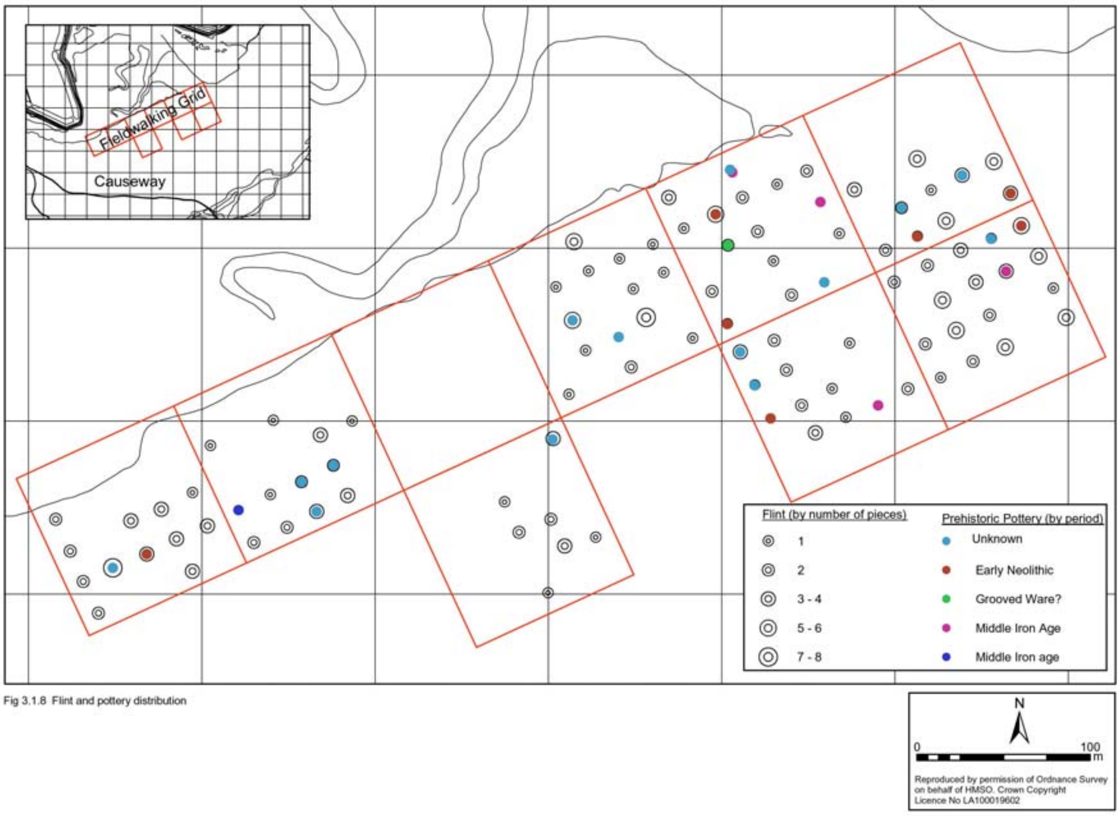


Fig 3.1.8 Flint and pottery distribution

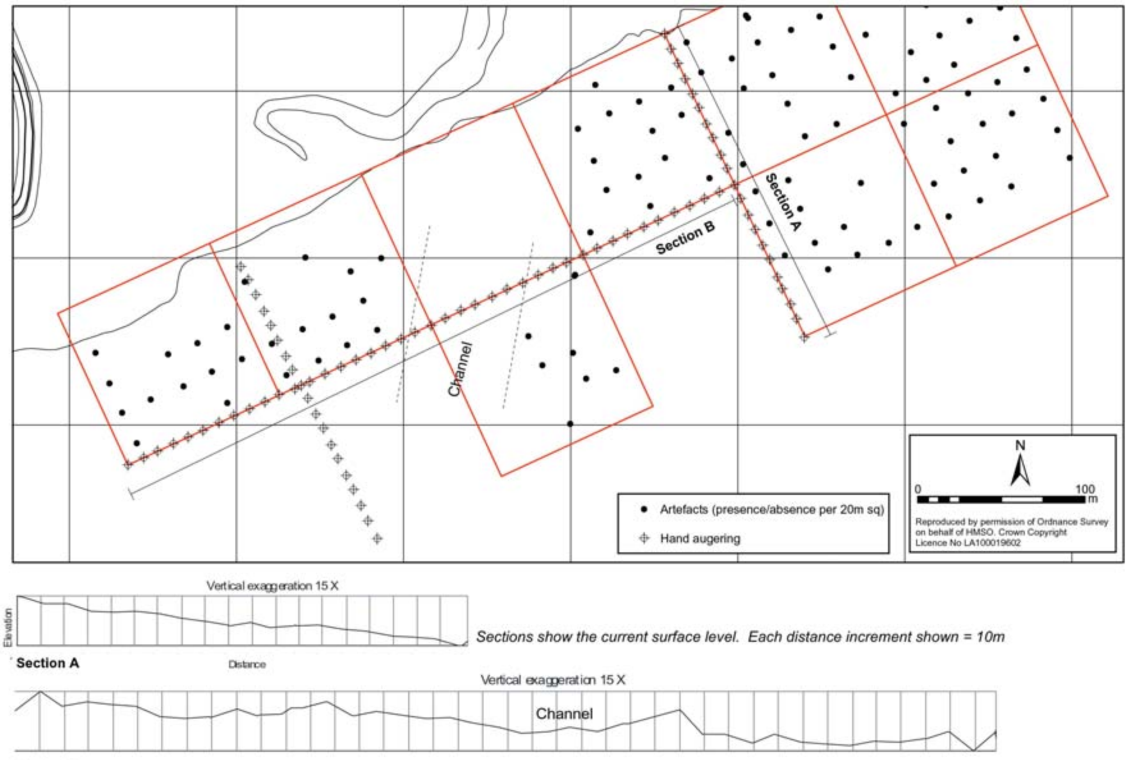


Fig 3.1.9 Location of hand augerings, artefacts and selected profiles

Discussion

The ECC team was joined by representatives from KCC, Wessex Archaeology (on behalf of KCC), VIOE and ROB. The participants took part in a number of discussion periods through the course of a week long exchange programme. At these discussions a number of detailed points relating to the techniques were raised.

Refining the fieldwalking grid:
The possibility of utilising a 10m grid rather than a 20m grid was raised. In the case of the Stumble it was considered that this might be appropriate given the considerable amount of artefacts and background information available. The remainder of the survey was carried out on the 20m grid to allow statistical 'like for like' analysis to be undertaken.

Should further survey work be proposed a selected area will be surveyed on a more refined grid so that results can be compared.

The Flemish general walkover technique, where a parcel is walked by a team of archaeologists spaced at around 3m intervals and material assigned to that parcel, would not have been an appropriate method of survey at The Stumble. This method is best utilised to provide data on presence/absence and this was already known at the Stumble. If, however, a new area of flats were surveyed it could be an appropriate technique for preliminary survey but collection units would have to be defined, given the absence of any defined boundaries.

Use of Volunteers and Local Societies:
ECC is in general keen to encourage local societies and volunteer work. It is participating in a number of Local Heritage Initiative and Heritage Lottery Fund projects. Volunteers were also encouraged to take part in the Essex RCZAS survey (Heppell 2001). Consideration has been given to the use of volunteers for monitoring in a more formal fashion than at present. Complications can, however, arise as a result of the health and safety considerations and insurance.

It is considered that all of the techniques applied during the Essex pilot studies were successful.

Fieldwalking did establish that the general distribution of material was wider than previously noted in the 1980s. It also showed that it was possible to use the results to identify underlying features, in this case a channel crossing the site. The results proved to be limited in establishing better defined areas of activity. This, however, is the result of the sheer volume of material to be found at The Stumble. Distinguishing a significant concentration from that of a general background scatter of prehistoric pottery proved impossible.

Auger survey proved both useful and practical. In the long term this is likely to be a technique which will be applied more often on intertidal sites. Transfer of Ordnance Datums to provide a comparison with landward data is likely to be the main practical problem at the present time. The further development of survey equipment, particularly DGPS, may in the longer term provide a solution to this.

Fig 3.1.10 Excavating the Test Pits; the perspex sheets prevent the pits being filled by surface water and seepage from the surrounding esturine muds

3.2 THE BELGIAN POLDERS, FLANDERS: A TEST CASE 2002-2006

M Pieters, L Schietecatte, I Zeebroek, C Baeteman, J Bastiaens, K Deforce, I Jansen, E Meylemans & J van Laecke

Introduction

From 2002 to 2006 about 400ha of the Belgian Polders reclaimed wetlands, in the vicinity of Oostende and Middelkerke, have been surveyed archaeologically in order to establish a methodology to determine efficiently their archaeological value (fig. 3.2.1). The surveyed area, perpendicular to the present coastline and stretching from the beach to the sandy region, is 3 to 4km wide and about 7.5km long. The museum of Walraversijde is the logistical centre for public outreach for the project. The Belgian Polders are very poorly understood archaeologically and, as a result, also largely undervalued. This survey project set out to develop an efficient strategy for the proper archaeological evaluation of this area and to contribute to a better understanding of the potential for research and presentation.

Methodology

Several techniques have been used to survey the area, including line walking, grid walking, geophysical techniques (electrical resistivity and magnetometry), boreholing and analysis of the Digital Terrain Model of Flanders. These techniques were applied in a well-defined order: from the general to the specific. The project started with rapid line walking of a 'statistically significant' area. The average individual plot of land had an area of a little more than 2 ha. Following this, detailed grid walking was applied to specific plots, highlighted as interesting by the line walking. Some of the plots walked in lines were also surveyed using adapted geophysical techniques. Geological research was also carried out, to compare the archaeological dataset with the geological one. This chain of activities allowed the elimination of some hypotheses which resulted from the line walking alone, but also gave support to others.

Line walking was carried out only on arable fields. The plot boundaries used by the farmers were used to define the survey units. Where arable fields were too big, they were divided into smaller survey units of about 2 ha. This was intended to increase the precision of the location of archaeological remains. Survey work in Flanders does not require the permission of the owner or tenant, but the project was publicised in a local newsletter to make people aware of the activities of the survey team. There were no problems with the team walking the arable fields, so long as this was not done after it had been sown. All the fields were walked under ideal conditions after a long period of rain, sufficient to wash the archaeological material free from the soil matrix so that it could be efficiently gathered.

About 13 % of the test survey area was surveyed. The survey team consisted of 4 to 5 people, one archaeologist and 3 to 4 technical assistants. The fields were surveyed in lines parallel to the direction of ploughing and with an interval of 3 to 5 metres. All the archaeological material was collected regardless of date or type. The objective was to survey fields with high densities of archaeological material, in a more detailed way. Survey unit 32 was surveyed in grids measuring 3 by 10 m. These more detailed surveys added useful information allowing more elaborate interpretations.

All the collected material was cleaned, numbered and analysed. Pottery formed the most common find, comprising about 54,000 fragments in total from the 174 survey units surveyed so far. Analysis consisted primarily in splitting the material into 46 different categories of which 32 refer to ceramics. The categories were based on technical characteristics identifiable on small and worn fragments. This detailed analysis of a very large dataset has allowed detailed research questions to be asked. Some artefact types, such as flint, remain absent in the study area.

Following the line and grid field walking, magnetic and electric resistivity surveys were applied in areas of concentrations of archaeological material. As a final stage boreholing was also carried out in order to add geological information.

Results

Line walking: results in chronological order

During the fieldwork no flint artefacts or any pre- or protohistoric pottery was found. This agrees with the present understanding that the sediment at the surface in the Belgian Polders is Post-Roman in date. Some Roman artefacts have, however, been found. The digging of peat in medieval and later times has been suggested as the major mechanism by which this material was brought to the surface. This peat digging, however, does not appear to have brought pre- or protohistoric remains to the surface. This could mean that the coastal plain didn't support human occupation during these periods, but this seems highly improbable when one considers data from similar wetlands in adjacent Zeeland (The Netherlands). It may be that the hypothesis of peat-digging activities, bringing objects to the surface, has not been as effective as first thought.

A total of 31 survey units presented Roman pottery fragments at the surface (fig. 3.2.2), in other words, nearly one in six. Half of these only produced one fragment, with the other half producing 2 or more fragments per unit, with densities up to 31 fragments per ha. These concentrations can probably be considered as zones of increased activity in the Roman period. One problem is to determine the stratigraphic position of the source of the material: on top of the clay, below the clay or in the clay lying at the surface. In addition, a zone without Roman remains at the surface has been defined and interpreted as the area of a former tidal creek, the so-called Testerep-creek. Recent geological work shows the late Holocene creeks to be in the same position as their early and middle Holocene forerunners. This means that in the creeks no settlement remains are expected but remains of boats and fishing gear could be present in these areas.

In concluding the remarks about the Roman period, the study area could be divided into 3 separate areas. The survey work detected two concentrations of Roman period material, a zone with dispersed Roman artefacts and a zone without Roman remains at the surface. This should result in different management regimes: preventive excavations for the identified concentrations and watching briefs for both the upper part of the soil stratigraphy in the second zone and deeper layers of the stratigraphy in the third zone.

There are a number of ceramic groups that are useful for evaluating archaeology in the early and high Middle Ages (5^{th}-12^{th} century). Chaff-tempered wares (fig. 3.2.3), wares with calcium carbonate temper (shelly wares: fig. 3.2.4), wares with a dark core (fig. 3.2.5), Badorf ware (fig. 3.2.6), red-painted Rhineland wares (figs 3.2.8 & 9), Ardennes wares (fig. 3.2.10), Hamwih class 13 wares (fig. 3.2.11) and Paffrath wares (fig. 3.2.12). Some of the early medieval wares (chaff tempered and Badorf) were found in the vicinity of an early medieval place name (*Eiergem*). This suggests that early and high medieval place names are useful indicators that can be used in archaeological management. The red painted pottery from the Rhineland is a very useful tool for evaluating the period from the 10^{th} to the 12^{th}/13^{th} century. It occurs in statistically meaningful quantities and allows identification of scatters which can be interpreted as former settlements, zones with less finds which can be interpreted as former agricultural land and zones without such material, which we assume were not used as arable land. It has been concluded from the survey work, that plots with more than 5 such fragments per ha (fig. 3.2.7, about 10 % of the area) should be incorporated into areas where an increased level of archaeological follow-up for all infrastructure works is required. Areas with densities above 40 fragments per ha (fig. 3.2.7) are interpreted as defining former settlements and in these areas, a minimum of trial-trenching is recommended before any activity takes place that penetrates the soil below the plough depth. The zones without red painted fragments at the surface correspond approximately with the area of the Testerep tidal creek though interestingly the areas immediately adjacent had no fragments of ceramic material either.

Grey ware (figs. 3.2.13 & 14) is useful for evaluating the Middle Ages (9^{th}-15^{th} century). The distribution pattern of grey ware is very similar to the distribution of red painted ware and in combination an appreciation of chronology becomes possible, as late medieval (13^{th}-15^{th} century) concentrations can be separated from one another. Ceramics from Siegburg and highly decorated red wares are very suitable for evaluating the late medieval period (figs. 15-16). They occur throughout the study area and demonstrate that the reclaimed tidal creeks were definitely used as agricultural land in late medieval times. Scatters of red wares (fig. 17) systematically occur in the vicinity of existing farms and this suggests that many of these farm-sites date back to the high Middle Ages. During their evolution, these sites have repeatedly seen slight changes in location and this is detected by the field survey. Archaeological management has to take into account the existing farm sites and their surroundings as areas of considerable potential. Three specific scatters were identified during the field walking.

The material remains from the second half of the 16th century to the present-day have yet to be analysed in detail, but no significant concentrations from this period have been located. There is, however, considerable research potential related to distribution of certain types of ceramics and much of this type of data is thought unlikely to exist elsewhere in the same quantities.

In summary, this quick method of line walking identified 13 units, in which two scatters of Roman date were defined, four units identified as former settlements dating from the early and/or high Middle Ages and sixteen others which could potentially be identified as such. Three artefact scatters dating from the late Middle Ages and thirteen others could also be potentially identified. A total of 45 survey-units require detailed archaeological follow-up. This represents about 25% of the area and is a good expression of the archaeological potential of these reclaimed wetlands, which at present are undervalued.

Detailed grid walking

In survey unit 32, a concentration of material that could not be precisely defined by quick line walking, was surveyed in grids during the second stage. Seven grids of 30 by 30m, subdivided into individual units of 3 by 10m were used (fig. 3.2.18). The distribution patterns of red painted ware, red ware and grey ware were analysed in detail (figs 3.2.19-21). Red ware concentrations were identified in block 6 and the grey ware, though less concentrated, identified that blocks 5 and 7 also belonged to this concentration. The red painted ware had a distribution pattern situated outside the main area of the concentration. This detailed survey showed the potential of grid walking to refine distribution patterns. These are still visible and are not entirely obliterated by ploughing. The results also show that red painted ware had been spread out by other mechanisms. This method of grid walking is time consuming but provides more detailed information, which allows more thorough interpretation. The distribution of the red ware strongly suggests that the concentration is not older than the 13th century and the absence of material from the 16th century suggests an upper chronological limit. The combination of this dating evidence, of the remains themselves and their distribution pattern, allows a date range of the 13th – 16th century for the concentration in survey unit 32. The grid walking also provides important management information as it allows more precise areas to be defined. This method when repeated should allow a differentiation to be made between both scatter resulting from ploughed-out settlements and scatter resulting from intensive and long manuring of agricultural areas.

Results of the Magnetometer survey

Survey-units 26, 27 and 28 were geomagnetically tested and revealed a set of plot boundaries related to a former trackway. Along this track way, concentrations of material dating from the high and late medieval period have been detected by the line walking. Survey unit 32 was tested in the zone of block 6 and 7 where detailed grid walking had been undertaken. In this zone numerous anomalies were detected including a possible oven. Ditches were not detected, which if correct, implies that the settlement was not a ‘moated site’. In survey units 142-143 a number of rectilinear positive anomalies were revealed. This strongly suggests that the scatters dating to the early and/or high Middle Ages may be related to structures, remains of which lie below the plough soil. By contrast, survey unit 155, which had a very high concentration of pottery fragments of early and/or high Middle Age date, showed no sign of anomalies, which might suggest the presence of structural remains. Apparently the roughness of the surface of the plot resulted in less clear magnetic signals and it is suggested that in order to achieve the best results, areas in the Flemish Polders should be entirely level before applying magnetometry with success.

Geophysical research at Walraversijde

The site of the former medieval fishermen's settlement at Walraversijde, has seen more than 10 years of archaeological work, in close collaboration with the province of West Flanders. About 2 ha of the site has been excavated so far. The area untouched by excavations, has been surveyed using magnetometry and electrical resistivity. Close to the excavated area, the magnetometry revealed the continuation of ditches recorded during excavation. In the area of the former chapel, the electrical resistivity provided evidence for the ditch and/or brick wall of the churchyard. These non-destructive techniques allow more detailed hypotheses to be elaborated and programs for future excavation work to be designed.

The Digital Terrain Model of Flanders applied to archaeology in the coastal plain

The development of the DTM for Flanders in the period 2001-2004 was coordinated by the Support Centre GIS Flanders and commissioned by the Flemish water management institutes, primarily initiated by the floodings in the last decade. Two acquisition techniques were used: scanning airborne laser altimetry (LiDAR) in the non-urban areas and photogrammetrical techniques in the urban areas (about 5% of the total surface). LiDAR data is available at a mean density of 1 point/20m², and the photogrammetrical data has a density of 1 point/100m². On hard surfaces or surfaces with, for example, short grass, a mean precision of 7cm is guaranteed. In the polder area the data was collected in the period 2003-4. From the onset of the creation of this product the high potential of the DTM for archaeological and geomorphological applications was realized. Since the product became regularly available in 2005 it has been used more systematically fashion in archaeological and landscape studies.

In this project the DTM is used on different scale levels and with different goals. During the first phase DTM was used to identify general structural elements of the landscape (anthropogenic and geomorphological features). For this the DTM was processed (with ArcGIS' *spatial analyst*, using Kriging analysis for creating the raster) for a large area: from *Bredene* to *Slijpe*, about 15 km along the coast and 5 km land inwards. It was striking that it was possible to identify and define fossil gully systems (for example in the historical polders of Ostend), creek ridges, relict parcel structures, dykes, moated sites and areas of former peat extraction. For these latter areas the DTM proved itself to be a better source for identification and demarcation than the soil map. During a second stage, archaeological information for the area, especially the fieldwalking results, have been compared with the DTM. For this a range of spatial analysis and imaging techniques were used (hillshade imaging, contouring etc.). A striking pattern for the two larger concentrations of Roman finds was noted: here the association with higher areas (fossil creek ridges?) amidst thoroughly peat extracted zones becomes apparent. Where the Medieval concentrations were noted several associations become immediately apparent. Firstly all large concentrations are situated in zones where the DTM shows no peat extraction, and in the zones with peat extraction very few finds have been recovered. Secondly these finds seem to be situated in zones where, using a combination of the soil map, aerial photographs and the DTM, one or more moated sites can be identified. A third possibility of association, but one which needs a lot more study, lies in relating the identified moated sites and surface findings with on the DTM visible relic parcel systems.

The DTM also proves to be a very interesting instrument with respect to the problem of the so called '*terpen*'. As a testcase the DTM was analysed for Leffinge and Bredene, two villages which are thought to be situated on *terpen*. In both cases a clear circular mound structure is visible as a central structure - in the case of Bredene about 150m. in diameter, in the case of Leffinge about 300m. in diameter.

In general the DTM offers a number of possibilities in recognizing patterns and identifying features in the polder area, which can be used to formulate new hypotheses for a number of problems, for example the interpretation of the Roman surface material, or the *terpen* issue.

For this a larger sample is needed, and the DTM needs to be compared with other surface collections or archaeological data. In general, also because of the relative scarcity of data for, for example, the Roman period, it seems necessary to analyse the total Flemish polder area with the DTM.

Geology in support of the archaeological survey

Following the archaeological prospection, a geological reconnaissance survey has been undertaken in the study area. The aim was to detect whether there is a correlation between the concentration of archaeological finds of the Roman period and the geological setting. Therefore, a series of undisturbed hand borings has been carried out at those localities with a high concentration of pottery fragments. In order to integrate the results in a larger context, all the existing borehole descriptions of the study area have been re-examined with special attention to the deposits covering the surface peat (*i.e.* the last 2000 years).

The results show that the locations with a high concentration of ceramics from the Roman period coincide with peat extraction zones. Since the geological history of the post-peat period is rather well known (Baeteman *et al*., 2002; Baeteman, 2005), it could be assumed that the peat extractions are from medieval or later periods. The excavation pits show a complex stratigraphy which can change from place to place. In many places, the bottom of the pit is filled with a thin layer of sand with a concentration of *Hydrobia* overlain by a 2m thick heterogeneous mud characterised by reduction spots and containing a lot of peat detritus and occasionally a few small sherds and freshwater gastropods. Sometimes thin organic horizons are present. From a certain level, the heterogeneous layer is covered by thinly laminated tidal flat deposits. This stratigraphy shows that the abandoned excavation pits were initially flooded by coastal waters with little sedimentation. The water-filled pits became fresh and were progressively filled with material from the direct surroundings. This implies that for a quite long time this area was deprived of natural sedimentation. This is in accordance with the geological history of the last 2000 years, showing that tidal flat deposition was again occurring after 1400-1200 cal BP.

The boreholes carried out in the southern area with a high concentration of archaeological remains have been correlated in five cross-sections. They show that the peat excavations are located in an area where the Pleistocene subsoil (well-drained and relatively consolidated sand) is at a relatively high level. The area is also located between two major 'young' Holocene sand-filled tidal channels. The geological setting of the area with a high concentration of archaeological finds in the northern area shows a similar situation with a high position of the Pleistocene subsoil and the presence of a major tidal channel.

In order to find out whether the peat excavations were planned systematically according to environmental conditions, two maps have been made indicating all the new and existing boreholes with peat excavations and where the peat has not been excavated. The map of the southern area shows that many places have been excavated including areas where no archaeological remains have been found so far. However, the maps do not show any particular pattern. It appears that peat extraction occurs randomly and there is no apparent relation with a particular geological setting.

As a tentative conclusion of the geological survey, it can be suggested that peat extraction was undertaken randomly in the entire area. However, it seems that the settlements were selected according to the most favorable locations in the plain.

Testing a mechanical drilling set in the Flemish wetlands

In order to facilitate stratigraphical and palaeobotanical survey and research, a mechanical coring set has been used within the framework of the Planarch 2 project. A percussion drilling set for heterogeneous soils, powered by a gasoline driven percussion hammer was used. In comparison with the classical hand augers and hand soil core samplers the percussion drilling set offers better possibilities for inspection, description and sampling, thanks to its wide, open gouges and closed liner sampler (Canti & Meddens 1998). With the percussion drilling set specific problems can be tackled better, such as the environmental setting of archaeological sites, the evolution of the landscape, the identification of inhabitable places.

In the Planarch 2 project percussion drillings have been carried out in the marine wetlands, in completion of archaeological and palaeobotanical research carried out earlier (Deforce & Bastiaens, in prep.). The earlier palaeobotanical research had been conducted on a sequence exposed in an archaeological excavation pit and focused on the presence of peat layers, the so-called surface peat. The aim of the percussion drilling was to describe and sample the underlying stratigraphy and to locate the so-called basal peat in order to allow a better deposit modelling.

As a way of evaluating the percussion drilling performed in the Flemish wetlands, hand auguring was also carried out. The two sets of results were compared and clearly they offer an insight into the pros and cons of both methods.

Conclusions

So far pre-Roman remains have not been detected in the survey area. As a result, the possible material record of those periods cannot yet be properly managed. Other methods are needed either to detect material remains from these periods or to explain their absence.

For the Roman period, three distinct areas were identified: zones without scatter, zones with dispersed scatter and zones with concentrated scatter at the surface. The zones without scatter correspond to visible former tidal creeks. The nature and the exact stratigraphical position of the concentrations have still to be analysed. Analysis of the Digital Terrain Model suggests a relationship with higher areas, probably fossil tidal gullies mainly with sandy sediments in the subsoil.

The data relating to the early and/or high Middle Ages allows a number of conclusions to be drawn. Areas with place names from this period are important archaeological zones that can be deduced from the distribution of pottery from the early medieval period. Red painted ceramics are a very useful tool for evaluating the archaeological potential related to the high Middle Ages. This results from the fairly large amounts of red painted ware and the dating evidence it provides. Based on the densities of this material, distinctions can be made between ploughed out former settlements and zones interpreted as former agricultural land. Five fragments per hectare is considered as defining a limit between agricultural land and former settlements. Areas with densities higher than five per need to be watched carefully. That does not mean that every hectare plot with more than five fragments of red painted pottery should automatically be interpreted as a former settlement but the possibility cannot be excluded.

The distribution of imports of early and/or high medieval date, has been compared with the distribution of grey and red ware. This comparison allows the dating of the duration of occupation and land use to be made.

For the late medieval and early modern period red wares are very important. Zones with high densities of such material systematically occur near existing farms. The area around these farms frequently contains material remains from earlier periods and these farms constitute zones of high archaeological potential.

For the last five centuries the survey work mainly provides information about the distribution of certain ceramic groups and less about former settlements and the landscape seems to have attained more or less its present day structure. The distribution of certain ceramic products is probably only present in the plough layer but nonetheless should be considered as an important archaeological resource.

The line surveys revealed 45 units, which deserve appropriate archaeological management. This is about 25% of the total survey area: an extremely high percentage.

Using the detailed grid surveys, scatters can be efficiently and precisely located and this type of information allows more detailed interpretation of chronology and site evolution.

Geophysical analysis has allowed scatters to be connected to structures present below the plough soil, providing important information for the development of management strategies.

The Digital Terrain Model of Flanders with a mean guaranteed precision of 7cm seems to be a very powerful tool in archaeology. This Model should be thoroughly confronted with existing SMR's.

Geological research has been carried out in order to evaluate patterns observed via the systematic field survey. It looks as if the Roman pottery concentrations are to be correlated with peat extraction zones. Peat extraction seemed to have been a lot more intensive in the pre-medieval times than thought before and this factor should be taken into account in management plans.

A mechanical drilling set has been tested in the Flemish Wetlands. It provides a useful tool for deposit modelling.

Notwithstanding these survey techniques, trial trenching is still considered necessary to efficiently control the information obtained by the before mentioned techniques and methods.

As a general conclusion, it is recommended that a larger area of the Flemish Polders should be rapidly surveyed. This is a very efficient way of providing information for archaeological management of the existing landscape. The analysis of a statistically significant part of the Polders should allow a valid model for the whole of the Polders to be made. Using this method a great deal of information can be added to the existing SMRs and understanding of the important landscape of the polders can be improved.

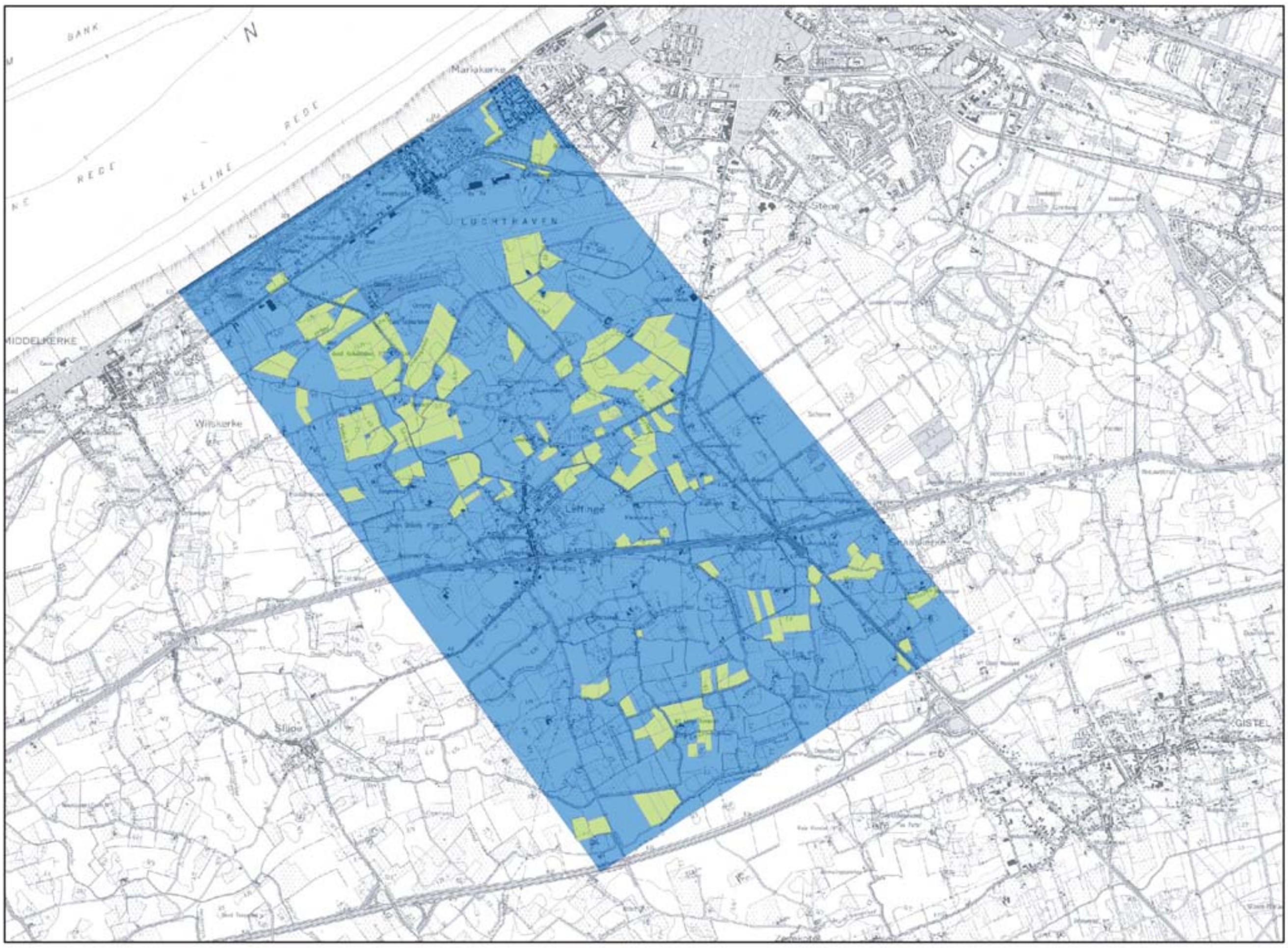


Fig 3.2.1 Location of the study area

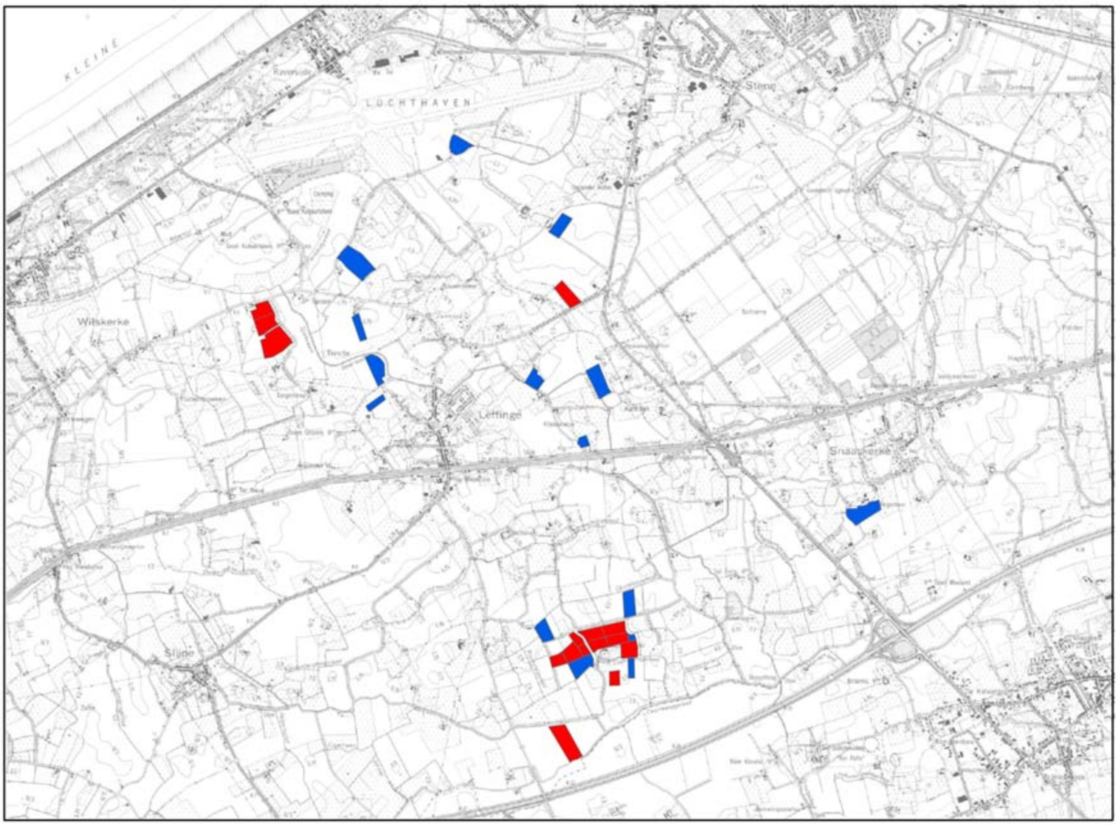


Fig 3.2.2 Distribution of plots with Roman pottery at the surface. Units with 1 fragment per plot are compared to units with 2 or more fragments per plot.

Blue:1 Fragment
Red: 2 or more fragments

Fig 3.2.3 Distribution of chaff tempered wares.

Fig 3.2.4 Distribution of shelly wares.

Fig 3.2.5 Distribution of wares with a dark core

Fig 3.2.6 Distribution of Badorf

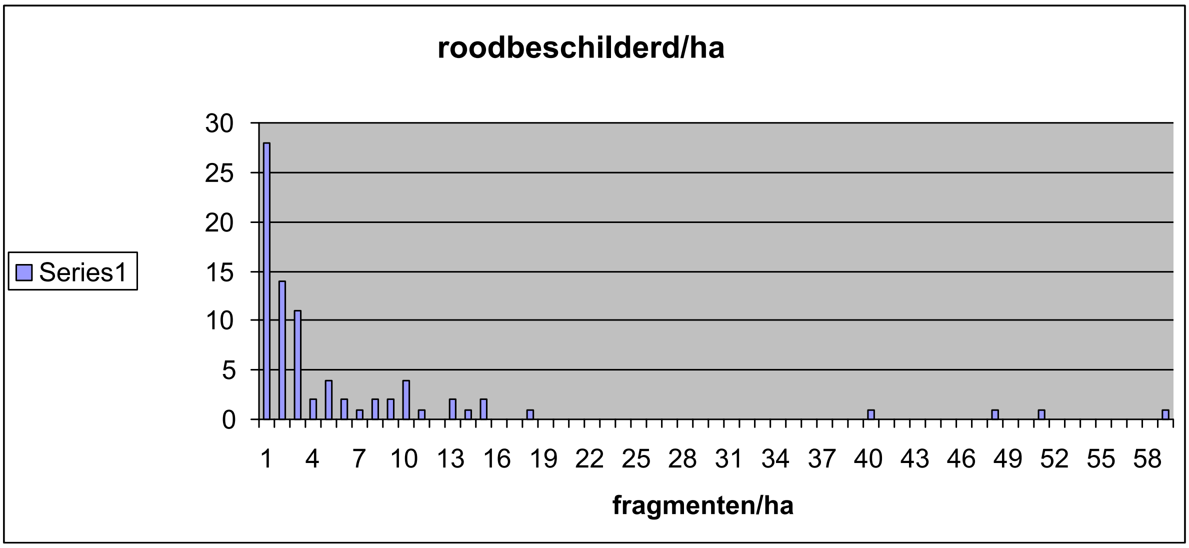


Fig 3.2.7 x-axis = number of fragments of red painted pottery per ha. & y-axis = number of survey units

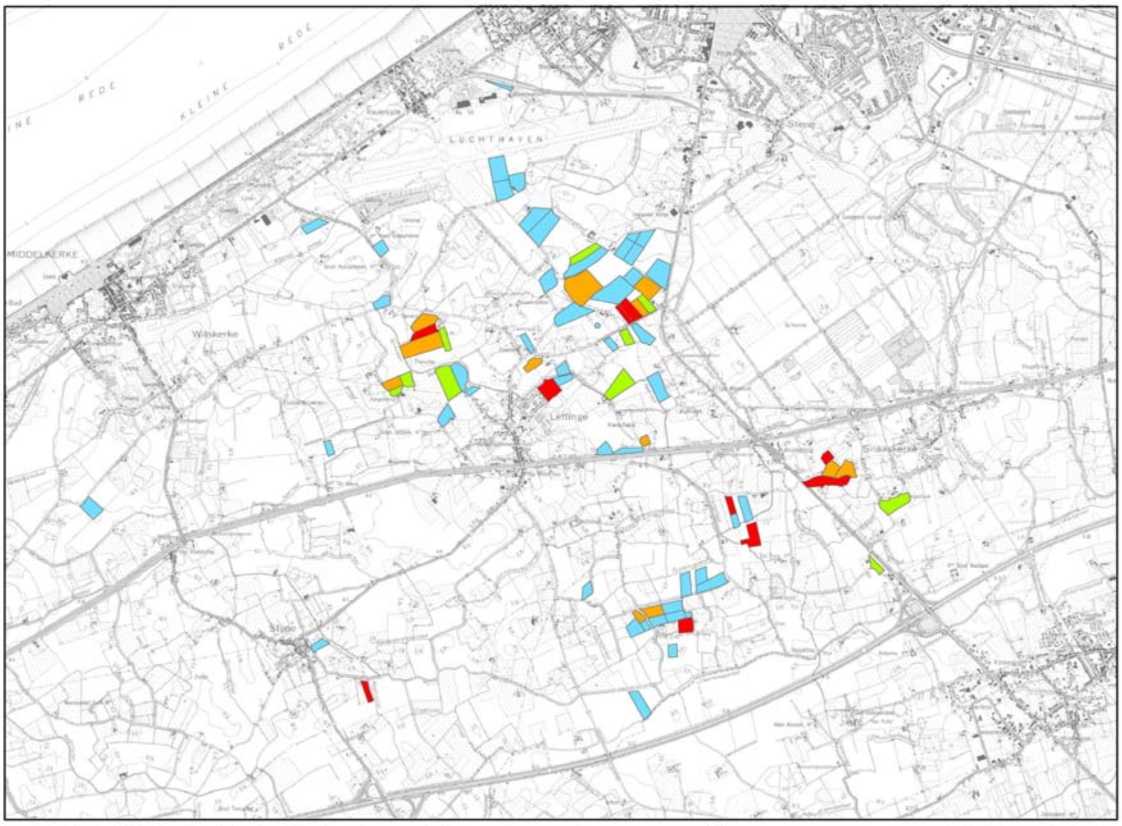


Fig 3.2.8 Distribution of red painted pottery in 4 classes (fragments per survey unit)

Red: 20 fragments or more
Orange: 10-19 fragments
Green: 5-9 fragments
Blue: 1-4 fragments

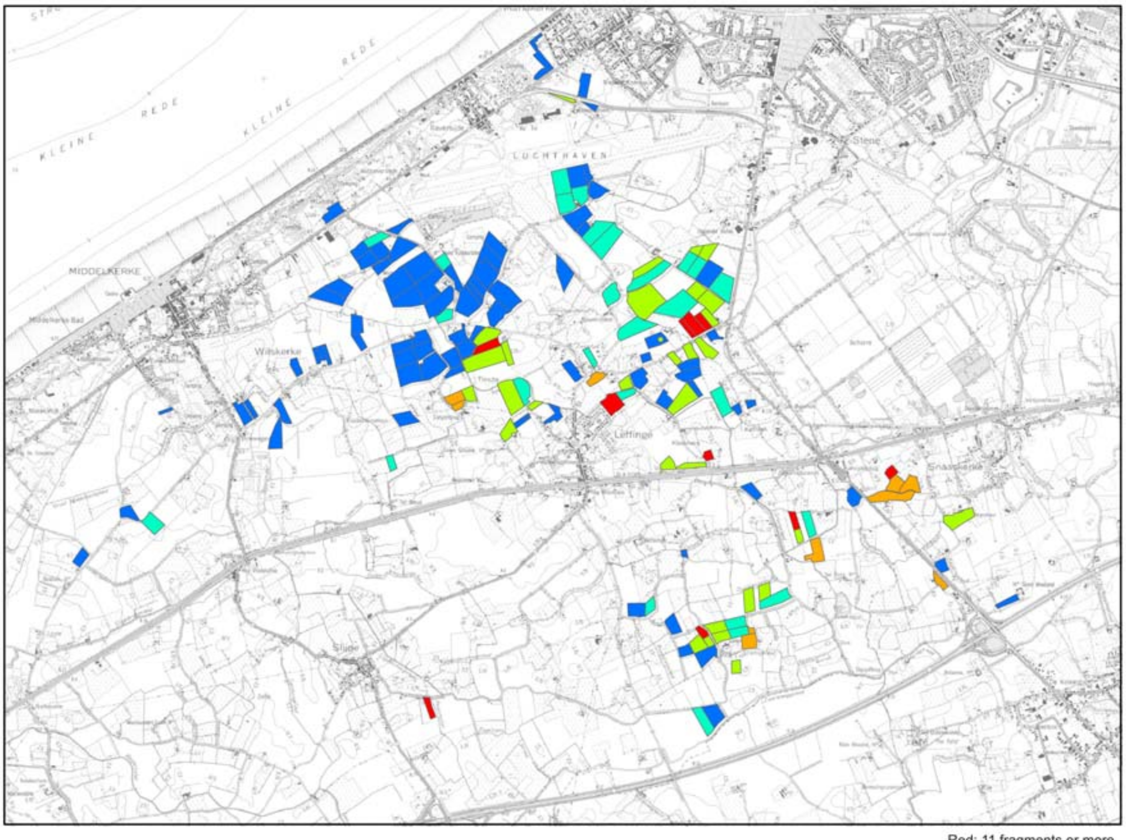


Fig 3.2.9 Distribution of red painted pottery in 5 classes (fragments per hectare)

Red: 11 fragments or more
Orange: 6-10 fragments
Light Green: 1-5 fragments
Dark Green: less than 1
Blue: None

Fig 3.2.10 Distribution of Ardenne

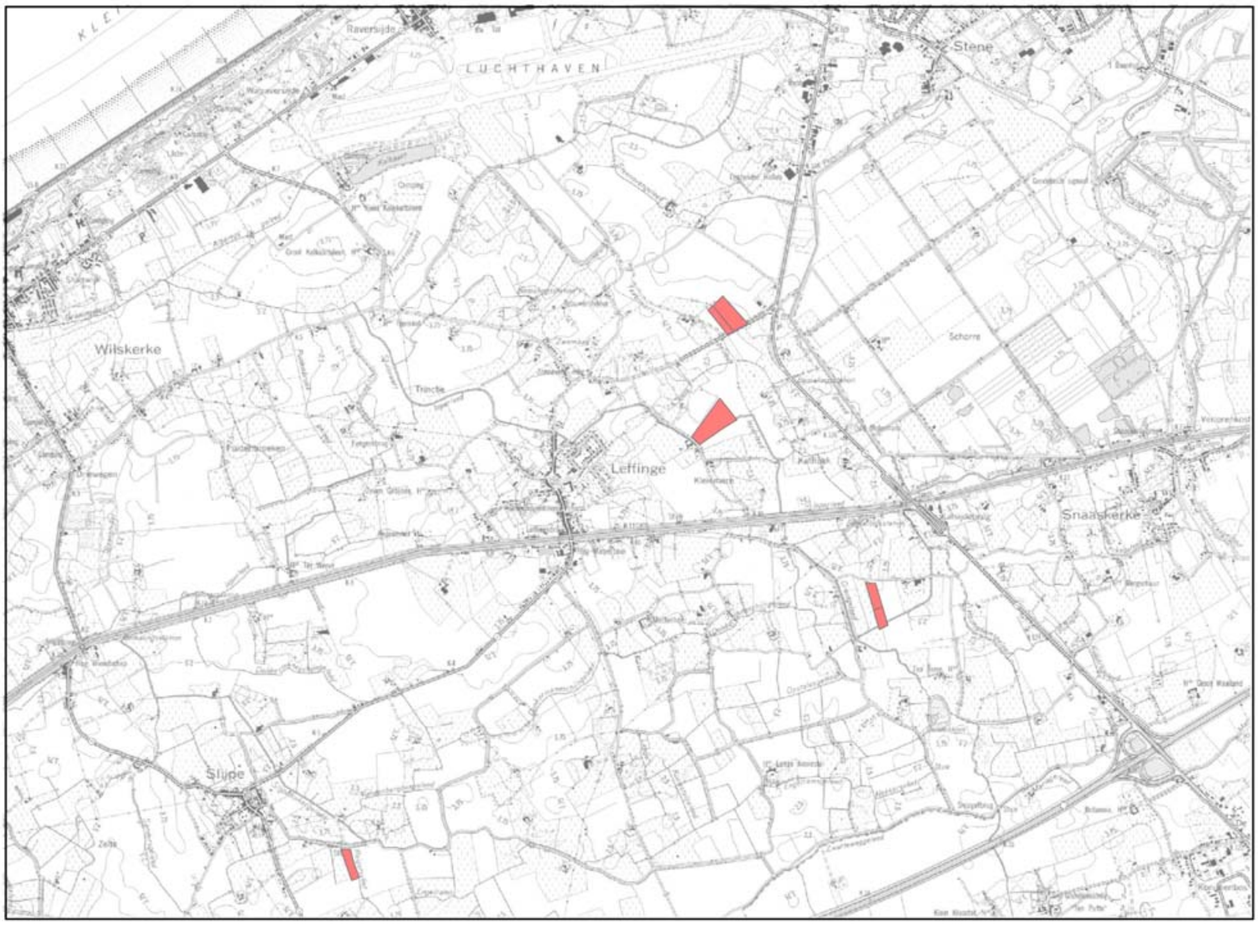


Fig 3.2.11 Distribution of Hamwih Class 11

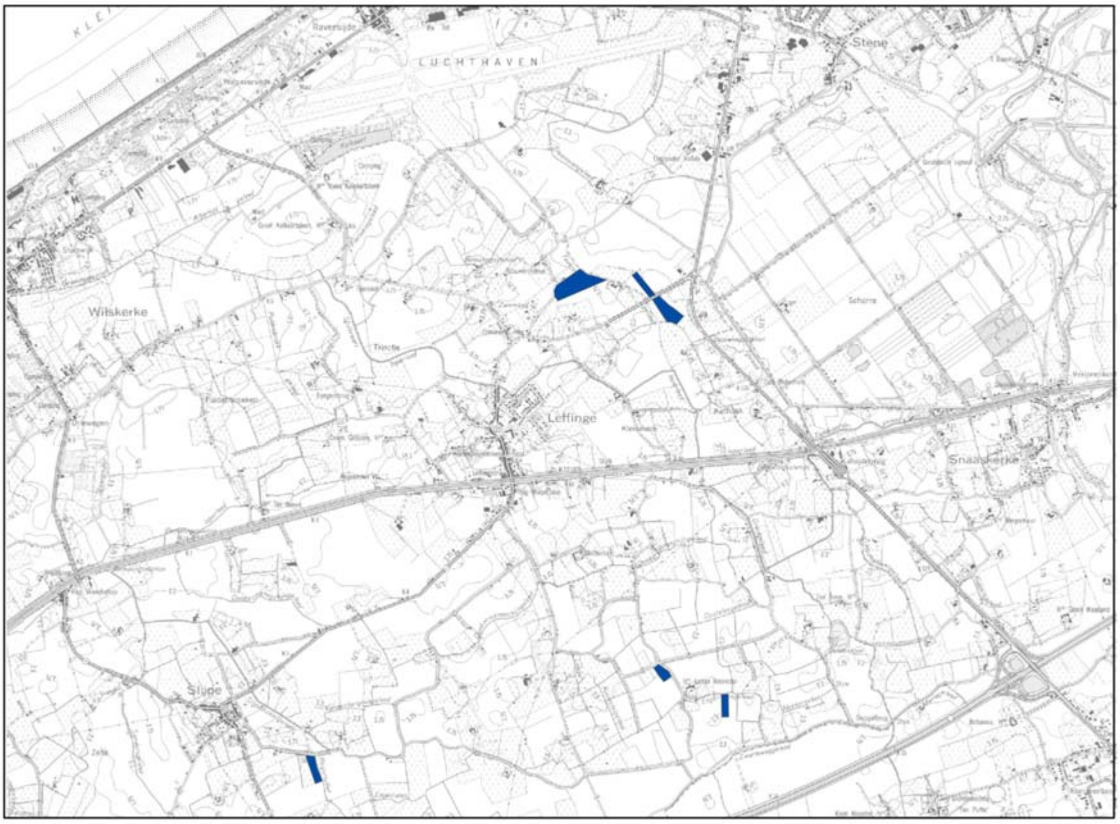


Fig 3.2.12 Distribution of Paffrath pottery

Fig 3.2.13 Distribution of grey wares in 5 classes (per hectare)

Red: More than 150 fragments
Orange: 100-149 fragments
Brown: 10-99 fragments
Green: less than 10 fragments
Blue: None

Fig 3.2.14 Ration of grey ware/red ware in 6 classes

Red: 4 or more
Orange: 3-3.9
Light Green: 2-2.9
Dark Green: 1-1.9
Blue: 0.5-0.9
Rose: less than 0.5

Fig 3.2.15 Distribution of Seigburg pottery

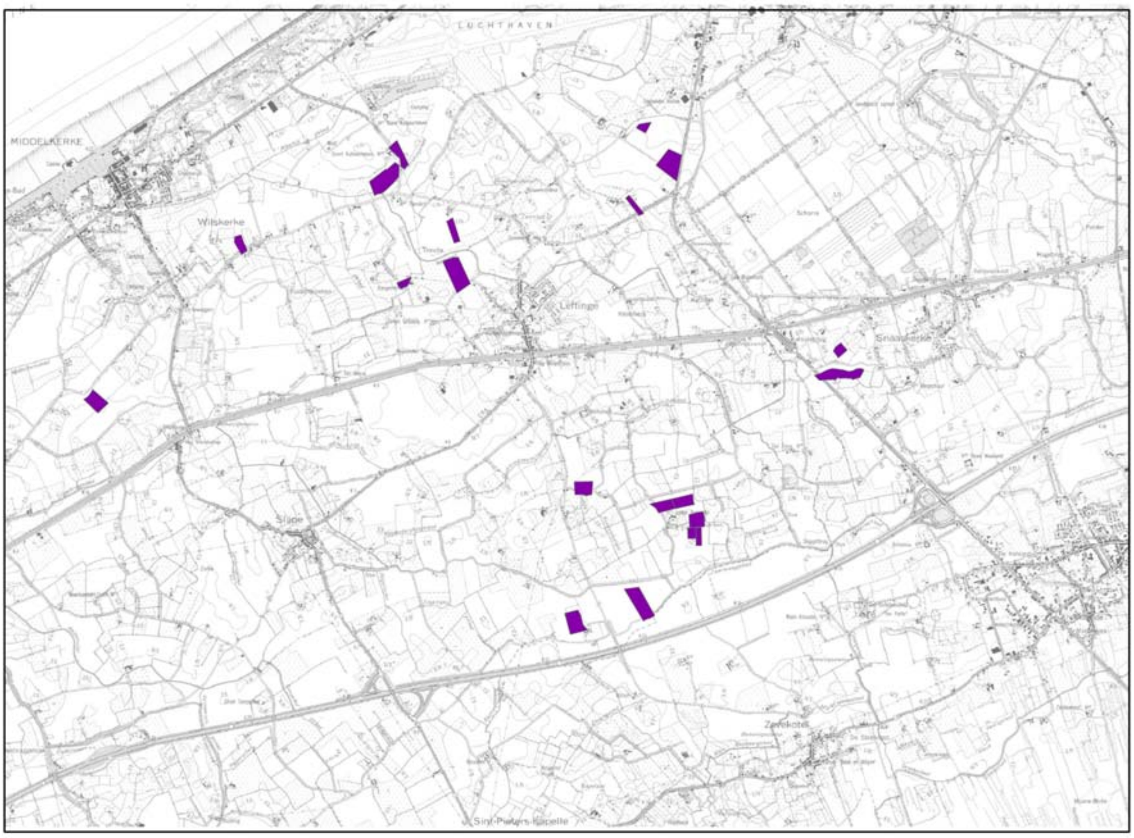


Fig 3.2.16 Distribution of highly decorated red ware

Fig 3.2.17 Distribution of survey units with high densities of red wares and two separately identified concentrations

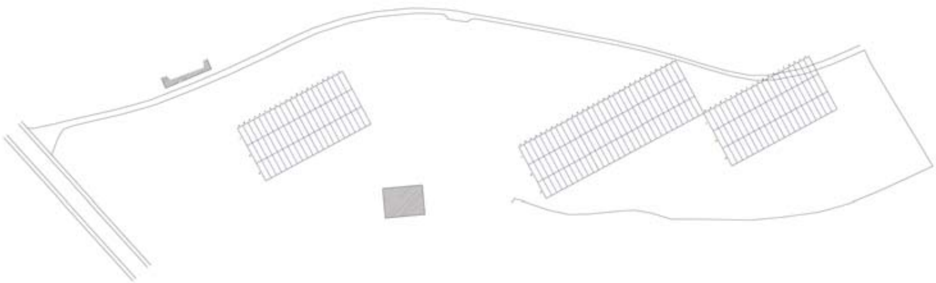


Fig 3.2.18 Location of 7 blocks for the grid survey at unit 32.

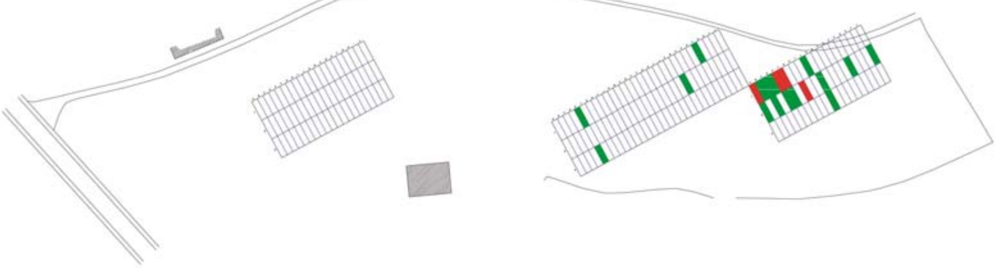


Fig 3.2.19 Distribution of red ware at unit 32

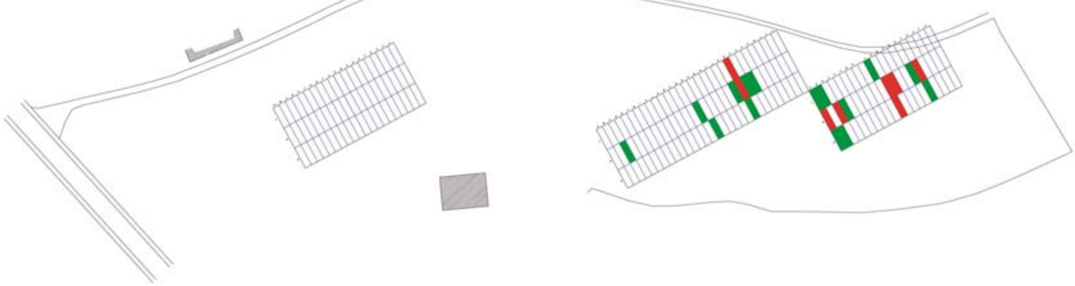


Fig 3.2.20 Distribution of grey ware at unit 32

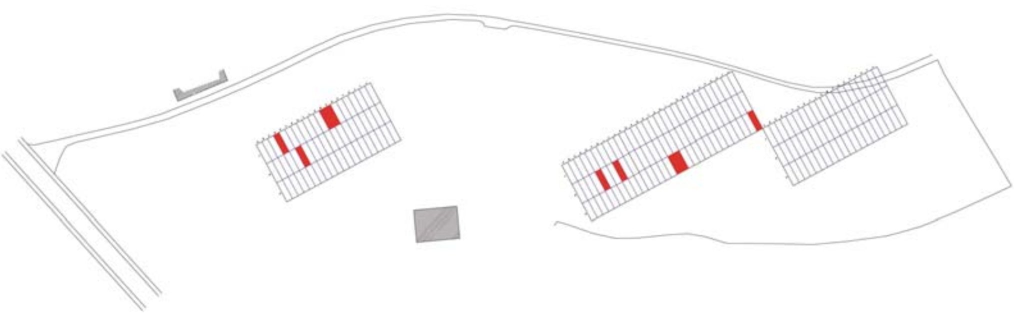


Fig 3.2.21 Distribution of red painted ware at unit 32

3.3 KENT

L Dyson

The North Kent Coast

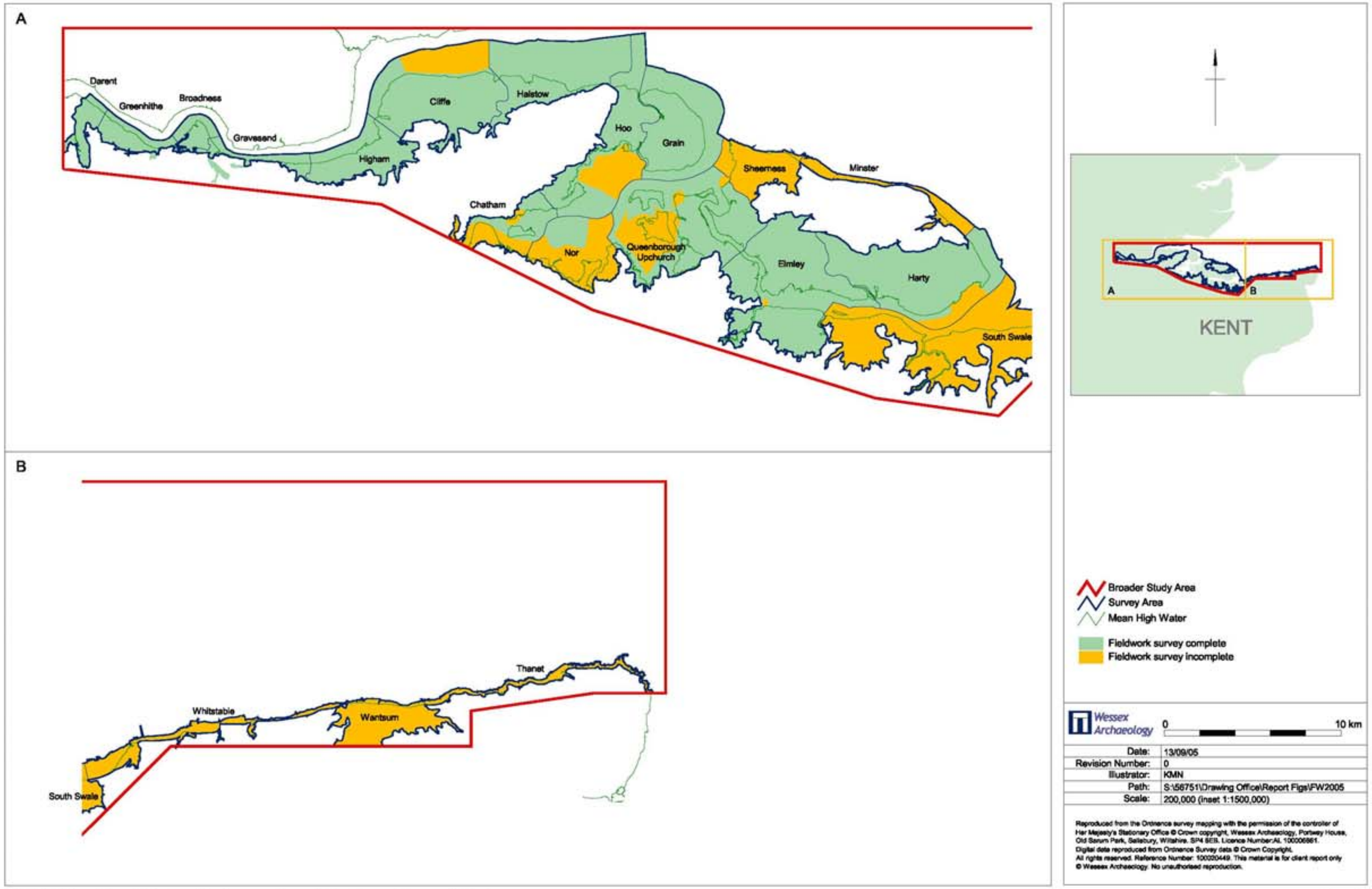
The north Kent coast stretches from the confluence of the River Darent and the River Thames at the county boundary in the west to North Foreland in the east. It includes the southern part of the Thames estuary, the Medway estuary, the Swale sea channel and numerous islands, such as the Isle of Sheppey, and former islands, such as the Isle of Grain. The coastline is highly indented with one large and many small peninsulae, and numerous tidal inlets. The north Kent coast can be measured at about 104km in length but is far longer if the numerous islands and inlets are also taken into account.

Most of the coast is low-lying, below 5m OD, but there are low cliffs towards the west at Gravesend, on the north side of the Isle of Sheppey, and towards the east around Whitstable, Herne Bay and Margate. Extensive areas of grazing marsh, reclaimed since at least the Medieval period, are protected by sea and counter walls. Changes expected in the next 100 years on the North Kent coast can be summarised as predominantly large scale mudflat loss, with some areas of significant saltmarsh gain in the Medway estuary (North Kent Coastal Habitat Management Plan Final Report 2002). Extrapolation of historical trends suggests future saltmarsh loss on the southern bank of the Thames Estuary and a gain in mudflat. The Medway estuary is a macro-tidal estuary, considered to have a positive sediment budget, and is the largest tributary to the Thames. It has undergone significant modification due to human activity through the construction of flood defences and large-scale digging of clay in the 19th and 20th centuries.

Like the Essex coast, the North Kent Coast is highly important for nature conservation, and much of it is designated under the RAMSAR convention and as a Special Protection Area. The majority of the coastline is also protected by the national designation of SSSI.

Coastal Archaeology in North Kent

Throughout prehistory and history the River Thames has formed a major thoroughfare between the continent and the heart of England. Indeed for substantial periods of time the British Isles have been part of the continental mainland, with the Thames, which moved to its present valley during the Anglian glaciation, forming a tributary of the Rhine. The lower Thames, particularly the area between Crayford and Gravesend, is probably the richest and most well-known area in the UK for Palaeolithic archaeology and Quaternary geology. Following the end of the last glaciation, deep alluvial deposits have accumulated in the river valleys, burying the earlier Holocene land surfaces and preserving artefacts, structures and environmental evidence. The marshes and inter-tidal zone that fringe the Thames, Medway and Swale are also rich in visible evidence of their long occupation. There are numerous examples of maritime and military remains, large medieval churches founded on wealth from the wool trade, and substantial industrial remains such as gunpowder works, and structures relating to the cement, power and chemical industries. Archaeological remains on the north Kent coast have attracted sporadic attention for centuries. From at least the mid-eighteenth century it has been recognised that very large quantities of Roman pottery could be found in the marshes north east of Rochester. Various local archaeological groups have undertaken fieldwork in the coastal zone. In particular the Upchurch Archaeological Research Group has carried out long term monitoring of archaeological sites and monuments in the intertidal zone in the area north of Gillingham and Rochester, and the Oyster Coast Fossil Society have recorded archaeological remains in the Whitstable area. Discoveries of prehistoric trackways and other sites made by the groups have enhanced awareness of the considerable archaeological importance of the Thames and Medway estuaries. In general, however, systematic survey of the north Kent coast had not been carried out until the recent Rapid Coastal Zone Assessment Survey.



The 20 Stretches of the north Kent coast showing areas of completed and incomplete survey fieldwork

Figure 12

Fig 3.3.1 North Kent coastal survey area (image: Wessex Archaeology)

Fig. 3.3.2 Survey of hulk during north Kent coastal survey (photo: Wessex Archaeology)

Fig. 3.3.3 Wooden fish-trap, Shornmead, Kent (photo: Wessex Archaeology)

Fig. 3.3.4 Recording Shellness WWII minefield control tower, north Kent coastal survey (photo: Wessex Archaeology)

North Kent Coast Rapid Coastal Zone Assessment Survey

A Rapid Coastal Zone Assessment Survey (RCZAS) of the historic environment of the north Kent coast is being undertaken by Wessex Archaeology on behalf of Kent County Council with funding from Interreg IIIB and English Heritage. The work originated as one of a number of pilot coastal zone surveys undertaken in England with the aim of refining methodologies and practice. The aim of the north Kent coast RCZAS is to enhance information in the county Sites and Monuments Record (SMR) in order to allow more informed decision-making in relation to strategic coastal planning and management initiatives, and for individual development proposals.

Phase One of the survey comprised a desk-based assessment of the historic environment of the north Kent coast from the River Darent in the west to North Foreland in the east. The vertical extent of the study area was from 0m OD (Mean Low Water) to +5m OD. The former generally represents the county boundary whilst the latter is generally above the extent of Holocene alluvial deposits. All readily available archaeological, documentary, cartographic and air photographic sources were studied and 1864 new records were created and incorporated directly into the Kent SMR. In addition a simple digital elevation model of coastal change from the Mesolithic to the present day, based on modern bathymetry and topography, covering the area between 30m below Chart Datum and 50m above Ordnance Datum, was provided.

The desk-based phase has been followed by a phase of field survey that aims to check existing records and identify and describe new, previously unrecorded, monuments and finds. The Phase 2 survey has focussed primarily on the inter-tidal zone as the area subject to most change, due mainly to coastal processes, coastal protection works and built development. At the present time there is also no clear funding mechanism for mitigation of the effect of natural coastal processes on the historic environment. The methodology for the field survey has been developed and refined over five seasons of fieldwork (Wessex Archaeology 2006 North Kent Coast Rapid Coastal Zone Assessment Survey Phase II Field Assessment Year Two Report and earlier reports). From the outset it was decided that it would be most efficient to be able to access the digital SMR in the field and similarly to be able to edit existing records, and create digital data for new records, also in the field. It was therefore necessary to find software and equipment that could be taken into quite harsh field conditions. The most cost-effective equipment was found to be a handheld Trimble GeoXT which combines a Trimble GPS receiver and a computer running 'Pocket GIS' Windows mobile software for Pocket PCs. This unit was found to have a lateral and vertical accuracy to within one metre, which is considered adequate for this type of survey. More precise surveying would obviously be required for detailed monument survey and to obtain sea-level index points. A second survey unit which had been used during the earlier phases of the field survey and comprised a GPS in a backpack and a linked handheld PC, was also carried as a back up.

The estuaries along the north Kent coast contain many islands, and it has been necessary to use a small workboat (W4.65 Avon inflatable) to gain access for survey. In future it may also be helpful to use the workboat to access areas of firm ground near low water which are not easily accessible from land because of large expanses of soft mud.

The field survey comprised an extensive 'walkover' survey of the high water mark and a sample of the intertidal zone of each stretch of coast. Depending on access and time constraints a proportion of the area above high water was also surveyed. Possible walkover routes were identified before going into the field but health and safety issues relating to the soft mud found along much of the north Kent coast often meant that it was a case of assessing which was the safest route to use when in the field. Walkovers were generally undertaken by teams of two people, except when the workboat was being used, in which case two two-person teams were used. Data recorded in the field, including GPS derived polygons for existing and new records, were converted into ArcMap shape files and incorporated into the SMR database.

A total of 221 new monuments were recorded and 230 updated during the 2004 field survey, and 198 added and 379 updated in 2005. Highlights among the new discoveries include a prehistoric submerged forest at low water in the west of the study area, the remains of possible prehistoric brushwood trackways, possible Roman pottery and salt-working sites, substantial wooden fish-traps, and numerous post-medieval wrecks and WWII defence structures.

Pilot Deposit-modelling Survey

In addition to the RCZAS, a second project has been assessing and developing methodologies for deposit modelling. Coastal wetlands are often characterised by areas of deep alluvium. Archaeological investigation in advance of construction of a tunnel under the River Medway revealed a sequence of Holocene alluvial deposits up to 14m thick, and even deeper sequences are known elsewhere along the north Kent coast. Such deposits can contain excellently preserved waterlogged artefacts, structures and environmental indicators, and sometimes preserve whole landscapes with detailed evidence of past activities. These sequences are under threat from coastal erosion, coastal defence works, built development in the inter-tidal zone and deep sub-surface impacts such as tunnels and dredging for navigation and other channels. By their very nature, such sequences may mask the presence of important archaeological remains, which may be very deeply buried and not easily accessible using standard evaluation techniques. It is therefore important to develop cost-effective methodologies for improving understanding of deep alluvial sequences and the archaeological information they contain, and for predicting where particularly significant archaeological remains might be located.

In this context a pilot deposit modelling study was commissioned as part of Action 2A. The project was undertaken by Dr M Bates, University of Wales, Lampeter and supported by Dr R Bates, University of St Andrews (Bates and Bates 2006 Deposit modelling: A Geoarchaeological pilot study in the Kent/Essex Thames estuary – see below). The first stage comprised a review of recent literature on methods and techniques for investigating deeply buried or sub-marine sequences of fluvial, estuarine or marine sediments and producing sub-surface models at different scales. For most areas of the UK in which deeply stratified Pleistocene and Holocene sediments are present, geological maps only show the near surface sediment types, and it is difficult to ascertain the nature of the deposits at depth. Borehole logs obtained for geological purposes can help but the records may not be sufficiently detailed, and terminologies used by engineering geologists may differ from those used by geoarchaeologists. At the present time regional scale-mapping using borehole information is the norm for the north Kent coast area. Site-scale information is commonly available but it is difficult to scale up to the local level.

Part of the northern end of the Hoo peninsula was chosen as an area for a case study of local-scale modelling. An area was selected for site investigation to improve understanding of complex deposits where Pleistocene deposits enter the Holocene floodplain. Binney Farm, Allhallows was chosen for this work because previous development-related fieldwork in the area has shown that the geological sequences are more complex than suggested by the BGS mapping, and interglacial sediments of unknown age had recently been discovered to the west of the site. The investigation used a combination of geophysical and boreholing techniques, and aimed to demonstrate whether:

1. Electro-magnetic (EM) surveying techniques are able to differentiate near surface (upper 3m) differences in sediment types within typical Holocene sequences;
2. Electrical resistivity sectioning can produce sequences that match the EM survey techniques in the near surface zone and extend the electrical sectioning into the deeper sub-surface zone (3-15m);
3. Electrical sectioning can differentiate geological sequences from Pleistocene and Holocene deposits;
4. Careful placing of ground truthing locations (boreholes/test-pits) can significantly enhance understanding of the geophysical data;
5. Combined datasets can provide a detailed picture of sub-surface stratigraphy and site evolution.

The survey instrument used to map the near surface geoelectric units was the Geonics EM-31 with digital acquisition. The site was surveyed with data recorded at 1m intervals along lines spaced at 20m intervals perpendicular to the projected lines of any channels. The lines were surveyed using surveyors tape and compass with the corner points surveyed using the EDM and DGPS.

2D electrical sections were surveyed using a Syscal Junior 2D resistivity geo-electric profiler. Electrode spacings from 1m to 5m were tested at the site with different survey configurations and offset programmes. Ground truthing of geoelectric units was achieved using boreholes drilled either by a Terrier drill rig or a shell and auger drill rig.

The electromagnetic survey was conducted across nearly the full width (c.400m) of the low-lying floodplain between the Allhallows and the former Binney Island to the east. The results suggest the presence, near surface, of low resistance (conductive) units narrowing in a south-westerly direction and being replaced by fingers of more resistant (non-conductive) sediments. A zone of very high resistance exists to the south eastern parts of site suggesting the presence close to the surface of coarse, relatively resistive sediments, perhaps gravels or sands. These results can be interpreted as depicting the distribution of Holocene channels within the marsh system with more conductive units representing channel fills. These appear to equate with recent drainage features on the marsh surface. This information would predict the location of sediments of finer grained texture (clays/silts/organic sediments) within the low resistance zones that might be suitable for palaeoenvironmental investigation. The edges of these zones are likely to be those zones in which channel marginal structures (jettys, trackways etc.) may be present.

Ground truthing through the drilling of the boreholes and microfossil assessment of the contained foraminifera and ostracoda indicated that a thick sequence of laminated sands and silts is present beneath the Holocene superficial sediments. These deposits are certainly of pre-Holocene date being separated from the Holocene deposits by a gravel unit of braided channel character. This evidence enables the geophysical results to be re-interpreted and the moderately conductive units adjacent to the Holocene channel fill re-interpreted as Pleistocene sediments.

The results clearly demonstrate that the electromagnetic surveying techniques are able to differentiate near surface differences in sediment types within typical Holocene sequences (upper 3m of stratigraphy) and Pleistocene sequences. Matching results from the electrical resistivity sectioning and the EM survey techniques in the near surface zone (upper 3m) has been achieved, and geophysical survey has been extended, using the electrical sectioning, into the deeper sub-surface zone (3-15m). Electrical sectioning can be used to differentiate bedrock sequences from Pleistocene and Holocene deposits, although this is difficult without ground truthing. The geophysical survey data have allowed a number of scenarios to be developed for interpreting the subsurface sequence. This has allowed a number of critical locations to be selected for the careful placing of ground truthing locations (boreholes/test pits) that can be used to test the models. Other case studies of local-scale modelling have also been examined as part of the study.

The pilot deposit modelling study has identified a number of limitations on the investigation of sequences and palaeogeographies in the lower Thames Kent/Essex area, including the following.

i) The large-scale mapping provided by the BGS does not reflect the complexity of the subsurface sequences.
ii) Although Pleistocene palaeogeographies are now reasonably well established for the region and are at a scale suitable for placing known sites within a landscape context, their ability to predict the location and characterise the nature of individual sites is poor.
iii) Pleistocene sediment bodies have had a complex post-depositional history and are often characterised by lateral discontinuity.
iv) Within the Holocene and late Pleistocene sequences, preservation and lateral continuity is better but subsurface stratigraphy bears little resemblance to near surface stratigraphy.
v) BGS mapping of the floodplain is too generalised and cannot be used to indicate depth, principal sediment types, or ages/environments of deposition for alluvial sediments.
vi) At present there is a paucity of borehole information available in accessible archives. Detailed modelling can only be undertaken with considerable quantities of point specific data.
vii) Deeper geophysical survey datasets are not presently available for the study area.
viii) Models developed at a regional scale cannot simply be downsized to apply at the local (archaeological site) scale.

Fig. 3.3.5 Geophysical survey, Binney Farm, Hoo, Kent (photo: M. Bates)

Fig. 3.3.6 Shell and auger survey, Binney Farm, Hoo, Kent (photo: M. Bates)

Fig. 3.3.7 Terrier drilling survey, Binney Farm, Hoo Kent (photo: M. Bates)

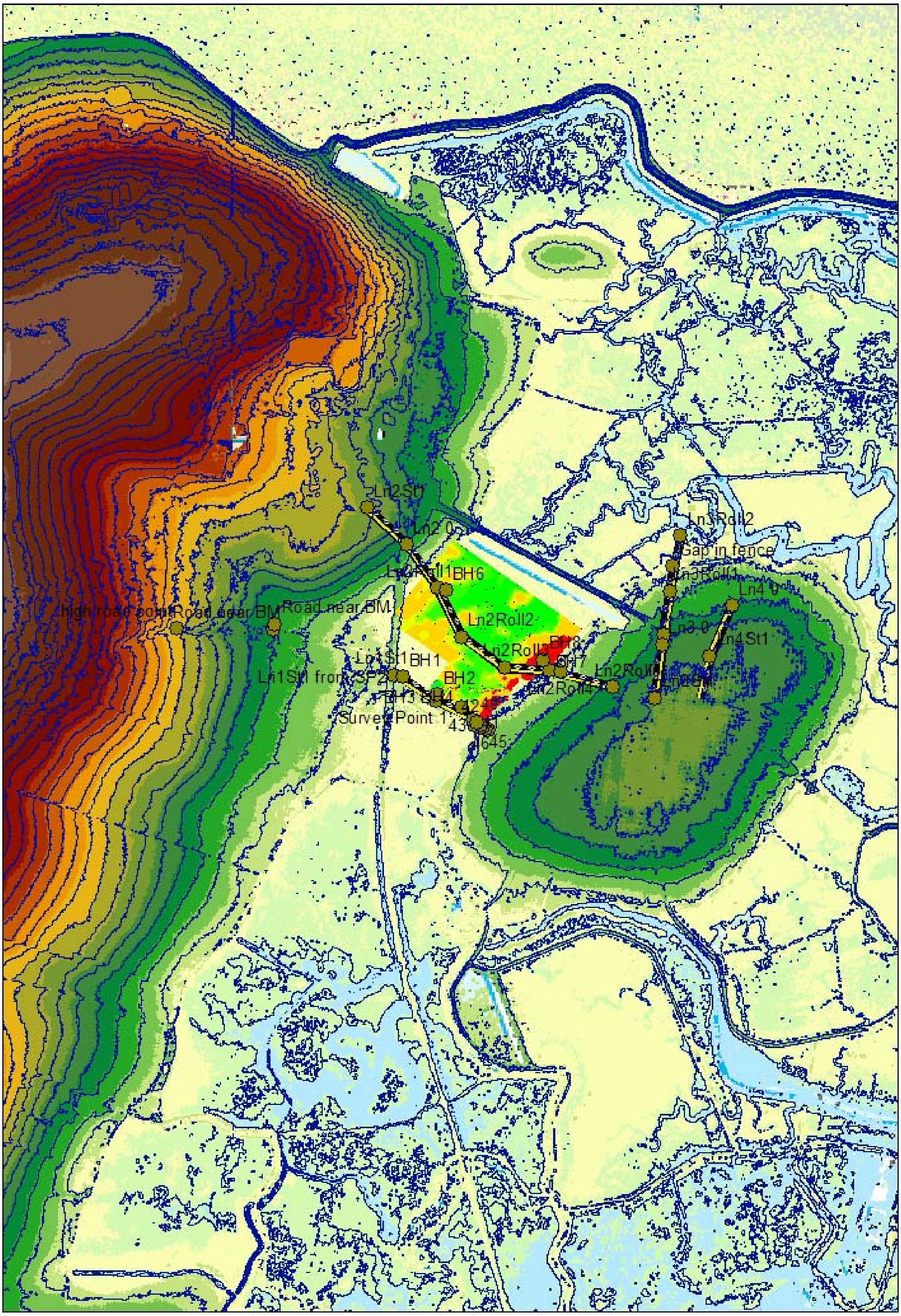


Fig 3.3.8 Map of survey area at Binney Farm, Hoo, Kent (photo: M. Bates)

In order to progress future modelling of the Kent/Essex Thames estuary area, considerable investment in data gathering and interpretation is required. Further work is required in developing and refining methodologies for investigation, in developing a larger number of case studies, and applying methodologies and testing models at a variety of scales. Major development projects should be preceded by the construction of a ground model (following appropriate data gathering), thereby enabling areas to be targeted for detailed investigation. This approach has been demonstrated with positive results in advance of the CTRL Section 2. There is a particular need for further work in the transitional zone between wet and dry landscapes i.e. the intertidal and shallow marine zone, where techniques are often at the limit of their applicability. There is an urgent need for better publication of Holocene case studies and models, and for the rigorous testing of such models. In the short term, 'publication' via the web would get the information into the public domain and allow researchers access to data, enabling models to be developed and improved information to be used in relation to future development and coastal protection proposals.

Discussion

The projects outlined above contribute to a number of objectives and areas of research set out in An Archaeological Research Framework for the Greater Thames Estuary (Williams and Brown 1999). In particular, the development of non-intrusive techniques such as geophysics for the location of sub-surface deposits and features, and undertaking baseline survey to provide a framework for defining further research priorities in the intertidal zone.

The methodology for the RCZAS of the north Kent coast is now well established and highly effective. The baseline survey is now about two-thirds complete. The results of the survey are presently being used in assessing the significance of the historic environment in connection with flood risk management programmes (Thames Estuary 2100), and Shoreline Management Plans for the coast from the Hoo Peninsula to South Foreland, and the Medway estuary and Swale sea channel. It is also being used in relation to spatial development plans and historic environment strategies for the area.

Geophysical survey combine with limited boreholes has been shown to be a very cost-effective method for broadly characterising the sediment sequence over large areas. Such an approach should be a first stage in assessing the potential of alluvial areas proposed for development, allowing a strategy to be devised for more detailed survey and investigation as appropriate.

Future Work

In the immediate future, funding will be sought to complete the baseline survey of the north Kent coast. Once baseline survey is complete there will be a need to set up mechanisms for ongoing monitoring of archaeological remains in the intertidal zone. Observations during the RCZAS and by local groups have demonstrated that the coastal environment is highly dynamic with archaeological landscapes disappearing over periods of 5-10 years in some areas. Although targeted funding may be available in relation to specific coastal management and development proposals, it is likely that local archaeological groups will continue to play a significant role in the ongoing monitoring and recording of the historic environment of the North Kent Coast.

There is an urgent need to improve the dissemination of geoarchaeological and deposit modelling reports and to make accessible to researchers and contractors information on boreholes in the region. Further models of coastal sequences should be prepared, tested in the field and used to improve curatorial responses to development and management proposals.

3.4 THE THREAT OF DESSICATION - RECENT WORK ON THE *IN SITU* MONITORING OF ARCHAEOLOGICAL WETLAND SITES IN THE NETHERLANDS

R.M. van Heeringen & E.M. Theunissen

Wetlands: a vulnerable archaeological resource

Large areas of the pre- and protohistoric wetlands along the present coast of the Netherlands dating back as far as 5500 cal BC are under agrarian and urban pressure (Fig. 3.4.1). This is because large parts of the region have been under the influence of human activity since about 1000 AD. Actually most of these former wetlands are now diked areas with a controlled water level (*polders*). Arable farming has also taken its toll on this unique cultural heritage, through the ploughing of occupation layers near the surface, desiccation as water tables were lowered, oxidation of organic materials, and so on (Van Dockum *et al.* 2001).

Growing awareness of the rapid erosion of the archaeological record has meant that the mission of the National Service for Archaeological Heritage (formerly State Service for Archaeological Investigations in the Netherlands/ROB) has changed in recent years (www.archis.nl , see under English content: Archaeology Report 2002). Large-scale rescue excavations in rural and urban areas have now been handed over to the private sector, under strict conditions and, hopefully, from 2006 under a new Monuments and Historic Buildings Act (revised in accordance with the 1992 Valletta Convention). The ROB now collaborates closely with provincial and municipal planning departments, other government agencies, and private landowners, focusing on an integrated conservation policy. Preservation of sites and monuments in their historical landscapes is one of the main objectives (Valletta Convention, article 4).

Monitoring the physical quality of archaeological sites in situ in the western Netherlands

Over the past five years, the ROB has conducted a series of projects in the coastal area of the western Netherlands, focusing on the quality of sites of archaeological importance (Fig. 3.4.2; Table 1).

The projects established baseline measurements for a number of special manmade landscapes with a long occupation history. The landscapes are special because many are home to unique remains rarely found in Pleistocene sandy soils. Favourable preservation conditions have allowed organic material and structural elements to remain intact in the oxygen-poor burial environment. They include unburnt botanical macro remains, zoological material, wood and wooden tools, fishing weirs and fykes (bags for catching fish), vehicles and house structures (NOaA in prep.). Where this highly perishable part of the archaeological resource remains well preserved, it largely determines the value of the archaeological wetlands in the Holocene area of the Netherlands.

No.:	1
Province:	Noord-Holland
Project area:	West-Friesland and the Kop van Noord-Holland (de Gouw)
Project realization:	1999-2000
Number of sites:	15 (37)
Archaeological periods:	Late Neolithic, and Early Bronze Age
Literature:	Van Heeringen & Theunissen 2001a; 2001b
No.:	2
Province:	Zuid-Holland
Project area:	Voorne-Putten
Project realization:	2000-2002 (PLANARCH)
Number of sites:	18
Archaeological periods:	Late Neolithic, Iron Age, and Roman period
Literature:	Van Heeringen & Theunissen 2002

Table 1: **ROB archaeological monitoring projects (1999-2005) in the Western Netherlands.**

No.:	3
Province:	Noord-Holland
Project area:	Broekpolder
Project realization:	2002-2003 (PLANARCH)
Number of sites:	1
Archaeological periods:	Early Bronze Age, Iron Age, Roman period, and Middle Ages
Literature:	Van Heeringen, Smit & Theunissen 2004
No.:	4
Province:	Flevoland
Project area:	Schokland
Project realization:	1999-2004
Number of sites:	3
Archaeological periods:	Late Neolithic, and Middle Ages
Literature:	Van Heeringen, Mauro & Smit 2004
No.:	5
Province:	Noord-Holland
Project area:	Former Oer IJ estuary
Project realization:	2002-2005
Number of sites:	13
Archaeological periods:	Iron Age, and Roman period
Literature:	Theunissen & Van Heeringen 2005

Table 1 (Cont): **ROB archaeological monitoring projects (1999-2005) in the Western Netherlands.**

The vulnerability of the organic portion of the archaeological resource makes it suitable as a parameter for tracking any decline in quality over time (archaeological monitoring). The layered structure of the soil in the delta of the rivers Scheldt, Maas, Rhine (and Oer-IJ) and Overijsselse Vecht means that the remains are embedded in archaeological layers that can be identified and sampled relatively simply, using non-destructive methods such as boreholes.

The projects form part of a well-considered whole and are aimed not only at establishing the quality of the sites but also at developing methods and standards for relating it to the preservation potential of the burial environment (Table 1). Such a tool would allow archaeologists to give better advice about the future prospects of sites and mitigating measures for stable preservation *in situ*. Many methods for measuring specific parameters have been tested in the field and the techniques that produced usable data have been further developed (Table 2). To go into this subject in any further depth would be beyond the scope of this paper, but three examples are given below.

	Projects	1	2	3	4	5	SAM
coring							
	soil profile description	x	x	x	x	x	x
	oxidation-reduction boundary	x	x	x	x	x	x
occupation layer							
	organic matter content	-	x	x	x	x	x
	thin sections (micromorphology)	x	x	-	x	-	pm
	archaeo-samples: artefacts	x	x	-	x	-	x
	archaeo-samples: shell material	x	-	-	x	-	pm
	archaeo-samples: botanical remains	x	x	x	x	x	x
	archaeo-samples: pollen	-	-	-	-	x	pm
	archaeo-samples: bone	x	x	-	x	-	pm
	archaeo-samples: wood	-	-	-	-	-	pm

Table 2 Recorded parameters during the monitoring projects 1-5 (see table 1).

	Projects	1	2	3	4	5	SAM
dipwell (water measurements)							
	water level	x	x	x	x	x	x
	redox potential	x	x	-	x	-	-
	oxygen (O_2)	x	x	x	x	-	-
	electrical conductivity (Ec)	x	x	x	x	-	-
	acidity (pH)	x	x	x	x	-	x
	nitrate, sulfate a.o.	-	x	x	-	-	-
	chloride	x	x	-	x	-	pm
	temperature	x	x	-	-	-	-
burial environment (soil measurements)							
	redox potential (occupation layer)	-	-	-	-	-	-
	redox potential profile	-	x	x	-	x	x
	chalk presence	-	-	x	-	-	x
	acidity (pH) profile	-	-	x	-	x	x
	pH buffering capacity	-	-	-	-	-	pm
	soil water measurements	-	-	-	-	-	pm
climate	/meteological data						
	precipitation/(crop)evaporation	-	x	x	-	x	x
on surface integrity data							
	(not further worked out here)	(-)	(-)	(-)	(-)	(-)	x

Table 2 (cont.) Recorded parameters during the monitoring projects 1-5 (see table 1).

Measuring the groundwater level

The groundwater level, or water table, is one of the most important parameters affecting preservation conditions. Below the water table, the oxygen content of the burial environment is much lower, which slows down or stops the decay of organic remains (oxidation). Two years after the first cautious attempt at installing a dipwell and measuring the water table at three archaeological sites in De Gouw in 1999, 13 sites on the former islands of Voorne and Putten were subjected to structural hydrological examination. The water table there was measured by hand every two months for a whole year (Fig. 4.3.3). The method was refined during the pilot project at Broekpolder, where the water table was measured automatically four times a day for a year using a diver, and the data transmitted to a website via a GSM modem (a so-called 'e-sense system') (see, *inter alia*, SMIT 2004a, 2004b). Monitoring over a year allows a series of measurements to be used, in combination with precipitation and evaporation data, to forecast the future water table after climate change, provided a number of hydrological conditions are met.

Measuring the redox potential

The redox potential is a measure of the total oxidising capacity of the soil. Initially, measurements were taken in the groundwater. Later, however, for various reasons, it was decided to take measurements in the soil itself (see, *inter alia*, SMIT 2002). Redox electrodes and the necessary equipment have now been developed specially for this purpose (Fig. 3.4.4). At the moment, the preferred method is to take a series of measurements at different depths (redox profiles), to give an idea of the vertical variation in the oxidising capacity of the soil over time. Work is also underway on digitally generated maps that can predict the archaeological preservation conditions in various hydrogeological units.

Fig 3.4.1. Aerial photograph of Aartswoud with channels and levees dating from the Neolithic near and at the surface (Single Grave Culture).

Quality of botanical macro remains and bone material

Archaeobotanists and archaeozoologists have developed methods for describing the state of preservation of vulnerable organic material, and the degradation processes to which it is subject (incl. VERNIMMEN 2002; JANS 2002; JANS ET AL. 2004). They have devised preservation categories which allow different sites to be compared. The main thing is to consider the quality (information value) of the material compared with the quality after deposition. Human and natural formation processes play an important role. Micromorphological analysis of thin sections can help produce an insight into these processes (Kooistra & Makaske 2002; Exaltus 2004). The above implies, for example, that poor quality, in a *botanical* sense, might be the best we have available from a certain period in a certain area for *monitoring* purposes. And it is the monitoring potential that needs to be safeguarded for the future.

The results of the specialist studies to establish the quality of the archaeological material and the hydrological and pedological conditions were eventually combined, in line with a recently developed quality assessment system (Deeben *et al*. 1999). Such an interdisciplinary synthesis provides an insight into the most desirable preservation conditions, and how to achieve them. Unfortunately, there are no conditions that provide the best guarantee for the preservation of all archaeological materials (KARS & SMIT 2003). A tailor-made solution will therefore have to be found for each site, depending on the state of preservation and information value of the archaeological material and features present.

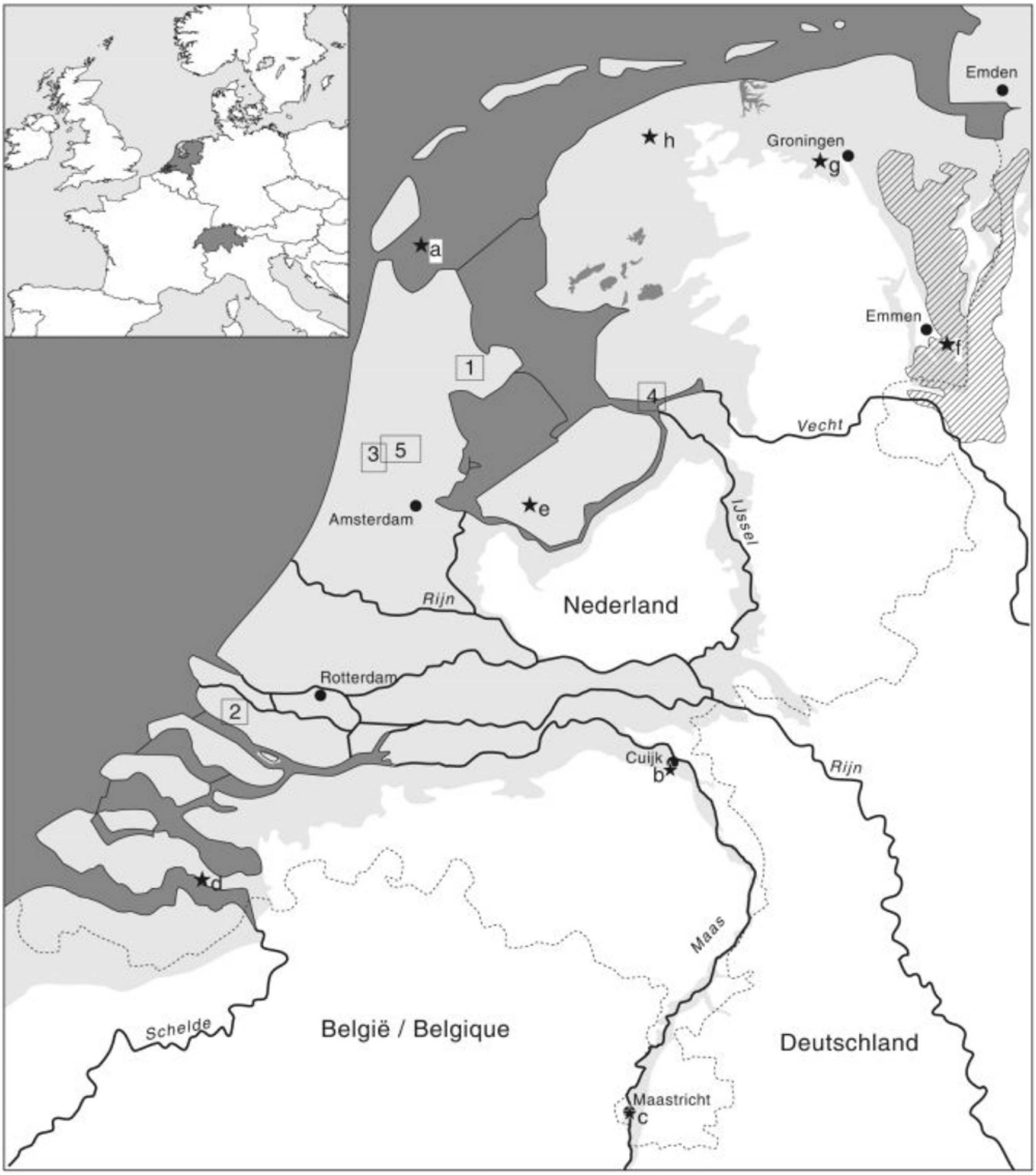
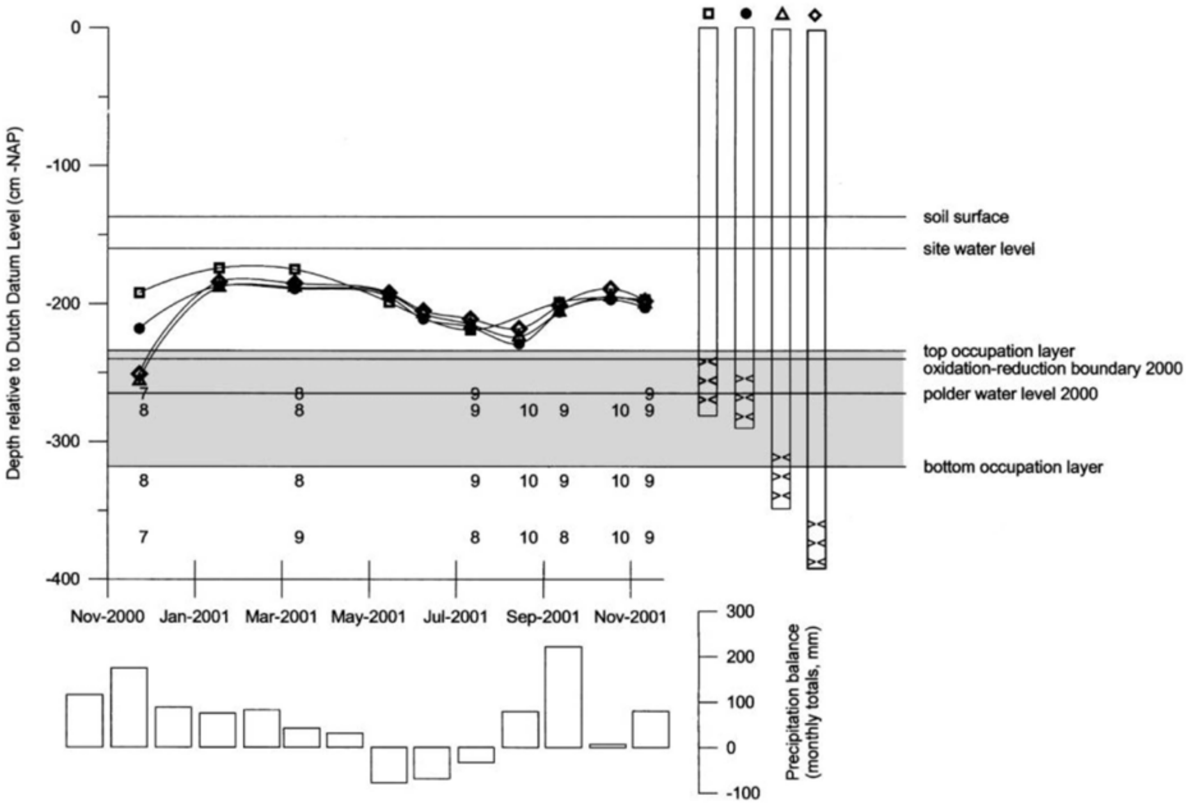


Fig 3.4.2 Overview map of the western Netherlands showing places and sites mentioned in the text. The map has been radically simplified.

In many cases, the paleowetlands in the western Netherlands are currently close to the surface. One example is the Neolithic settlement site at De Gouw (Fig. 3.4.1). Not only is the water table too low there, the site is also subject to erosion as a result of annual ploughing. Optimum preservation would be possible if the site were transformed into an extensive meadow with a relatively high water table, where no ploughing was allowed (Fig. 3.4.5).



Fog 3.4.3 Groundwater level and redox measurements taken in 2000-2001 (Planarch) at the Neolithic Spijkenisse-Vriesland site in the province of Zuid-Holland. Symbols indicate recorded values, lines are interpolation. Numbers indicate redox quality at various depths: 1 (very poor quality) through 10 (very good quality).

Preserving for the future

Many initiatives have been launched and projects completed in the field of quality assessment. An evaluation of all the project results mentioned above is due to commence shortly, to gather all the knowledge acquired in this new field. The aim is to produce a standardised set of guidelines for archaeological monitoring studies (SAM, or Archaeological Monitoring Standard) in 2005. The guidelines will form part of the Kwaliteitsnorm Nederlandse Archeologie (KNA; Dutch Archaeology Quality Standard (KNA), which is maintained under the supervision of the Stichting Infrastructuur Kwaliteitsborging Bodembeheer (SIKB - www.sikb.nl; Foundation Infrastructure for Quality Assurance of Soil Management).

The quality assessment studies performed in various parts of the palaeowetlands in the western Netherlands have added a great deal to our knowledge of the condition of the archaeological resource and the processes affecting it. Gradually, we are developing a policy tool that should allow us to make better recommendations for the future, about what quality we can expect to find and how sites should be managed and developed (Fig. 3.4.6). These are the first steps on the road to the sustainable preservation *in situ* of the vulnerable wetlands in the Dutch coastal area. We still have a long way to go, but we have made a start.

Fig 3.4.4Recording a redox profile, using equipment developed during the ROB Degradation of the Soil Archive Programme (Senter project 2003/2004, TSA02102: A. Smit/A. Beeker).

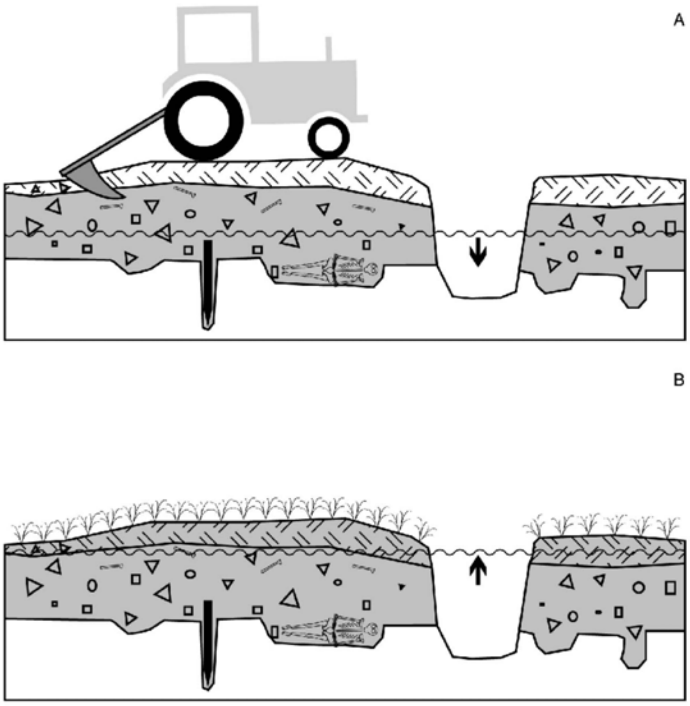


Fig 3.4.5 Preferred proactive policy: from insidious erosion (A) to sustainable preservation (B). Legend: A. during ploughing, the upper part of the shaded occupation layer is disturbed (ploughed up and incorporated into the soil); B. the site is managed in an archaeology-friendly way, arable land has been converted to meadow and the water level has been adjusted.

Fig 3.4.6 Active *in situ* preservation. Vlaardingen Culture settlement, Late Neolithic (Spijkenisse-Vriesland, Voorne-Putten, Zuid-Holland): one of the few protected monuments in the Netherlands where the water table is controlled (Photo Ruurd Kok, Leiden / Planarch).

4. JOINT FIELD WORKING

C. Johnson

Introduction

The Planarch 2 Action 2A joint fieldwork was undertaken to provide an opportunity to develop a shared approach to the evaluation of wetlands. Six sessions of joint fieldwork, with two in each Planarch partner region (Essex, Flanders and Kent) have taken place. They have been successful in bringing together archaeologists from planning departments, universities and commercial units in England, Flanders and the Netherlands in order to develop and share techniques related to the evaluation of a variety of wetland types. As well as increasing the expertise of the individuals taking part, their experience was used to improve the ongoing surveys in each of the regions, to facilitate sharing of best practice and to create a network of contacts (see Appendix 1).

Each week of joint fieldwork was structured in a similar manner, with an introductory session on the first day, followed by two to three day's fieldwork and a discussion session on the final day. Each of the partner's wetland projects have been outlined in the previous sections. This section provides an overview of the key issues and lessons learnt from the transnational joint field working.

Joint fieldwork in Essex

Joint fieldwork was undertaken in Essex, hosted by Essex County Council Field Archaeology Unit (ECCFAU) between the 10th and 14th May 2004 and between the 16th and 19th May 2005. The first week of joint fieldwork in Essex commenced with an introduction to the Stumble along with health and safety induction. The fieldwork comprised fieldwalking and surface collection on the inter-tidal mudflats of the Stumble. The aim of the week's work was to engage participants in locating and recording the current extent of artefact scatters in relation to the underlying stratigraphy in order to define areas of potential. The Planarch work revisited areas surveyed over 20 years previously (The Hullbridge Survey) but now being surveyed using GPS and employing GIS mapping. The key experience for participants during this week was to see how standard fieldwalking methodologies can be effectively applied to inter-tidal mudflats. Site visits included Cudmore Grove, Mersea Island (Essex County Council Country Park and part of a National Nature Reserve) and Othona (the site of a Roman fort and Saxon chapel) and Rolls Farm (a multi-period inter-tidal site).

The second week began with a site induction and health and safety briefing before participants joined the ongoing investigations of the Stumble, with a particular focus on its prehistoric landscape elements. A programme of investigation in the 1980s intensively test-pitted The Stumble using oil drums with the bottoms cut out serving as coffer dams to excavate the waterlogged deposits. This earlier work has been re-assessed and augmented by fieldwalking and further intrusive survey to measure the extent and degree of survival of the prehistoric horizons now under threat from erosion and rising sea levels. The aim of the joint fieldwork was to establish the nature and extent of sediment layers and their archaeological potential as a follow-up to the previous study. The joint team took part in a trial programme of small test pitting using perspex sheets to create mini-coffer dams which allowed buried deposits to be recorded. In each case a set of four Perspex sheets was hammered into the beach deposit and the sediments then hand excavated and recorded (Fig 4.1). Discussion focussed on the applicability of developing test pitting of this type during developer funded evaluation and Wessex Archaeology considered developing this approach in North Kent where similar Neolithic sites may exist. It was agreed that rather than using four sheets of Perspex it would be better in future to develop some form of water tight box that could be driven into the deposit. The Belgian and Dutch participants were surprised at the level of survival of archaeological remains on the foreshore. Although it was felt that in North Kent, for example, the more fluid mud of the Medway and Swale would be too heavy for this approach, it was noted that there are some areas of that coast with firm enough beach deposits for this approach to be adopted (Wessex, 2005). As well as test pits using perspex, an auger survey (Fig 4.2) and some direct excavation of surface deposits were also undertaken. Prehistoric pottery and flint were recovered from the surface of the foreshore, the deposits were seen to comprise complex sands and clays over Pleistocene gravels and the estimated rate of erosion calculated at 1.2cm per year.

In addition to the test pit excavation, team members made visits to Dovehouse Field, Maldon Hythe and to Abbots Hall Farm to see examples of integrated shoreline management plan implementation. The Stumble is part of the Blackwater Estuary, a SSSI covering 4,400ha split between Colchester and Maldon districts and historic environment concerns are considered alongside natural environment ones. The implications of managed retreat in England were discussed, but this approach was not seen as likely in Flanders and the Netherlands, where maintaining the main sea defences is vital to protecting the reclaimed land. In Essex, where the sea wall had been breached in one area to allow flooding behind, a new artificial creek had cut through one of the former salt-working 'red hills'. Elsewhere, a medieval ship lock had been preserved. For further details on the second week of joint fieldwork in Essex see; http://www.planarch.org/downloads/library/planarch_essex_2005_revised.pdf

Joint fieldwork in Flanders

Joint fieldwork was undertaken in Flanders, hosted by the Flemish Institute (VIOE) between the 19th and 23rd April 2004 and between the 15th and 19th November 2004. Here, the Flemish Institute (VIOE) undertook field survey (see Chapter 3.2 this report for details) to evaluate the archaeological potential of the polders. The joint team took part in rapid walkover (Fig 4.3), line walking and grid fieldwalking over a selected area of the Flemish polders running inland from the coast, but not including the foreshore. The week also included site visits to provide team members with an understanding of the nature of the Flemish polders and current approaches to evaluation in Flanders. It is generally the case that across the Planarch region, the use of fieldwalking as an evaluation method, has declined with the increase of developer-funded work. The opportunity, therefore, for the team to contribute to the Flemish use of this technique, has allowed a review of its role and the exchange of views between members of the joint team, has led to changes and improvements in practice in both Flanders and Essex. The team was introduced to the polders as reclaimed former wetlands with high archaeological potential but little present information. Fieldwalking has been used in Essex as an evaluation technique, but elsewhere it appears to be less popular in development-led schemes. In Flanders, the use of rapid walkover, line and grid field walking as an evaluation method has been adopted as a strategic survey approach to an area under a range of potential threats from climate change to agricultural change and development. Participants from England were surprised by the ease of access afforded to archaeologists to carry out survey work. In Flanders archaeologists can without problems enter land to carry out non-intrusive field survey, without permission from the landowner. In the UK, desktop survey is most usually the first stage, where as in Flanders, this had not been the case with this survey. A difference in approach to the provision of information on SMRs was noted between England and Flanders. In England there has been a movement towards providing access to detailed SMR information whereas this is resisted at present in Flanders. Whilst the Flander's survey has been concerned with comprehensive collection and study of artefacts scatters as a means of identifying archaeological potential, it was noted that in England recent survey methods have been more concerned with presence/absence of artefacts, and the collection of only a representative sample. There has been no move in Flanders to introduce a scheme similar the Portable Antiquities Scheme in England and it was noted that iron and other metal objects had very poor survival rates in the polders. Finally, it was noted that to date in Flanders, there had been little systematic survey of the inter-tidal areas (Fig 4.4), but following the joint fieldwork in Essex and Kent, this is likely to change.

Joint fieldwork in Kent

The joint fieldwork weeks in Kent were held between June 28th and July 2nd 2004 and between the 4th and 8th October. The first week focussed on boat survey (Fig. 4.5) of inter-tidal areas of the Medway and Swale estuaries, led by Wessex Archaeology, acting as contractors for Kent County Council. The second week focussed on approaches to deposit modelling on the Hoo Peninsula, using a combination of boreholes and geophysical survey undertaken by the University of Wales, Lampeter.

In the first week, participants joined Wessex Archaeology in their boat survey of the inter-tidal area of the Medway and Swale estuaries. These environments are highly dynamic and fast changing with both erosion and accretion taking place. Archaeological remains are rapidly exposed and then covered back up. Survey needs to be flexible and repeated. A range of archaeology, from early prehistoric land surfaces and Roman industrial sites to hulks of Thames Barges and modern military installations, has been recorded. The joint fieldwork week was developed to give participants an insight into the specialised techniques, equipment and procedures needed to survey the coast and inter-tidal areas of North Kent and demonstrate the value of using a boat for access to survey areas. During the week, the group were given a presentation on development-led archaeology in the UK and the North Kent Rapid Coastal Zone Survey by Dr Anthony Firth, Head of Coastal and Marine Projects at Wessex Archaeology.

Following initial briefing presentations at KCC the group was taken to Queenborough on the Isle of Sheppey to see the work boat, go through further health and safety briefings and have initial training in the use of the GeoXT and Huskey survey equipment (Fig 4.6). Hand-held computers were used to update SMR data and add new records in the field. Wessex Archaeology demonstrated the value of liaison with local special interest groups with a visit to the Fleur de Lis Heritage Centre in Faversham. The team were also taken to Upnor Castle, built in 1559 to protect ships and the dockyards at Chatham, a good example of a military site on the Medway.

Survey sites accessed by boat, included Burntwick Island and Bedlam's Bottom, where all team members were able to practise using the GeoXT and Huskey. The survey area of North Kent comprises large expanses of deep mud with scattered islands of salt marsh cut by systems of tidal gullies. Coastlines of this type to not exist in Belgium and Holland, though it was noted that today's polders have been reclaimed from just such environments and this 'view' into their past was of great interest to the Belgian and Dutch participants.

Participants were introduced to the practice of downloading the relevant section of the existing SMR onto a hand-held computer with GIS software so that new records could be added directly in the field, existing records amended and the new and amended records then uploaded back to the KCC SMR. Participants noted that this technology allowed numerous sites to be accurately covered in a short period of time.

Access to land was seen as a major difference between the English partners and their Belgian and Dutch colleagues. In England there are considerable restrictions and much time is needed to ensure access.

The extant and breached seawalls of Kent were noted by Wessex Archaeology during discussions, not only in terms of their role in shoreline management but also as monuments in their own right. North Kent's sea walls can date from the medieval period and hence are archaeologically significant. A parallel was noted here with a large defensive dyke in Flanders dating to the 1390s, which it is understood, requires a structural and topographical survey. The need to balance the requirements of sustainable coastline management with the preservation of the manmade landscape is an issue that may become increasingly relevant to the Belgian and Dutch partners should any change to their shoreline management policy be considered.

Joint discussions raised the issue of how to record sediment and deposits with archaeological potential in Sites and Monuments Records. All participants agreed that with a defined thesaurus of terms and using GIS it would be helpful to map deposits of varying potential. This has been undertaken in the Netherlands.

This session of joint fieldwork raised important issues about risk assessment and heath and safety. The main issues here included working from a boat, in areas of soft mud and within tidal regimes. The joint fieldwork brought a greater awareness to some participants of the need for comprehensive risk assessment.

For further details on the first week of joint fieldwork in Kent see:
http://www.planarch.org/downloads/library/nkc_joint_fieldwork_report.pdf

The second week of joint fieldwork in Kent allowed participants to take part in a deposit modelling study. Here, a team led by Dr Martin Bates of University of Wales, Lampeter carried out a programme of combined geophysical and borehole survey. The aim of the week was to study the effectiveness of geophysics (in this case electromagnetic survey and resistivity) at characterizing below ground deposits where Holocene alluvium overlay Pleistocene gravels. The 'ground truthing' of three geophysical transects was carried out by boreholes using a Terrier Rig. This rig produces 1m long cores and is faster than the 'Shell & Auger' type. The work was carried out at Binney Farm, Allhallows Marsh on the Hoo Peninsula in North Kent and participants were able to experience all parts of the work. Initial results were generated during the week and the data was of good quality. The boreholes demonstrated that the geophysical survey results were cost-effective and reliable. The work revealed a much greater complexity and local variability than expected. The approach is not seen as being prescriptive for other areas of the Planarch partnership, but rather demonstrating by way of case studies and active joint fieldwork, the possibilities for developing new approaches to evaluation. Participants from the Netherlands found the combined approach particularly interesting and are seeking to develop similar capabilities with the University of Amsterdam (Frieda Zuidhoff, *pers. comm.*).

Partners noted that a variety of different techniques are being explored but essentially the situation is familiar across the Planarch region. A common aim appeared to be the desire to create models of potential both in terms of the environmental history and for more defined units of buried archaeological remains using a variety of techniques and then allow the development control process to effectively test the model.

The CAI in Flanders were particularly interested in the use of GPS with pocket-arcview and the significant section of the SMR uploaded on it. This method demonstrated that a large area could be mapped quickly and accurately, new records added to the SMR and existing records updated on the field. This could be used in Flanders and would be very practical and save time but the costs might be prohibitive at this time.

Partners from Belgium and the Netherlands were surprised that in England there is little attempt to locate artefacts from borehole surveys. Defining layers and depths of artefact remains from borehole surveys is routine on the continent. The CAI considered that in providing historic environment information, the techniques used during the exchange (survey, boring and geophysics), could help give more detailed and accurate information on the archaeological value of areas (evaluation) that are involved in planning projects. Best practice examples for health and safety and comprehensive risk assessment for fieldwork were shared between all partners.

Conclusions from joint fieldwork

In conclusion, the joint field working was successful in realising wetland evaluation surveys using teams of field workers from a range of countries with the additional expertise enhancing the practice in each region. It has successfully achieved the aim of developing a transnational network of specialists who have worked together in the field and who cover a wide range of roles within archaeology and spatial planning. The six weeks of fieldwork allowed a number of specialists from across the Planarch partnership area to see how wetland evaluation was practised in other regions and countries. The principal similarities experienced by the partners were defined as including the types of threats, including climate-change, development pressures and changes in agricultural practice as well as the range of evaluation techniques available to the archaeologists (field walking, boreholing, geophysics etc.). The main differences were seen as the range of wetlands that surround the southern North Sea as well as the archaeological practice, policy frameworks and financial systems that have led to the development of a range of different priorities for evaluation methodologies. The Planarch wetland evaluation joint field working has played a useful role in helping to recognise these similarities and differences, exchange best practice and enhance ongoing survey projects. Most participants felt that during a future similar project, fewer staff should join existing projects for longer periods, but that this should also then be mixed with a larger group for a workshop to exchange and capture ideas.

Planarch 2 joint field working in Essex, Flanders and Kent 2004 - 2005

Fig 4.1 Essex 'mini coffer' excavation (A Single)

Fig 4.2 Essex augering (photo Wessex Archaeology)

Fig 4.3 Flanders fieldwalking (photo Wessex Arch.)

Fig 4.4 Flanders survey (photo Wessex Archaeology)

Fig 4.5 Kent boat survey (photo Wessex Arch.)

Fig 4.6 Kent coastal survey (photo Wessex Arch.)

5. DISCUSSION

In this section the following evaluation techniques, employed during the Planarch 2 Action 2A, are reviewed and evaluated:

- Fieldwalking
- Rapid Coastal Zone Assessment Survey
- Geophysics (resistivity and magnetometry)
- Deposit Modelling (geophysical survey & boreholing combined)
- Auger and borehole survey
- Test pitting

These techniques are reviewed both in terms of their archaeological suitability and in terms of their cost effectiveness and efficiency. In addition, related issues including health and safety, risk assessment, access to land and permissions are considered. The pilot studies raise issues on how the information generated is used for management and decision-making and, where natural threats apply, what mechanisms can be used for funding evaluation?

Action 2A set out to "…develop methodologies for evaluating and managing wetlands archaeology". To assess the suitability and effectiveness of the techniques, their results need to be considered against the purpose of archaeological evaluation: to identify, define and place a value on the resource. Within this broad purpose evaluations aim to locate remains (establish presence or absence), and define their extent, date, character, survival and, ultimately, their value within a local, regional, national or indeed international context.

Fieldwalking

The partners in Essex and Flanders both used fieldwalking as an evaluation technique and two methods, line walking and grid walking, are discussed below.

Linewalking

In Flanders line walking has been utilised across a wide survey area where little archaeological work had previously taken place. The results identified plots of land with artefacts dating to the Roman, early and/or high Middle Ages and the early modern periods. Analysis of sherd counts per plot and distributions has enabled recognition of the types of activity that the surface scatters may represent, including, for example, former settlements and areas of agricultural activity dating to the early/high Middle Ages. The wide geographical scope of the Flanders project has also enabled consideration of the landscape beyond individual areas of activity. The distribution of Roman pottery has supported recent geological work which showed that the late Holocene creeks were located in much the same place as those of the middle Holocene. The results also suggest that many existing farms may date back to the Middle Ages. The results demonstrate the archaeological effectiveness of this technique in the Flemish polders where it has located remains, approximately defined their extent (to a plot), and enabled interpretations to be made as to the character of the resource. In contrast with other non-intrusive survey techniques dating of the remains is also possible. In practical terms the technique is rapid and inexpensive and can involve local communities.

A number of factors need to be considered when applying the technique elsewhere:

- Land use: the surface needs to be visible, ideally ploughed and left to weather. It is therefore not a technique that could be used on former wetland now used as grazing marsh
- Survey units: for meaningful statistical analysis to take place an appropriate 'survey unit' needs to be defined. In the case of the Flemish study the fields were small enough and of a consistent enough size. In other areas where the fields are larger, or on mudflats where there are no boundaries, units or grids would have to be defined.
- Geology: Fieldwalking relies on archaeological material being on the surface, dragged up by ploughing or exposed by erosive processes. The depth of deposits overlying archaeological horizons therefore needs to be considered and it should also be recognised that on deeply

stratified sites or where there is substantial alluvium or colluvium present, only the later archaeological material is likely to be exposed.

In conclusion, if the above factors are taken into account, line walking is an effective technique particularly for identifying areas of interest for more detailed study.

Gridded Field walking

Field walking based on a grid system operates on the same principle as line walking by recovering artefacts visible on the surface. The main difference is that a grid (the density of which can vary from project to project) is superimposed on a survey area and artefacts collected per unit within that grid; for example the Essex system utilises a grid of 20x20m. A grid system allows artefact scatters to be located to a smaller area and a wider range of statistical analysis to be applied. It is however inevitably more time consuming than line walking as the grids take time to set up. Grid size must remain consistent for statistical analysis to be coherently applied.

In Essex the use of grid field walking is well established and has been used on a number of large infrastructure projects. Experience has shown that a team of three can survey an area of around 4ha per day. As with line walking land use and geology need to be considered when interpreting results.

The use of grid field walking in the intertidal environment at The Stumble has provided useful data on the changes in distribution patterns between the survey of the 1980s and the present day and has allowed some provisional interpretation of areas of erosion, deposition and survival. Had this been a previously unknown site the results of the survey would have clearly demonstrated its presence and significance.

The use of the technique in other intertidal areas would have to be considered on a case by case basis given the complex and potentially hazardous nature of the environment. Factors to consider include:

- Tidal windows: How much time is the area exposed for? Establishing a grid can be time-consuming so where the tidal window is short it becomes impractical. The use of very precise GPS equipment could be helpful in this respect.
- Nature of the deposits: The Stumble is a relatively firm surface on which to work, but on many mudflats there are extensive areas of soft sands or silts that will affect the practical uses of the technique. Mudflats can be difficult, if not impossible, to walk on and the surface is often masked, making the identification of artefact scatters difficult.

The results from Planarch 1 (Hey and Lacey 2001,23) and Planarch 2, both in Action 2A and 2B, have demonstrated the archaeological suitability of field walking as an evaluation technique. It has advantages over other non-intrusive techniques in that it can suggest dates and identify sites now confined to the ploughsoil. It also has limitations, particularly relating to characterisation and quality assessment. It is most effective when used in conjunction with other techniques.

Rapid Coastal Zone Assessment Survey (RCZAS)

As part of Planarch 2, RCZAS has been carried out along the North Kent Coast, particularly in the Thames Gateway area. Surveys of this type have also been carried out in Essex, Suffolk, Norfolk and Dorset. The success of RCZAS as an archaeological technique has been amply demonstrated in the results of these studies, which have identified a wide variety of site types from the full range of archaeological periods. They provide a broad assessment of the historic environment that can be used to inform further archaeological studies and decision-making in relation to spatial planning and coastal management.

The North Kent Coast Survey (undertaken by Wessex Archaeology on behalf of Kent County Council) combined standard RCZAS with boat-based survey (to gain access to the many islands in the Medway estuary). Boat-based survey would also be useful to access low water areas that are inaccessible from the land due to extensive areas of soft mud or sand. The North Kent Coast study followed English Heritage Guidelines for undertaking RCZAS; these have recently been revised

(English Heritage 2005 A Brief for English Heritage Rapid Coastal Zone Assessment Surveys). For the Kent survey a team of two walked along the high water mark as a minimum and covered a sample of the intertidal zone where possible. A second team was used for the boat-based survey. Existing SMR records were checked and amended as needed in the field and new records created for new discoveries. During the period of Planarch 2, the survey identified 419 new monuments for incorporation into the SMR and updated 609 existing records.

The application of RCZAS within the other partner areas was discussed during the course of joint fieldwork. A broadly similar methodology has been utilised in Essex (Heppell 2001). It was noted that the main differences between the two were technical, particularly the type of software used in the field to log data from the GPS. Data transfer to the HER/SMR also differed, with Wessex Archaeology updating the records directly in the field and the Essex team supplying the field data in a suitable format for subsequent input into the HER. Updating SMR records in the field has the advantage of direct transfer of information but also the drawback that other records cannot be added to the SMR during the extent of the project. This problem could be avoided in future by having secure dial-in access to the SMR.

The application of the methodology in Flanders and the Netherlands was also discussed. The technique was considered to be suitable for use in the Netherlands where, despite extensive reclamation, there are intertidal areas with comparable remains (A. Otte, ROB). In Flanders the nature of the coastline differs, with the greater part being sandy beaches and dunes. RCZAS along the Suffolk coast has suggested that the technique is less effective in this type of environment (Everett L 2003 Rapid Field Survey of the Suffolk Coast and Intertidal Zone: Assessment Report).

There are a number of factors to be taken into account when planning any intertidal work,

- **Health and Safety**: This is a complex, dynamic and hazardous environment. Health and safety must take priority over all other concerns
- Project planning: Careful planning of works around the tidal cycle and daylight hours needs to take place to make the best use of the limited time available
- Access permissions can be time-consuming to arrange, especially where land ownership is unclear. In Kent and Essex it was often easiest to arrange permission during the early phases of fieldwork through personal contact.

RCZAS is, due to the nature of the physical environment, more time consuming (and therefore expensive) when compared with its land based equivalents. It succeeds in identifying areas of archaeological interest that can, through the use of GPS and GIS be located accurately and compared with existing information. Characterisation is sometimes possible, depending on the type of site represented. It can also provide information on survival, particularly in relation to existing monuments.

"*The constant dynamic pattern of erosion and destruction of archaeological deposits within the intertidal zone makes regular monitoring vital if important information and discoveries are not to go unrecorded*" (Williams and Brown 1999, 40). RCZAS is crucial to this process.

Geophysics

Like fieldwalking and RCZAS, geophysics is a non-intrusive technique of archaeological evaluation. In contrast to these techniques, which rely on material being visible at the surface, it provides data on sub-surface features. In Flanders, magnetometry and electrical resistivity surveys were carried out on a number of the survey units where significant concentrations of material had been located. This allowed the links between artefact scatters and sub-surface features to be postulated, enhancing the interpretation of sites.

The use of geophysical survey as an archaeological evaluation technique is well established, particularly in the UK. There are a number of guidance documents that provide detailed information on the variety of techniques available, what types of archaeological (and other) features they can locate and their suitability for different geologies:

English Heritage 1995 *Geopysical Survey in archaeological field evaluation* (available to download from www.helm.org.uk)

Gaffney, C., Gater, J. and Ovenden, S. 2002 *The use of Geophysical techniques in archaeological evaluation* IFA Paper No 6

Some geophysical techniques can have problems when used in alluvial areas, presenting variable results depending on depth of alluvial deposits, the nature of the target features, soil texture, waterlogging and the magnetic nature of the overburden (Gaffney and Gater 2003, 17).

Deposit Modelling (Geophysical Survey and Boreholing)

Coastal wetlands contain extensive areas of deep alluvium that is difficult to evaluate using standard archaeological evaluation techniques. The alluvium can, however, contain very well preserved archaeological remains and it is necessary therefore to develop new techniques for evaluating such deep waterlogged deposits. One approach is to prepare a model of the subsurface geology and use this to help identify the likely location of significant archaeological remains. It is important that the appropriate scale of model is used in this regard. Models based on regional-scale mapping are not suitable for site-scale interpretation. As part of Planarch 2, a pilot deposit modelling study was undertaken on the Hoo peninsula, on the north Kent coast. The project was carried out by Dr M Bates, University of Wales, Lampeter and Dr R Bates, University of St Andrews. An area was selected for site investigation as a case study of local-scale modelling, to improve understanding of the complex deposits found where Pleistocene sequences meet the Holocene floodplain. The study used electromagnetic surveying techniques to map near-surface sediments (upper 3m) and electrical resistivity sectioning to examine deeper sediments (3-15m), followed by selective boreholing to ‘ground truth’ the geophysical survey.

The results clearly demonstrate that the electromagnetic surveying techniques are able to differentiate sediment types within typical Holocene and Pleistocene sequences in the upper 3m of stratigraphy. The electrical resistivity sectioning was found to match the electromagnetic surveying in the upper 3m, and was able to extend the geophysical survey down to 15m. Examination of selective boreholes and analysis of microfossils enabled Holocene sediments to be differentiated from Pleistocene sediments, and this information was then used to enhance interpretation of the geophysical results. The study found that electrical sectioning can be used to differentiate bedrock sequences from Pleistocene and Holocene deposits but this is difficult without ground truthing.

This study, and development–related archaeological work over the last ten years, has demonstrated that the large-scale mapping provided by the British Geological Survey does not reflect the complexity of the subsurface sediments in the area, and indeed it was never intended to perform this function. Regional-scale mapping should not be used for site-scale interpretation and models developed at a regional scale cannot simply be downsized to apply at the local (archaeological site) scale. In order to progress future modelling of the Kent/Essex Thames estuary area, considerable investment in data gathering and interpretation is required. Further work is also required in developing and refining methodologies for investigation, in producing further case studies, and in developing and testing models at a variety of scales.

In general, it is very useful, as a first stage of archaeological evaluation of major development areas, to create (following appropriate data gathering) a ‘ground’ or deposit model, which can then be used to define areas of high potential that can be targeted for investigation. Such an approach was followed recently in advance of the Thames Crossing of Section 2 of the Channel Tunnel Rail Link with positive results. The cost of preparing a preliminary model and then, following site survey, developing a detailed deposit model is not negligible and can perhaps only be justified in planning terms in the case of major infrastructure and development projects. Such an approach does, however, have the benefit of targetting the use of limited financial resources to areas of greatest potential and also reducing the risk of unexpected archaeological discoveries during the construction phase of a development, which would probably have far greater cost implications.

Auger Survey and Test Pitting

Auger survey and the excavation of test pits was carried out at The Stumble as part of Planarch 2. The auger survey was successful in enhancing the fieldwalking data and in providing information on the depth of the old land surface below the masking silts, sands and estuarine muds. There were problems in interpreting the data for detailed uses, such as the positioning of test pits, which resulted from the complexity of the underlying stratigraphy in the area that had not been identified in the auger survey. Following discussions during the Planarch exchanges it was decided that this problem could be solved by utilising a smaller sample interval in the auger survey.

The hand auger survey would not, in this instance, provide a method of identifying sites but rather provide valuable information on the general landscape which can be combined with other data, such as the fieldwalking, to provide a fuller picture than one technique alone. It proved to be a practical technique, and the main problem encountered was in relating the survey to absolute heights (Ordnance Datum in the UK) due to the absence of known benchmarks in the immediate vicinity. This is a general problem with survey in the intertidal zone. It can be addressed for the purposes of most archaeological work by using precise GPS equipment which would give an accuracy of 2-3cm. In some cases, however, even greater precision may be required.

The test pits, adapted from a technique of ‘bin sampling’ used by Wilkinson and Murphy in the 1980s, did prove to be practical in terms of keeping water away from small areas of excavation. They were not as successful in locating archaeological remains as hoped but this is thought to reflect weaknesses in the auger survey that was used to determine the location of test pits rather than the technique itself. The application of this technique in other intertidal areas would depend on a number of factors such as tidal windows, depth/type of deposits and access (ie the distance which equipment has to be carried). It is a technique that provides information on a defined area rather than the wider landscape.

Scientific Monitoring

Over the last five years, the ROB has conducted a series of projects in the coastal area of the western Netherlands, focussing on the quality of important archaeological sites. Baseline measurements were established for a number of special man-made landscapes with a long occupation history, where the oxygen-poor environment has allowed the rare survival of unique remains, including plant remains and wooden tools and structures, such as fishing weirs and houses.

Careful assessment of the survival and quality of these remains is important in spatial planning terms as it largely determines the value that should be placed on this archaeological wetland resource.

The layered structure of the soil in the delta of the Rivers Scheldt, Maas, Rhine and Overijsselse Vecht means that archaeological layers can be identified and sampled relatively simply using non-destructive methods such as boreholes. The ROB western Netherlands monitoring project is aimed not only at establishing quality but also at developing methods and standards for relating quality to the preservation potential of the burial environment. Such a tool will enable archaeologists to give better advice about suitable mitigation measures for preservation *in situ* of archaeological sites in relation to proposed developments.

Specific parameters were recorded in the field, including measurements relating to the archaeological layer, water measurements, and soil measurements. One of the most important parameters affecting preservation conditions is the groundwater level, or water table. At a pilot project in Broekpolder, the water table was measured automatically four times a day and information sent to a website (an ‘e-sense system’). Monitoring over a year enables a series of measurements to be combined with precipitation and evaporation data to forecast the future water table. This allows the effects of climate change on the preservation of archaeological landscapes to be predicted.

Another important parameter is the redox potential (total oxidising capacity) of the soil. Measurements were initially taken in groundwater but it was found to be preferable to take a series of measurements at different depths in the soil itself (redox profiles) to give an idea of the vertical variation in oxidising capacity over time. Work is ongoing to develop digitally generated maps that can predict archaeological preservation conditions in various hydrogeological units. Measurements of the state of preservation of plant macro remains and bone material have also been used. It is important in this respect to establish the state of preservation at the time of deposition; for example 'poor' preservation might be all we shall ever have for certain categories of evidence. Synthesis of a number of specialist studies suggests that unfortunately there are no ideal conditions that provide the best guarantee for preservation of all archaeological materials. A tailor-made solution will therefore have to be devised for each site, depending on the state of preservation and types of archaeological material and features present.

The quality assessment studies have added a great deal to our knowledge of the condition of the archaeological resource and the processes affecting it. Gradually a policy tool is being developed that should allow better recommendations to be made in the future about how sites should be managed and developed. A standardised set of guidelines for archaeological monitoring studies (SAM or Archaeological Monitoring Standard) is being produced, forming part of the Dutch Archaeology Quality Standard (KNA). Hopefully this tool will have applications beyond the western Netherlands, and can be adapted for use elsewhere in north western Europe.

Wetland Archaeological Evaluation Strategies

Wetland areas, particularly coastal wetlands, are characterised by deposits of deep alluvium, which can contain excellently preserved organic evidence, such as wooden artefacts, and structures, and biological evidence, such as seed and plant remains, which can inform our knowledge of past environments and activities. Such evidence is generally not preserved in dryland environments, making the wetland resource of critical importance to our understanding of the past. The wetland environment can also contain extensive buried landscapes that were once dry land themselves but have become inundated as a result of sea-level rise following the end of the last glaciation. It is likely that for much of prehistory, and indeed history, travel by boat was much easier than travel by land and contact between people across the southern North Sea or Channel may have been as easy, if not easier, than contact with people 30-40km inland. As a result, the coastal areas and large river basins also have an important role to play in furthering our understanding of the shared cultural heritage of north west Europe.

Wetlands are under threat from various factors including major and minor harbour installations, coastal defence works, built development, infrastructure works such as tunnels and pipelines, and erosion caused by natural processes, which is expected to increase in the future as a result of climate change. It is important therefore to improve our knowledge of the historic environment of wetlands and to ensure that this information is in a form that can be readily understood by spatial planners, developers and coastal managers.

Archaeological evaluation techniques, such as trial trenching, commonly used on dry land do not easily transfer to wetland environments due to the need to examine deposits at considerable depths and to deal with the effects of a high water table. There is therefore a need to develop new techniques and methods in order to provide the information necessary for decision-making. Where mitigation measures have been agreed to preserve archaeological remains *in situ* there is also a need to develop techniques to ensure that preservation is actually being achieved.

The section above has explained how the evaluation techniques employed by the Planarch 2 partners in this study have each been effective when considered against the aims of the individual project and the wider objectives of archaeological evaluation. It has also been observed that there are a number of factors that can limit the applicability of a given technique, and it is considered that there is no single methodology that addresses all the aims of archaeological evaluation in a wetland context.

"The appropriateness of archaeological evaluation techniques varies depending on geology, depth of deposits and likely character of archaeological remains" (Hey and Lacey 2001, 1). This observation made by Hey and Lacey in their assessment of evaluation techniques (Planarch1) is also applicable to the archaeological evaluation of wetlands. The development of an evaluation strategy for wetlands needs to consider such variables. Given the practical complexities of working in a wetland environment, particularly for machine trenching, a staged approach is considered to be the most appropriate. The evaluation process should make use of the full range of available methods from desk-based assessment to trial trenching.

The studies in this report demonstrate that the underlying geology, depth and nature of overburden are crucial factors when considering which technique to employ. Equally, the scale at which information is required will influence which technique is appropriate. The purpose and aims of any archaeological survey or investigation must be clearly defined. The projects undertaken under Action 2A have covered three main types of work:

1. broad based extensive survey aimed at quickly locating archaeological remains over a large area and providing a basic record, e.g. RCZAS on the north Kent coast;
2. more detailed site characterisation, e.g. test pitting on the Essex coast and the deposit modelling case study on the Hoo peninsula, and
3. ongoing monitoring of the condition and quality of archaeological sites, e.g. the work in the western Netherlands.

The Planarch 2 studies have gone some way towards improving our knowledge and awareness of appropriate evaluation techniques and methods that are effective for different purposes and in different wetland environments.

It is very important to ensure that from the outset projects are designed so that the information produced in a survey can easily be incorporated into the HER/SMR/archaeological inventory. The HER/SMR/inventory also needs to be adapted so that it is better able to deal with environmental and geological information that might be critical to understanding of the wetland environment. There is similarly a need to consider whether it is sufficient for inventories to deal with historic environment information just at the level of site or monument or whether it would be helpful to define areas of archaeological potential at more of a landscape scale.

In general, the type of information required depends on the type of question being asked of it. At the broad level of understanding required for decision-making at the Shoreline Management Plan or spatial plan scale, it might be appropriate to have information in the form of areas of archaeological potential and key known sites of particular importance. It is still necessary, however, for such areas of potential to be based on well-documented site information and interpretation. Where decisions need to be made about the potential within individual development sites, it is similarly necessary that information is provided at the appropriate scale. In these cases it is necessary to create a more detailed model of the sedimentary sequences at the site than is normally available in national geological surveys. This detailed model can then be used to identify areas of greater archaeological potential and target these for more costly intrusive field evaluation. Such an approach, although quite time-consuming, and requiring expenditure at an early phase of a development project, does allow limited financial resources to be better targetted and helps reduce the risk of important archaeological discoveries during the construction phase, when they would have far greater cost implications. This is particularly the important now that many engineering contracts are operated on a partnering basis and unexpected delays are even more likely to trigger compensation payments.

In this context the HER/SMR/ archaeological inventory is the key tool for decision making. Such inventories have generally accumulated over long periods of time and the way in which archaeological sites were described and the period divisions used say 50 years ago is very different to today. It is important that authorities responsible for such inventories recognise that there is a need to allow for review and updating of the information contained within them. It must also be remembered that the information contained in HER/SMR/inventories generally requires interpretation by a historic environment professional if it is to be considered appropriately in management and spatial plans.

Where the historic environment resource has only been recorded as part of broad based large-scale survey such as RCZAS it is difficult to ascribe values, in the sense of condition, date and quality, to individual ‘sites' and monuments. This is problematic as these types of surveys are intended to be used for assessing the significance of the historic environment in relation to coastal management plans or spatial plans. It is necessary therefore to be cautious in using information from this kind of rapid survey, and to be aware that because information on, for example, dating is rarely obtained, the true importance of the archaeological resource in these areas may be undervalued. Similarly, the rapid surveys only assess remains that are visible on the surface. It would improve our understanding of the wetland archaeological resource if, alongside the rapid surveys, provision was made for targeted dating of key features such as fishtraps, and targeted boreholing or test pitting to assess the potential and depth below ground surface of buried archaeological landscapes.

It is critical for ensuring that the historic environment is considered alongside other factors such as nature conservation or economic need, that good links are developed with decision-making bodies responsible for ICZM and spatial planning. An example where this has worked well recently would be the TE 2100 (flood risk planning for the next 100 years in the Thames estuary) programme where planning archaeologists have been involved from an early stage. It is also important that liaison with such bodies goes beyond individual projects. Again in the Thames estuary, archaeologists from the three local authorities have been involved in the Thames Estuary Partnership from its inception and, together with representation from local archaeological groups, form one of the topic groups (the Greater Thames Archaeological Steering Committee) of the partnership.

Involvement in such partnerships also helps promote awareness and understanding of the historic environment within the wider community. As noted above, coastal areas in this region, where most of the wetland archaeological resource is located, have a long tradition of shared heritage and appreciation of this can contribute to the sense of identity of such communities, and can highlight the transnational dimension of this shared culture.

Sometimes situations arise where the most appropriate way of dealing with the historic environment is in conflict with the needs of the natural environment. Such occasions are, however, fairly rare and can generally be dealt with through the normal balancing process of planning or ICZM. For the most part the historic environment benefits from the protection afforded to important natural habitats through designations such as RAMSAR sites or, for example in the UK, SSSI. It is interesting to note that many of the habitats considered to be important for nature conservation, such as grazing marsh, only exist because they have been created by human action.

One of the major issues facing management of wetlands, particularly those in coastal locations is how to deal with the impact of climate change, particularly increased storminess and sea-level rise. It is important that the historic environment is considered alongside other points of the sustainability triangle, in deciding on responses to this threat.

For the first time a digital map of the wetlands within the Planarch project area has been produced. The area of each partner region that can be described as wetland has been calculated. Of particular note is the high proportion of the Netherlands (58%) that can be considered wetland, and the relatively high percentages of 19% and 17% respectively for Kent and Essex in the UK. The preparation of the map across national boundaries revealed technical issues in relation to digital data and common definitions of landscape terms. It has, however, been a very useful exercise and demonstrates the extensive areas that are covered by wetland, and that require consideration in terms of their high heritage potential and the need for appropriate management.

6. CONCLUSIONS

Wetlands contain a wealth of archaeological information, often in an astounding state of preservation. This can include types of artefacts, structures and biological evidence rarely preserved in dry land contexts, and which play a vital role in our understanding of our past culture and environment.

This important resource forms part of the transnational heritage of north west Europe. It can play a vital role in contributing to a shared sense of identity for communities, and a sense of the special character of wetland environments.

The wetland archaeological resource is under substantial pressure from major developments, such as harbours and transport routes, and is threatened further by the effects of climate change and natural processes. Archaeological evaluation techniques normally used on dry land do not easily transfer to deep alluvial deposits or hazardous inter-tidal locations. It is necessary therefore to develop new and cost-effective techniques for evaluating this complex environment.

The Action 2A project, while looking at evaluation from a technical archaeological perspective, has been extremely valuable in terms of considering risk management, both in relation to development proposals and the duty of care towards the historic environment.

For the first time a digital map of the wetlands within the Planarch project area has been produced. The area of wetland in each partner region has been calculated. For many of the partners this forms a considerable proportion of their geographical area.

Work carried out as part of Planarch 2 Action 2A has:

- highlighted the transnational nature of the wetland archaeological resource
- indicated the significant size of the area covered by the resource
- noted the importance and unique nature of the archaeological resource in wetland contexts
- considered issues common to the partner regions
- helped improve awareness of evaluation techniques appropriate to wetland environments
- assessed the effectiveness of different evaluation techniques in different types of wetland environment
- shared best practice and created a network of specialists
- considered which techniques are appropriate for which scale of analysis, e.g. large-scale survey compared with more detailed site characterisation and ongoing monitoring
- noted that a staged approach to evaluation is most effective
- concluded that the evaluation strategy should be tailored to the questions being asked – one size does not fit all

Awareness of the historic environment in spatial planning and Integrated Coastal Zone Management decision-making should be increased. There is a need to improve the information base for the wetland historic environment, ensure better communication with spatial planners and wetland managers, and further develop techniques for cost-effective evaluation and management of the wetland archaeological resource.

Finally, the results of the co-operative working undertaken for Planarch 2 Action 2A should be promoted in order to help raise European standards by sharing best practice and by recognising and meeting European-scale challenges to the wetland environment. The wealth of the wetland historic environment, together with the pressure it is under, needs to be recognised, and the Planarch work has gone some way towards this, in providing a useful contribution to improving the protection and management of this valuable and vulnerable resource.

BIBLIOGRAPHY

Baeteman, C., 2005. How subsoil morphology and erodibility influence the origin and pattern of late Holocene tidal channels: case studies from the Belgian coastal lowlands. Quaternary Science Reviews 24, 2146-2162.

Baeteman, C., Scott, D.B., Van Strydonck, M., 2002. Changes in coastal zone processes at a high sea-level stand: a late Holocene example from Belgium. Journal of Quaternary Science 17, 547-559.

Bull, D. and Coles, B.: 2001 'Archaeology and RAMSAR in England' in Coles, B. and Olivier, A. (eds) 2001 *The Heritage Management of Wetlands in Europe* EAC Occ Pap 1

Canti M.G. & Meddens F.M. 1998: Mechanical coring as an aid to archaeological projects. *Journal of Field Archaeology* 25, 97-105.

Deforce K. & Bastiaens J. (in preparation). Paleobotanisch onderzoek van het oppervlakteveen. In: Pieters M., *Een laatmiddeleeuws landelijk vissersmilieu in het zuidelijk Noordzeegebied. Raversijde (Oostende, België): Opgravingsverslag van de opgravingen sinds 1992*.

Coles, J. 1984 *The Archaeology of Wetlands* Edinburgh University Press

Coles, B. 2001 'A past less Foreign: wetland archaeology and its survival in a European perspective' in Coles, B. and Olivier, A (eds) 2001 *The Heritage Management of Wetlands in Europe* EAC Occ Pap 1

Coles, B and Olivier, A. (eds) 2001 *The Heritage Management of Wetlands in Europe* EAC Occ Pap 1

De Ceunynck R. & Termote J. 1987: Een zoutwinningssite uit de Midden-Laat-La Tène periode te Veurne, Westvlaamse Archaeologica 3, 73-82.

Deeben, J., B.J. Groenewoudt, D.P. Hallewas & W.J.H. Willems 1999: *Proposals for a practical system of significance evaluation in archaeological heritage management*, European Journal of Archaeology 2, 177-200.

Deforce K. & Bastiaens J. (in preparation). Paleobotanisch onderzoek van het oppervlakteveen. In: Pieters M., *Een laatmiddeleeuws landelijk vissersmilieu in het zuidelijk Noordzeegebied. Raversijde (Oostende, België): Opgravingsverslag van de opgravingen sinds 1992*.

DEFRA 2005 *Environmental Stewardship; Look after your land and be rewarded* Defra

De Man, J., & Brondeel, M. 2004: Het digitaal hoogtemodel Vlaanderen. *Geo-info*, 2004 (2), p. 47-56.

De Man J., Cordemans K., Verkeyn J. & Mestdagh H. 2005: *A Laser Based Digital Elevation Model. New Possibilities for Flemish Archaeologists*, in Bourgeois J. & Meganck (red.) 2005: *AP&A 2003. A Century of Information*, Gent, p. 151-161.

Demolon P. & Verhaeghe F. 1993: 'La céramique du Vème au Xème siècle dans le Nord de la France et la Flandre Belge: état de la question', in: Piton D. (ed.) 1993: Travaux du Groupe de Recherches et d'études sur la céramique dans le Nord-Pas-De-Calais. Actes du colloque d'Outreau (10-12 avril 1992). La céramique du Vème au Xème siècle dans l'Europe du Nord-Ouest, Numéro hors-série de Nord-Ouest Archéologie, Arras, 385-399.

Dockum, S.G. van, D.P. Hallewas & E. Jungerius 2001: 'The Netherlands: Some Recent Initiatives', in: Coles, B.,Olivier, A. (eds.) 2001, *The Heritage Management of Wetlands*, EAC Occ Pap 1, 35-46.

English Heritage, 2005: A Brief for English Heritage Rapid Coastal Zone Assessment Surveys

English Heritage, 2003: *Coastal Defence and the Historic Environment; English Heritage Guidance* English Heritage

English Heritage, 1995: *Geophysical Survey in archaeological field evaluation* English Heritage

Ervynck A., Baeteman C., Demiddele H., Hollevoet Y., Pieters M., Schelvis J., Tys D., Van Strydonck M. & Verhaeghe F. 1999: Human Occupation because of a regression or the cause of a transgression?. A critical review of the interaction between geological events ans human occupation in the Belgian coastal plain during the first millennium AD, Probleme der Küstenforschung im südlichen Nordseegebiet, 26, p. 97-121.

European Commission 2001 *EU focus on Coastal Zones; Turning the tide for Europe's Coastal Zones* European Commission

Exaltus, R.P., 2004 'Micromorphological analysis of thin sections', in: Van Heeringen, Mauro & Smit (eds.), 2004 *A pilot study on the monitoring of the physical quality of three archaeological sites at the Unesco monument of Schokland, province of Flevoland, the Netherlands,* Amersfoort Nederlandse Archeologische Rapporten, 26 59-71.

Everett, L., Allan. D., McLannahan. C., Anderson. S., and Loader. T., 2003*: Rapid Field Survey of the Suffolk Coast and Intertidal Zone; Assessment Report*, Suffolk County Council

Gaffney, C. And Gater, J. 2003 *Revaling the buried past*

Gaffney, C., Gater, J. and Ovenden, S. 2002 *The use of Geophysical techniques in archaeological evaluation* IFA Paper No 6

Gijsseling M. 1978 *Inleiding tot de toponymie van Oost-Vlaanderen*, Naamkunde 10, 1-2, 1-24.

Hamerow H., Hollevoet Y. & Vince A. 1994 *Migration Period Settlements and 'Anglo-Saxon' Pottery from Flanders*, Medieval Archaeology XXXVIII, 1-18.

Heeringen, R.M. van, & E.M. Theunissen (eds.) 2002: *Desiccation of the archaeological landscape of Voorne-Putten, the Netherlands,* Amersfoort (Nederlandse Archeologische Rapporten, 25).

Heeringen, R.M. van, & E.M. Theunissen 2001a 'Repeated water table lowering in the Dutch delta: a major challenge to the archaeological heritage management of pre- and protohistoric wetlands', in B.A. Purdy (ed.), *Enduring Records. The Environmental and Cultural Heritage of Wetlands*, Oxford, 271-276.

Heeringen, R.M. van, & E.M. Theunissen (red.) 2001b: Kwaliteitsbepalend onderzoek ten behoeve van duurzaam behoud van neolithische vindplaatsen in West-Friesland en de Kop van Noord-Holland [drie delen], Amersfoort (Nederlandse Archeologische Rapporten, 21).

Heeringen, R.M. van, A. Smit & E.M. Theunissen 2004: *Archaeology in the future. Baseline measurement of the physical quality of the archaeological monument at Broekpolder,* Amersfoort (Nederlandse Archeologische Rapporten, 27).

Heeringen, R.M. van, G. Mauro & A. Smit 2004 (eds.): *A pilot study on the monitoring of the physical quality of three archaeological sites at the Unesco monument of Schokland, province of Flevoland, the Netherlands*, Amersfoort (Nederlandse Archeologische Rapporten, 26).

Heppell, E.,2001 *Greater Thames Estuary, Essex Zone. Archaeological Assessment Report* ECC Limited Circulation Report

Heppell, E. 2004 *Greater Thames Estuary, Essex Zone: Monitoring Survey, Assessment Report 2* unpublished

Heppell, E. and Brown, N. 2001 *Greater Thames Estuary, Essex Zone: Survey, Assessment Report* unpublished

Heppell, E. and Brown, N. 2002 *Greater Thames Estuary, Essex Zone: Monitoring Survey, Interim Report No 1* unpublishedvan Heeringen R.M. 1999 The Iron Age in the Western Netherlands, Amersfoort.

Hey, G. and Lacey, M. 2001 *Evaluation of Archaeological Decision-making Processes and Sampling Strategies* KCC

Hillewaert B. 1984 *Oostkerke-bij-Brugge, Gent* (Archeologisch Inventaris Vlaanderen 2).

Hodges R. with a contribution by Cherry J.F. 1981 *The Hamwih pottery: the local and imported wares from 30 years' excavations at Middle Saxon Southampton and their European context,* CBA Research Report 37, London.

Jans, M.M.E., 2002 'Evaluation of the physical quality of bone material from Voorne-Putten', in: Van Heeringen & Theunissen (eds.) 2002, 163-180.

Jans, M.M.E., E.M. Theunissen, R.M. van Heeringen, A. Smit & H. Kars, 2004: Monitoring the Quality of Archaeological Bone in situ, in: R.C.G.M. Lauwerier & I. Plug (eds.), The Future from the Past. Archaeozoology in wildlife conservation and heritage management, Oxford, 133-140.

Kars, H. & A. Smit (eds.), 2003 Handleiding fysiek behoud archeologisch erfgoed: degradatiemechanismen in sporen en materialen. Monitoring van de conditie van het bodemarchief, Geoarchaeological & Bioarchaeological Studies 1, Amsterdam.

Kightly C., Pieters M., Gevaert G., Denis H. & Goigne J. 2003: Walraversijde 1465 van archeologische opgraving tot daadwerkelijke reconstructie, Oostende/Brugge, 128 p.

Kightly C., Pieters M., Tys D. & Ervynck A. 2000 Walraversijde 1465. De bloeiperiode van een vissersdorp aan de zuidelijke Noordzeekust, in vier talen, Brugge, 88 p.

Kooistra M.J. & B. Makaske, 2002 Micromorphological Research on Site Formation Processes, in: Van Heeringen & Theunissen (eds.) 2002, 115-136.

Marsden, S 2001 'The Heritage Management of Wetlands; Legislative Designation and Protection, A Viewpoint From England And Wales' in Coles, B and Olivier, A (eds) 2001 *The Heritage Management of Wetlands in Europe* EAC Occ Pap 1

Medlycott, M. and Gascoyne, A. 2005 *A Contemplation of Things Wide and Infinite: An Archaeological Desk-Based Assessment and Walkover Survey of the Proposed New RSPB Reserves in South Essex* ECC Unpublished Report

Medlycott, M. and Germany, M. 1994 'Archaeological Fieldwork in Essex 198501993: Interim Results' *Essex Archaeo. & Hist.* **25** 14-27

Meylemans E., Bastiaens J., Cousserier K. & Jansen I. 2006: *Verkennend onderzoek langs de Witte Nete (provincie Antwerpen): een geomorfologische benadering van archeologisch-landschappelijk diagnostisch onderzoek in de Kempen*, in Cousserier K., Meylemans E. & In't Ven I. (red.) 2006: CAI-II: Thematisch inventarisatie- en evaluatieonderzoek, VIOE rapporten 2, Brussel,

NOaA in preparation: *Nationale Onderzoeksagenda Archeologie* (Netherlands Research Agenda for Archaeology).

OC GIS Vlaanderen 2003: Digitaal Hoogtemodel Vlaanderen, Nieuwsbrief GIS-Vlaanderen 16.

Olivier, A. 2004 'Great expectations: the English Heritage Approach to the Management of the Historic Environment in England's Wetlands' Journal of Wetland Archaeology 4, 155-168

Pieters M. 1997 'Raversijde: a late medieval fishermen's village along the Flemish coast (Belgium, Province of West-Flanders, Municipality of Oostende)', in: De Boe G. & Verhaeghe F. (red.): *Rural Settlements in Medieval Europe. Papers of the 'Medieval Europe Brugge 1997 Conference'*, Vol. 6 (IAP Rapporten 6), 169-177, Asse-Zellik.

Pieters M. 2002: Aspecten van de materiële leefwereld in een laatmiddeleeuws vissersmilieu in het zuidelijk Noordzeegebied. Een bijdrage tot de middeleeuwse rurale archeologie, in zonderheid naar aanleiding van de opgravingen te Raversijde (stad Oostende, provincie West-Vlaanderen, België). S.l.(Brussel & Aalst), ongepubliceerde doctoraatsverhandeling Vrije Universiteit Brussel.

Pieters M. 2005: Le village de pêcheurs de Walraversijde et son approvisionnement en eau au quinzième siècle (Ostende, Belgique), in: Klapste J. (ed.): Water Management in medieval rural economy. Les usages de l'eau en milieu rural au Moyen âge (Ruralia V: 27e septembre-2e octobre 2003, Lyon/Villard-Sallet. Région Rhône-Alpes France) (Pamatky Archeologické-supplementum 17, Ruralia V, 14-18.

Pieters M., De Groote K., Ervynck A. & Callebaut D. met bijdragen van Cooremans B. & Van Strydonck M. 1999: Tussen kapel en kerk: een archeologische kijk op de evolutie van de dorpskern van Moorsel (10de-20ste eeuw) (Aalst, prov. Oost-Vlaanderen), Archeologie in Vlaanderen V-1995/1996, 131-157.

Reader, F. W. 1911 'A Neolithic Floor on the bed of the Crouch river and other discoveries near Rayleigh, Essex.' Essex Naturalist 16 249-64

Routier J.-C. 1998: La céramique carolingienne du Xe siècle de Saint-Omer, Revue du Nord LXXX, 51-67.

Smit, A., 2002 The Preservation Potential of the Burial Environment, in: Van Heeringen & Theunissen (eds.) 2002, 91-113.

Smit, A., 2004a Monitoring the burial environment, in: Van Heeringen, Smit & Theunissen 2004, 21-34.

Smit, A., 2004b Monitoring the burial environment of terrestrial wet archaeological sites in the Netherlands, Conservation and management of archaeological sites 6 (nos. 3 and 4), 325-332.

Spurrell, F.C.J. 1889 'On the estuary of the Thames and its alluvium' Proceedings of the Geological Society 11, 210-230

Strutt K. & Hay S. 2003 *Leffinge Area Settlement and Landscape project: Report on the Geophysical Surveys December 2003*, unpublished report SREP 15/2003 University of Southampton.

Strutt K. & Johnson P. 2005 Leffinge Area, West Flanders : Geophysical Survey Report February 2005, unpublished report SREP 5/2005 University of Southampton.

Theunissen E.M. & R.M. van Heeringen (eds.) 2005 (in prep.) Archaeological monitoring in the former Oer IJ estuary. A pilot study on the preservation capacity of a late prehistoric landscape, Amersfoort (Nederlandse Archeologische Rapporten)

Tys D. 2001/2002: De inrichting van een getijdenlandschap. De problematiek van de vroegmiddeleeuwse nederzettingsstructuur en de aanwezigheid van terpen in de kustvlakte: het voorbeeld van Leffinge (gemeente Middelkerke, prov. West-Vlaanderen), in Archeologie in Vlaanderen VIII, p. 257-279.

Tys D. 2003 Landschap als materiële cultuur. De interactie tussen macht en ruimte in een kustgebied en de wording van een laatmiddeleeuws tot vroegmodern landschap. Kamerlings Ambacht, 500-1200/1600, ongepubliceerde doctoraatsverhandeling Vrije Universiteit Brussel.

Vanmontfort B., Van Hove D., Verstraeten G., Van Rompaey A., De Man J. & Van Peer Ph. 2005: *Mens en Landschap in het Dijlebekken. Eindrapport*, niet gepubliceerd rapport, Leuven.

Vanmontfort B., De Man J., Van Rompaey A., Langohr R. & Clarys B. 2006: *De evaluatie van bodemerosie op de neolithische site van Ottenburg/ Grez-Doiceau*, in COUSSERIER K., MEYLEMANS E. & IN'T VEN I. (eds.) 2006: CAI-II: Thematisch inventarisatie- en evaluatieonderzoek, VIOE rapporten 2, Brussel, p. 101-126.

Verhaeghe F. 1988 Middeleeuwse en latere ceramiek te Brugge. Een inleiding, in: De Witte H. (ed.): Brugge Onder-Zocht. Tien jaar stadsarcheologisch onderzoek 1977-1987, Brugge, 71-114.

Verhulst A. & Blok D.P. 1981 De agrarische nederzettingen, in: Algemene Geschiedenis der Nederlanden, dl. 1, Haarlem/Bussum, 153-164.

Vernimmen, T.J.J., 2002: The Preservation of Botanical Remains at Archaeological Sites on Voorne-Putten, in: Van Heeringen & Theunissen (eds.) 2002, 137-162.

Vincent, S. W. and George, W. H. 1980 *Some Mesolithic Sites along the Rivers Blackwater and Crouch, Essex* Unpublished typescript in Essex Record Office

Vos P.C. & van Heeringen R.M. 1997 Holocene geology and occupation history of the Province of Zeeland, in: Fischer M.M. (ed.): Holocene evolution of Zeeland (SW Netherlands), Mededelingen Nederlands Instituut voor Toegepaste Geowetenschappen TNO, 59, 5-109.

Warren, S. H., Piggott, S., Clark, J. G. D., Burkitt, M.C. and H. and M. E. Godwin, 1936 'Archaeology of the submerged landsurface of the Essex coast' Proceedings of the Prehistoric Society 2, 178-210

Wessex Archaeology, 2004, *NKC Planarch Participation Flanders and Essex Exchange Visits Spring 2004*, unpublished report for Kent County Council, Ref: 56320.01

Wessex Archaeology, 2004, *NKC Planarch Participation North Kent Coast Exchange Visit, June- July 2004* Unpublished report for Kent County Council, Ref.: 56320.02

Wessex Archaeology, 2005, *North Kent Coast Rapid Coastal Zone Assessment Survey; Phase II Field Assessment* WA Limited Circulation Report

Wilkinson, T.J. and Murphy, P.L, 1995 *Archaeology of the Essex coast, Volume 1: the Hullbridge Survey*, East Anglian Archaeology 71, Chelmsford

Wilkinson, T.J. and Murphy, P.L, in prep *Archaeology of the Essex coast, Volume 2: The Stumble*, East Anglian Archaeology, Chelmsford

Williams, J. and Brown, N. eds 1999 An *Archaeological Research Framework for the Greater Thames Estuary* ECC

Zeebroek I., Jansseune G., Tys D. & Pieters M. in druk, Het Groot-Tempelhof te Slijpe, de oude Commanderie de Flandres van de orde van de tempelridders (gem. Middelkerke, prov. West-Vlaanderen). Geïntegreerde analyse van het landschap, archiefbronnen en opgravingsresultaten 1971-2003, Archeologie, Monumenten en Landschappen in Vlaanderen.

Zeebroek I., Tys D. & Pieters M. 2003: Bewoningssporen uit de vroege en/of volle middeleeuwen onder een fietspad te Leffinge-Leffingestraat (Middelkerke) (W.-Vl.), Archaeologia Mediaevalis 26, 82.

Zeebroek I., Tys D., Pieters M. & Baeteman C. 2002: From Saltmarsh to Battlefield. An exploration of the landscape of Testerep, Leffinge and Oostende from the early Middle Ages to the Siege of Oostende (1601-1604), Brugge.

APPENDIX 1

Planarch Action 2A Participants

Chapter 4 has discussed the numerous joint fieldworking sessions that have taken place through the course of the project. What is presented here is a list of the participants in those sessions and serves to illustrate that this project has included a large number of participants from many different elements of the heritage sector.

Thanks are due to all of these individuals, who have contributed greatly to making the action plan aims of creating a transnational network of specialists a reality.

Ben Barker, ECC
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Archaeological Evaluation of Wetlands in the Planarch Area of North West Europe

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