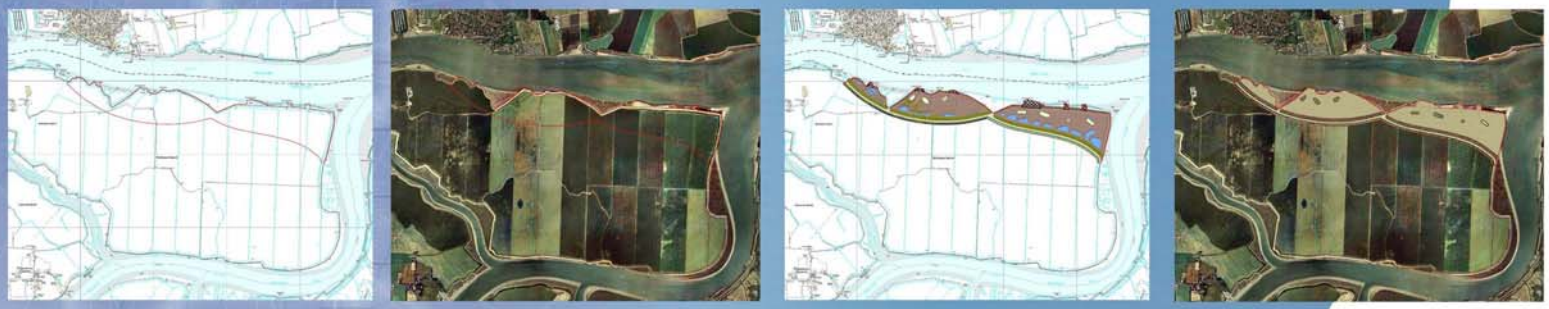

Wallasea Farms Ltd

Wallasea Island North Bank Realignment: Environmental Statement

Date: November 2004

Project Ref: R/3439/3

Report No: R.1114

ABP mer
marine environmental research

Wallasea Farms Ltd.

Wallasea Island North Bank Realignment: Environmental Statement

November 2004

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Non Technical Summary

Report Background

The Department for Environment Food and Rural Affairs (DEFRA) is proposing to undertake a coastal realignment project on the north bank of Wallasea Island in the Crouch Estuary (Essex). This proposal is being undertaken to create new mudflat and saltmarsh in compensation for losses of similar coastal habitats at Lappel Bank (in the Medway Estuary) and Fagbury Flats (in the Orwell Estuary). It is being pursued with the support and assistance of the landowner, Wallasea Farms Ltd, who will be responsible for the submission of the Planning Application for this work. To support this Planning Application, Wallasea Farms Ltd has commissioned ABP Marine Environmental Research Ltd (ABPmer) to conduct an Environmental Impact Assessment (EIA) as required under the Town and Country Planning Act (EIA) Regulations 1999.

As a first stage in the EIA process a Scoping Study was carried out to highlight the key issues to be considered in detail within the assessment. This Scoping Study was informed by the results of an initial meeting with Rochford District Council (RDC) as well as the findings from an extensive public consultation exercise that was undertaken by DEFRA prior to the selection of Wallasea as the proposed location for this realignment. The Scoping Report (ABPmer 2004a) was then circulated to Rochford District Council (RDC), English Nature (EN), Environment Agency (EA) and Royal Society for the Protection of Birds (RSPB), Crouch Harbour Authority (CHA) and the views of these parties were obtained to agree the assessment scope and identify any gaps that needed to be addressed as part of the EIA process. In accordance with this agreed EIA scope, and also taking into account the views from a range of other consultees, this report now presents the resulting Environmental Statement (ES).

Project Description

Project Background and Need for Scheme

The UK Government is committed to providing compensation for the above port developments following a judgement by the European Court of Justice. The most effective method for achieving this is through the realignment of flood defences to create new coastal habitats on suitable and low-lying hinterland (called 'Managed Realignment'). Prior to the selection of Wallasea Island North Bank as the preferred site for this realignment, an extensive and detailed site review and consultation process was pursued to consider potential candidate locations in estuaries extending from Suffolk (Stour Estuary) to North Kent (Swale Estuary). This process was overseen by the Lappel Bank and Fagbury Flats Project Management Group (PMG) which included representatives from DEFRA, EN, EA and RSPB. The PMG concluded that Wallasea met all the requirments from a set of the pre-defined criteria and represented the best location based on a range of relevant environment and socio-economic considerations. Based on this final recommendation, Ben Bradshaw, the Minister for Nature Conservation announced on 4

March 2004, that realignment of the Wallasea north bank site would be the Government's proposed approach to the compensation requirements.

One of the main reasons for choosing Wallasea, and the other advantage of it as a coastal realignment site, is that it will greatly enhance the coastal protection afforded the island, the north bank of which is at risk of natural and unmanaged seawall breaching. As a result of this risk the Environment Agency's Flood Management Strategy for the Crouch and Roach estuaries (Halcrow/EA 2003) recommends coastal realignment in this area of the island. This Strategy highlights that without 'managed' realignment the natural breaching could lead to significant flooding of the island and adverse impacts on the hydrodynamics of the estuary and increased stress on the existing estuary defences.

Scheme Design

The key components of the proposed realignment scheme, and the terminology assigned to them for this report, are as follows: -:

(1) Wall A: - A counterwall has already constructed on site by Wallasea Farms in 2002 that will be used as part of the managed realignment.

(2) Wall B: – A new counterwall is to be constructed (using suitable materials excavated on-site) linking Wall A to the east bank of Wallasea Island.

(3) Areas A (west and east) and Area B: – The land in front of Walls A and B respectively, which will be flooded by the tide to create new coastal habitat. After realignment there will be no flow between Area A and B. Area A also will be divided into two areas (called west and east) with no exchange of water flow between them. Thus there will be three discrete realignment areas. Across the majority of these areas mudflat will develop because the existing land is at the correct height for the development of this habitat.

(4) Sediment Recharge: – Along the seaward edge of Walls A and B sediment (dredge arisings) will be deposited to create an elevated strip of land fronting these walls. This is designed to provide habitat on which saltmarsh will develop but it will also increase the levels of coastal protection provided by the walls.

(5) Breaches 1 to 6 (numbered from west to east): - Six proposed breaches will be excavated through the existing seawall. Their total width will be 590m with one breach being 210m wide and the others being either 60m or 100m wide.

(6) Other elements and H&S Preparatory works: - Other elements of the scheme include: excavating a channel at Breach 2 to direct flow back across the site; blocking existing field drains to force water to flow over the site rather than through these ditches and a series of works to address Health and Safety aspects including placing

access ramps on and off the walls and a land bridge connecting the existing wall to Wall A.

Mitigation Measures

The original scheme also includes the following habitat creation measures to offset impacts from the scheme that could be identified in advance of the impact assessment: -

(1) Creation of a borrow dyke behind Wall B: - To mitigate for losses of freshwater/brackish habitats and grassland within the realignment site some new equivalent habitat will be provided through the creation of borrow dyke habitat behind Wall B (Borrow Dyke B). This will be linked to the existing dyke behind Wall A (Borrow Dyke A) and, on advice from conservation authorities, it will be deliberately excavated in a manner that is designed to enhance its ecological value relative to borrow dykes in the site to be flooded and other similar features in this area

(2) Creation of seven islands across Areas A (east) and B: - To provide roosting/breeding sites for birds as well as sites for the establishment of important plant species, seven island features are to be created within the new coastal habitat using material excavated from the breached seawalls. These will have a range of surfaces (vegetation, stone and cockleshell).

(3) Excavation of a lagoonal habitat next to Island 7: - To enhance the value of one island, a lagoon will be excavated directly adjacent to it. It is hoped that this habitat will support an invertebrate and fish food resource for waterbirds

Construction Methods

The construction works can be divided into four stages. These stages and their proposed timescales are as follows: -

(1) The Stage 1 Earthworks: - Construction of Wall B and the bunds to retain the sediment recharge. Scheduled to commence in May 2005 with completion by November 2005. From May to July 2006 works will be confined to Area B to limit disturbance to nesting birds on Area A.

(2) The Stage 2 Sediment Recharge: - Filling in of the area between the clay bund and Walls A and B. These works will commence from mid November 2005. This start date will be dependent on the availability of suitable material but this work should be completed by July 2006 at the latest.

(3) The Stage 3 Site Preparatory Work: – On-site channel excavations and a series of Health and Safety related preparatory works will commence in May 2006 and must be completed by September 2006 to enable breaching to be finished by October 2006 (i.e. before winter period) for safety reasons.

(4) The Stage 4 Breaching Work: - Excavation of breaches in the existing seawall will commence no later than 1 October 2006 with the breaching of Overland Point (Breach 1) being undertaken first as a trial to enable the contractor to fully assess his plant requirements and give plant operators experience.

Site Management

The management of the site during the construction period will be pursued as a joint venture between Wallasea Farms Ltd and DEFRA. Wallasea Farms will be responsible for the design, construction and future maintenance of the new seawall while DEFRA will be responsible for the scheme design, management of construction works and the environmental monitoring of the site (to check that it achieves its conservation targets). An independent Wallasea Project Management Team (WPMT) comprising local representatives from EN, EA, RSPB and CEFAS will be responsible for overseeing the project's environmental quality and project objectives. Management will wherever possible be kept to a minimum (e.g. only mowing top 1m of the wall to maintain footpath) to allow nature to take its course. Shooting and wildfowling will not be permitted on the new wetland although it will continue in its present form within the estuary. Existing sport fishing and walking is also likely to continue in its currently low numbers with access to areas outside of public footpaths being controlled by Wallasea Farms Ltd.

Alternative Options

As part of the site-selection process a large number of alternative locations (over 120) across the Greater Thames Estuary natural Area (GTENA) were considered over a period of several years. Of these, 13 were given very detailed analysis before Wallasea North Bank was identified as the preferred site based on a range of environmental, flood defence and socio-economic considerations as well as the results of an extensive public consultation. A range of ten different designs were also considered for the realignment scheme on the Wallasea North bank before a preferred final scheme was identified which functioned best in terms of flow conditions in the site. Therefore this scheme is considered to be the best available option.

Legal Requirements and Consents

For this proposal a formal Environmental Statement (ES) is required to accompany the planning application (to Rochford District Council). As the site is located partly within a European Marine Site and Ramsar area, an Appropriate Assessment may also be needed (this depends on views received by RDC from EN during the planning process). There a need to determine whether any species protected under national and European legislation will be affected by this proposal and if so what measures can be taken to avoid this. A series of other approvals from the EA and CHA are also required. The recharge material will also be tested thoroughly to ensure that it is of a high quality and will not bring contaminants into the site.

Assessment Approach

Prior to the EIA, DEFRA carried out an extensive public consultation, the results of this were used to inform the assessment. The Scoping Study identified the issues upon which the assessment needed to concentrate and the resulting Scoping Report was agreed with RDC, EN, EA and RSPB. Further consultations were then held throughout the impact assessment process with a range of authorities and interested parties where required.

An extensive review of local planning guidance documents and other information sources was carried out. Then a large number of surveys and studies were conducted to fill any gaps in the existing information and provide a detailed baseline description of the proposed realignment site and of the Crouch and Roach estuaries. These included a survey of the estuary channels and a computer modelling study which were carried out to describe the effects of the scheme on the water flows and physical conditions in the estuary as well as surveys of bird populations, insect communities, inland habitats, shoreline habitats and protected species in and around the site. A 3D computer visualisation of the scheme was also produced to aid understanding about the character and visual appearance of the site after realignment.

Impact Assessment

A standard approach was applied to identify the significance of the impacts from the proposal and impact levels were identified for each of the key issues. These impacts can be either

(1) Negligible – Insignificant change not having a discernable effect;

(2) Minor Adverse Significance - tend to be discernable but tolerable;

(3) Moderate and Major Adverse Significance - require some impact reduction or mitigation measure.

They can also be beneficial at each of these different levels if they are judged to provide some environmental, economic and/or social gain.

Physical Environment

The modelling and survey work indicates that the breaches will have a negligible direct effect on the shoreline because they are positioned to minimise such effects and because the flows through the breaches will be insufficient to cause erosion of the coastal sediments. Following realignment, minor changes in flow speeds and water levels are expected to occur during flooding and ebbing tides as the system accommodates the additional volume of water (on average about an extra 2%) that moves in and out of the estuary on each tide. The transient flow speed changes will be insufficient to cause sediment erosion in the estuary and their effects on the estuary are considered to be negligible. Over periods of hundreds of years the estuary is expected to respond by widening and deepening in the outer estuary areas. This change is minor over these timescales and should be seen in the context of the future

development of the estuary which, following realignment, will have an increased level of sustainability and a better ability to cope with sea level rise and impacts associated with coastal squeeze. Overall the effects are therefore considered to be minor adverse.

Water and Sediment Quality

As the breaches are expected to be stable and the sediments in front of Wallasea Island have low levels of contamination, the water moving in and out of the site is expected to have negligible effects on water or sediment contamination. This is confirmed by the modelling which shows no increase in suspended sediment in the estuary after realignments. Any pollutant releases during construction work will be controlled though appropriate planning and is expected to be negligible. The realignment will also prevent the release of land-borne contaminants which could occur if the walls were left to breach 'naturally' so that overall impact is therefore deemed to be minor beneficial.

Nature Conservation and Ecology

The flooding of the land on the north bank of Wallasea island will result in the loss of some important plant species and invertebrate communities on the seawall, in the borrow dyke and on grassland berm immediately behind the existing seawall. These are part of the internationally protected sites and are of national value but are also widely occurring locally. These impacts will be offset by the mitigation measures (i.e. the creation of new comparable land and aquatic habitats behind the new seawalls and the islands within the site itself). Therefore these effects are negligible with mitigation. Also there will be some minor losses of internationally protected saltmarsh in front of two of the breaches which cannot be specifically mitigated for at this site although some species will develop around the new islands. There are two protected species on site (common lizard and adder) to avoid affecting these they will be removed from affected areas of the sea wall before breaching and placed at a suitable alternative site. The effect on these species is therefore negligible with mitigation. Overall the direct ecological effects are considered to be minor adverse.

The indirect effects on other habitats/species in the estuary are negligible because of the findings from the physical processes and water quality assessments and the new habitats will provide large areas of new nursery and feeding habitats for fish species which are likely to benefit greatly from this scheme. Therefore the indirect effects are identified as moderate beneficial.

With respect to bird population, there are very few birds feeding at low water on the foreshore (due to a low abundance of prey and limited area). Some roost at high water in Area B but they will be able to avoid areas of disturbance during construction. Therefore impacts to these waterbird populations will be negligible. Disturbance levels after realignment (e.g. from walkers) are expected to be low and to have negligible effects. Breeding birds are present throughout the site although those in Area A will not be affected because work will not be carried out in this area during the spring and early summer months. In Area B, to mitigate for

impacts, the ground will be prepared before the commencement of work to ensure birds do not nest. The effect on these species is therefore minor adverse with mitigation.

Commercial and Recreational Fisheries

Given the findings from the water quality and physical assessment (showing negligible change) the effects on shellfisheries are considered to be negligible. The scheme will provide new valuable habitats for fish species which means that for recreational fishing the impacts will be moderate beneficial.

Marine Heritage

Following their assessment the Essex County Council Field Archaeology Unit has concluded that the archaeological potential of the proposed realignment site is low and that those remains, which may be present, are of minor significance. The impacts are therefore considered to be negligible.

Navigation and Marine Recreation

The findings from the physical assessment indicate that there will be no discernable effects on sailing boats or power craft that currently use the estuary extensively. This is because only transient minor changes in flow and water levels are expected. Areas close to the breach points will have different flow directions at ebbing and flooding tides that will have very localised effects on small craft passing close by but otherwise any changes are not likely to be detectable and effects will be negligible. The scheme will either improve or have no effect on other recreational activities. For instance, the footpath on a revised alignment on the new seawalls will be wider and safer with improved views of a range of habitats; wildfowling will continue at exiting low levels; bird watching and sport fishing opportunities will be improved; island anchoring points will be available within the site for shallow draughted dinghies (although access to the site will be limited by tidal conditions). The shingle beach areas at the north east corner will not be dircetly or indirectly affected by this proposal (the breaches were deliberately positioned to avoid such effects) and access to this area along sea wall footpaths will remain in place. Overall therefore the impacts of the scheme will be moderate beneficial.

Other issues

The following issues were also addressed in the ES although they are not identified as major concerns in the Scoping Study: -

(1) Coastal Defences: - The proposed scheme is in accordance with the Flood Management Strategy recommendations as it will greatly improve the coastal protection for Wallasea Island and will also make the estuary more sustainable in the longer term.

(2) Landscape and Visual Impact: - The realignment scheme is consistent with the existing landscape and will improve the appearance of the area by creating a range of new habitats but without having any negative effects because there are no visually intrusive features (e.g. buildings). To assist in the appreciation of the proposed change and its benign effect on the landscape, a GIS-based 3D visual model has been produced. Also available are a series of 3D fly though' visualisations which show the site under changing tidal conditions from various view points around the island.

(3) Socio-economic effects: - Whilst losses of arable land will be incurred (only now on Area B as farming has already ceased in Area A) the proposed realignment work will improve the currently poor defences and, in so doing, will protect the remaining farmlands and farm infrastructure on the island. Therefore, the scheme, in its own right, has economic benefits and hence the landowner is firmly supportive of this proposal. Protection of the island will also help ensure that significant effects (in terms of sediment erosion, channel changes and shellfish mortality) are not observed in the estuary, as would be the case if the wider island were flooded with significantly greater increases in water volumes.

In-combination/cumulative effects

There is no expectation that the proposed realignment scheme will have cumulative or in-combination impacts with other known proposals (such as maintenance dredging operations or beneficial sediment disposal works). This is because it has been shown that the realignment will not significantly affect the patterns of sediment accretion and erosion within the estuary in the short-term and that any long-term changes (over 100s of years) will be negligible. Therefore, it is not expected that the hydrodynamic conditions and sediment accretion/erosion rates will show a discernable detrimental change in areas where other estuary works are conducted. It is also known that an underground power cable is to be placed along an alignment across the Crouch and under Area A. The locations of the breaches were deliberately selected to ensure that no excavation works could affect a cable along this proposed alignment.

Additional Mitigation

In addition to mitigation measures already identified (see above) the following two requirments were also identified during the impact assessment: -

(1) Translocation of protected reptile species away from areas where they will be affected or isolated;

(2) Preparation of ground in Area B to discourage nesting and avoid deliberate impacts to breeding birds.

It is also recommended that, if possible, plant cuttings from the breach areas and other parts of the existing seawall are distributed across mitigation areas to accelerate the natural re-seeding of these new seawall habitats by the local plant species. Also use of an appropriate seeding to accelerate the site's development as a wildlife site for plants and invertebrate species is recommended.

Management

Following completion of the realignment scheme (i.e. after breaching), any further intervention in the site will be minimised because, having created the requisite conditions, it is expected that the habitats and communities will largely develop of their own accord. For instance only the top of the sea wall will be mown annually (to maintain the footpath) while other areas will be rotationally cut to limit disturbance to plant and insect communities. It is hoped, that this approach will maximise the ecological value of the created habitats including the mitigation areas. If required, based on monitoring results and the advice of the WPMT, intervention will be pursued although priority consideration will always be given to health and safety constraints.

Additional Monitoring

For this scheme two types of monitoring will be undertaken as follows: -

(1) Site Success Monitoring – To determine whether the created habitats attain their necessary ecological value;

(2) Impact Verification Monitoring – To confirm the findings of the assessment.

The Site Success Monitoring Programme (including surveys of birds, invertebrate prey species, sedimentation rates etc.) has already been agreed by the WPMT and has taken into account the joint DEFRA/EA guidance on monitoring managed realignment schemes. Using this guidance the Impact Verification Work should include:

(1) Flow monitoring in the breaches and in the estuary to confirm that the flow conditions are as predicted;

(2) Intertidal sampling on the Wallasea North Bank to confirm that the scheme does not have a qualitative (ecological) effect on mudflats and provide a context for the assessment of changes recorded during site success monitoring;

(3) Monitoring saltmarsh and mudflat habitat extent on the north bank to confirm that the scheme does not have a quantitative effect on these habitats and provide continuing contextual information on the status of these habitats especially the eroding saltmarsh;

(4) Fixed point photography to describe the foreshore in front of Area A and at Wallasea Ness to confirm that there are no significant changes to this feature.

It is recommended that these two monitoring requirments are integrated into a single programme to maximise both cost efficiency and the standardisation of survey methods.

Conclusions and Recommendations

The proposal has benefited greatly from having been pursued in an iterative manner over a period of several years and in several stages including: an extensive site selection process; advance consultations with the public and interested parties and the careful development of the scheme design. The proposal has also benefited from having the involvement, advice and input of key statutory authorities and NGO stakeholders throughout this process. It concurs with the established strategic plan for coastal protection as set out in the Flood Management Strategy because it will protect Wallasea and enhance the sustainability of the estuary.

As a consequence of the above process and this assessment it is considered that the potential impacts of the scheme have been foreseen and/or mitigated. With mitigation in place a number of minor and negligible impacts will occur. These impacts must also be seen in the context of the do-nothing option which, if pursued, would lead to natural breaching of the existing wall, flooding of the island in an unmanaged way and significant effects on the estuary. Equally, the active improvement of the existing defences, along their present alignment, would not be sustainable in the long-term as there would be increased stress on the defences and continued loss of intertidal habitats.

Therefore, while in the short-term the scheme, with the relevant mitigation and monitoring measures in place, is deemed to have a range of either negligible or minor (both adverse and beneficial) effects, there will be long term moderate beneficial effects in terms of coastal protection and estuary sustainability. The ecological gains provided by the creation of new mudflat and saltmarsh habitat within the realignment site have not been considered here because these are relevant solely to the port compensation requirments for which this proposal is being pursued.

Abbreviations

ABPmer	ABP Marine Environmental Research
BSS	Bed Shear Stress
BTO	British Trust for Ornithology
DEFRA	Department of Environment Food and Rural Affairs
EA	Environment Agency
ECCFAU	Essex County Council Field Archaeology Unit
EECOS	Essex Ecology Services Ltd.
EIA	Environmental Impact Assessment
EMS	European Marine Site
EN	English Nature
GTENA	Greater Thames Estuary Natural Area
HW	High Water
LiDAR	Light Detection And Ranging
LW	Low Water
NOTABLE	Regionally scarce;
NOTABLE A	Nationally Scarce thought to be in 30 or fewer 10km squares of national Grid;
NOTABLE B	Nationally Scarce thought to be in 31 to 100 10km squares of national Grid.
NRA	National River Authority
PMG	Lappel Bank and Fagbury Flats Project Management Group advising government on compensation requirments and including representatives from DEFRA, EN, EA and RSPB.
RDB2	Red data Book Category 2 – Vulnerable Taxa likely to be Endangered (RDB1) in the near future if causal; factors continue);

RDB3	Red data Book Category 3 – Rare Taxa with small populations in Great Britain;
RDC	Rochford District Council
RSPB	Royal Society for the Protection of Birds
SMP	Shoreline Management Plan
SSC	Suspended Sediment Concentration
WPMT	Wallasea Project Management Team comprising local representatives from EN, EA, RSPB and CEFAS overseeing the project implementation.

Acknowledgements

In advance of this EIA, a large number of organisations and local individuals were consulted by DEFRA to obtain their views about the Wallasea Island North Bank realignment proposal. This extensive consultation process (which included public presentations) and the large number of, mainly positive, responses received have been invaluable for the purposes of this study and for ensuring that relevant issues are highlighted for consideration within the subsequent Environmental Statement document. We would like to thank all those who contributed to this process.

In addition, we would like to thank the following who have contributed during the assessment process: Mark Dixon and John Clorley (DEFRA), John Hesp and Robert Bache (Wallasea Farms Ltd.), Shaun Scrutton (Rochford District Council), Roger Morris and Stephen Ayliffe (English Nature), Simon Barlow, John Daniels, Frank Saunders, Will Akast and Andrew Hunter (Environment Agency); Helen Deavin and Malcolm Ausden (Royal Society for the Protection of Birds) and Pat Connell (Essex County Council).

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1. Introduction

1.1 Report Background

The European Wildlife Division of the Department for Environment Food and Rural Affairs (DEFRA) is proposing to undertake a coastal realignment project on the north bank of Wallasea Island in the Crouch Estuary, Essex (see Figure 1). This proposal is being undertaken with the support and assistance of the landowner, Wallasea Farms Ltd, who will be responsible for the submission of the Planning Application for this work. To support this Planning Application, and also to underpin applications for other relevant legal consents/licences, Wallasea Farms Ltd has commissioned ABP Marine Environmental Research Ltd. (ABPmer) to undertake an Environmental Impact Assessment (EIA) as required under the Town and Country Planning Act (EIA) Regulations 1999.

As a first stage in the EIA process a Scoping Study was carried out to highlight the key issues to be considered in detail within the EIA. This Scoping Study was informed by the results of an initial meeting with Rochford District Council (RDC) as well as the findings from an extensive public consultation exercise that was undertaken by DEFRA prior to the selection of Wallasea as the proposed location for this realignment. The Scoping Report (ABPmer 2004a) was then circulated to Rochford District Council (RDC), English Nature EN, Environment Agency EA and Royal Society for the Protection of Birds (RSPB) and Crouch Harbour Authority (CHA). The views of these parties were then obtained to agree the assessment scope and identify any additional gaps that needed addressed within the Environmental Statement (ES). In accordance with this agreed scope (see next section) this ES now presents the results of the EIA process.

To support the EIA, ABPmer has separately carried out a series of detailed numerical modelling studies. These were undertaken to assess the short-term and long-term effects of the hydrodynamic conditions within the Crouch and Roach estuaries (ABPmer 2004b). They were also used to refine the design of realignment scheme. This work was undertaken directly under commission to DEFRA and the findings from this work have been used to inform this impact assessment.

1.2 Impact Assessment Scope

The results presented in the Scoping Study, and the findings from the subsequent consultations on this document, indicated that the key issues to assess the scheme's impacts are as follows:

(1) Physical Environment: - The effects of the scheme on the hydrodynamics, morphology and sediment transport characteristics of the Crouch and Roach estuaries based on the findings of the detailed modelling work.

(2) Water and Sediment Quality: - The effect on water and sediment quality conditions within the estuary from either the hydrodynamic changes in the estuary or from the localised mobilisation of the sediments and sediment-bound contaminants at the breach locations.

(3) Nature Conservation and Aquatic Ecology: - The effect on locally, nationally and internationally designated sites and species/habitats of conservation interest.

(4) Terrestrial Ecology and Protected Species: - The effect on the fauna and flora of the area proposed for realignment and particularly, the potential effects on species that are protected under national and international legislation (e.g. water voles, badgers, reptiles and breeding birds).

(5) Fisheries: - The effect, particularly, on the local oyster/clam fishery but also wider commercial fisheries interests from changes to the water quality conditions.

(6) Navigation and Recreation: - These two topics were linked together for this assessment in view of the particular importance of the estuary for recreational boating. The effects upon navigation and sailing activities are considered in the light of the predicted changes to the estuary-wide and local flow/tidal regime. The effects on other recreational activities (e.g. walking, wildfowling) are also addressed.

(7) Archaeological Interest: - The effects on potential features of archaeological interest within the realignment site.

Details of these key issues, and of the work required to underpin this assessment work, were presented in the Scoping Report and this information is summarised in Table 1. This summary table also includes a reference to those sections of this ES in which these key issues and assessment components are addressed. Further details about the full structure and content of this ES are presented in following section.

The content of this ES is also based upon the DETR'S Good Practice Guide and the requirements of the EC Directive on Environmental Impact Assessment (85/337/EEC), as amended by 97/11/EC, and draws together and interprets all relevant information on which the assessment has been based.

Table 1: Summary of Scoping Study describing key issues to be addressed in the EIA

Work Task	Details	Where in ES
Data Collection, Monitoring and Review	Bathymetric survey of the Crouch and Roach estuaries and detailed numerical modelling work) to identify the preferred site design and the physical process changes following completion of the scheme. This work will identify the short-term hydrodynamic and sediment transport changes within the estuary as well as the potential long-term response of the estuary system as a whole.	Section 5.2.2& Appendix F
	Field survey of the freshwater, brackish water and terrestrial invertebrates across the realignment site to describe the general ecological interest of the area and determine the presence/absence of protected species (by invertebrate ecology specialist Mr A Godfrey).	Section 5.2.2& Appendix H
	An Extended Phase 1 habitat survey and a detailed reptile survey to evaluate the ecology of the site and determine the presence/absence of protected species (by Essex Ecology Services Ltd EECOS)	Section 5.2.2 & Appendix I
	Benthic ecology and Marine Nature Conservation Review (MNCR) habitat survey of Wallasea foreshore and suitable control sites upstream and downstream to generate more detailed information on the marine species and habitats present.	Sections 5.2.2 & 8.3.3
	Data on water and sediment quality, fisheries and recreation to be sourced and reviewed	Sections 5.2.1 & 7
	Review of relevant guidance documents and plans and published literature.	Section 4
	Review of ornithological data (held by WeBS/BTO/RSPB) for Area A and the Crouch Roach estuaries	Section 5.1 & 8.4
	Photographic record to be obtained and GIS visual interpretation model to be produced	Section 13
Project Description and Rationale	Detailed description of proposed scheme including the construction methodologies and the cut/fill volumes	Sections 2.2-2.4
	Detailed explanation of the need for the proposed works and possible alternatives (in terms of other locations and other designs for the preferred site at Wallasea)	Section 2.5 & Appendix A
Analysis/ Assessment requirments	Physical Processes - The effects of the scheme on estuarine hydrodynamics, morphology and sediment transport through detailed numerical modelling work.	Section 6
	Nature Conservation and Ecology - The direct and indirect effects of the scheme on terrestrial and marine habitats with specific references to protected species and conservation interests of designated sites. This will based on the results of the detailed modelling work and the findings from extensive baseline surveys of the site. Information on indirect impacts to internationally designated sites to be presented in a way which allows RDC to prepare an Appropriate Assessment in accordance with the Habitat Regulations (1994) if this is required.	Section 8
	Water and Sediment Quality - The effect on water and sediment quality conditions within the estuary through localised mobilisation of the sediments and sediment-bound contaminants at the breach locations.	Section 7
	Fisheries – The effect, particularly, on local oyster/clam fishery but also wider commercial fisheries interests from changes to the water quality conditions and/or from physical changes within the estuary (as described by modelling work).	Section 9
	Archaeology – The effects on potential features of archaeological interest within the realignment site to addressed through desk study (by Essex County Council Field Archaeology Unit)	Section 10
	Navigation and Recreation (topics linked together given the importance of the estuary for recreational boating) - The effects of any changes in the estuary-wide and local (i.e. at breaches) flow/tidal regime upon navigation and sailing activities to addressed based on the results of the described by modelling work. Other recreational activities also to be considered (e.g. wildfowling and walking).	Section 12
Cumulative impact	Assessment to take account of the cumulative and in-combination effects of the proposal with other projects that are in the planning domain.	Section 15
Mitigation	The identification of appropriate mitigation and/or compensation measures that may be required to offset any impacts identified within the EIA.	Sections 2.2.5 & 16.1
Monitoring Requirments	A review of the requirments for future monitoring of the site to verify impacts (to be considered in context of proposed success monitoring which is currently proposed)	Sections 2.4.2 & 16.2

1.3 Report Structure

The structure and content of this ES are as follows:

(1) Project Background and Rationale (Section 2.1): - Includes an overview of the project's history and the motives for the realignment works.

(2) Scheme Description (Sections 2.2 to 2.4): - Describes the details of the proposed scheme including: its design, the construction methods and the proposals for site management and monitoring measures.

(3) Project Need and Alternatives (Section 2.5): - Presents an overview of the rationale for the proposed realignment scheme, together with a review of the extensive site selection process that was undertaken prior to the selection of Wallasea as the preferred site. This review identifies all the alternatives that were considered and the reasons why they were rejected in favour of the Wallasea site.

(4) Legislative Framework (Section 3): - Outlines the legislative framework within which the scheme will be progressed is summarised and details about the possible consent requirements are presented.

(5) Planning Context (Section 4): - Outlines the local and regional plans within which the proposal will need to be considered.

(6) Assessment Approach (Section 5): - Presents details about the approach taken for the assessment and includes details about the consultations undertaken, the baseline survey work and the main sources of other published and unpublished information that were used to support the assessment process.

(7) Impact Assessment (Section 6 to 15): - Presents the results of the assessment process for each of the key issues (as listed in Section 1.2) and includes, in each case, an initial review of the baseline conditions followed by an assessment of the impacts via each of the impact pathways that were identified within the Scoping Report.

(8) Cumulative/In-Combination Effects (Section 16): - Reviews the Cumulative and In-Combination effects of this scheme with any other extant proposals that were identified during the assessment process.

(9) Proposed Mitigation and Monitoring (Section 17): - Details the requirements for mitigation in those instances where moderate or major significant adverse effects are identified and also considers the residual impacts where such mitigation needs to be pursued. Also included are the

requirements for impact verification monitoring with due reference to the extant proposals for site success monitoring which is an existing integral part of the proposal.

(10) Conclusions and Recommendations (Section 18): - Summarises the findings of the impact assessment.

2. Description of proposed realignment scheme

2.1 Project Background and Rationale

The proposed realignment work on Wallasea Island is being pursued by DEFRA in order to create new intertidal mudflat and saltmarsh habitat in compensation for habitat lost due to port developments that were carried out at Lappel Bank in the Medway Estuary, Kent and at Fagbury Flats in the Orwell Estuary, Suffolk (see Figure 1) during the late 1980s and early 1990s. In addition to the habitat gains, this proposal will improve the levels of coastal protection afforded to Wallasea Island. Many of the existing seawalls on the north bank of the island are in poor condition with very little fronting intertidal habitat and are at risk of natural breaching. Therefore, the creation of a new seawall fronted by a large expanse of intertidal habitat will greatly enhance the protection afforded to the existing land holdings on the island (as owned by Wallasea Farms Ltd.). The sea defence benefits of this proposal are confirmed by the fact that that the Environment Agency's Flood Management Plan for the Crouch and Roach Estuaries (Halcrow/EA 2003) recommends coastal realignment in this area of the island.

2.1.1 Habitat Creation and Compensation Objectives

In 1993, the Medway Estuary was classified as a Special Protection Area (SPA) under the EC Birds Directive by the UK Government. The Government excluded 22ha of mudflat at Lappel Bank on the grounds that its reclamation was deemed to be essential for the continued viability of the port of Sheerness. This exclusion was challenged by the RSPB on the grounds that the ability to exclude habitat from on SPA on economic grounds was unlawful. In 1997, the House of Lords, after referring the matter to the European Court of Justice (ECJ), found against the Government. As a result the UK Government is committed to providing compensation measures to offset the environmental impacts from the exclusion of Lappel Bank from the SPA and at Fagbury Flats, where a similar situation occurred. These developments resulted in the cumulative loss of 54ha of intertidal habitat including 22ha mudflat at Lappel Bank) and 32ha of both mudflat and saltmarsh at Fagbury Flats.

The Government's drive to pursue these compensation measures is being overseen by the Lappel Bank and Fagbury Flats Project Management Group (PMG), which

presently consists of representatives from the following parties: DEFRA, English Nature (EN), Environment Agency (EA), the Royal Society for the Protection of Birds (RSPB), Government Office of the Eastern Region (GOER) and the Government Office for the South East (GOSE). The method, identified by the PMG, for providing the necessary compensation habitats was to create suitable areas of new mudflat and saltmarsh (in particular to provide feeding habitats for birds) through the realignment of flood defences at a suitable location. It was agreed that this location should be as close as possible to the sites that were lost and should ideally be within the Greater Thames Estuary Natural Area (GTENA).

The GTENA is a coastal environmental management area that covers the coastal areas and low-lying hinterland between the mouth of the Stour Estuary and the Swale Estuary in North Kent and to identify possible locations for coastal realignment within this area, an extensive and long-term site selection process was undertaken. In order to understand the alternative options that were considered, but rejected in favour of the north bank of Wallasea Island option, this process is summarised in Section 2.5 and also reviewed in greater detail in Appendix A.

2.1.2 Coastal Defence Objectives

Although habitat creation is the primary objective for this scheme, it is also important to note that this scheme will enhance the level of coastal protection afforded to Wallasea Island and the 800ha of land owned by Wallasea Farms Ltd. Of the 17km of seawall that surround the Island, it is the northern walls that are most vulnerable to natural breaching. In light of these risks from flooding, Wallasea Farms Ltd has already built a new wall, at their expense, at the centre of the island's north bank which will form part of the proposed scheme (as described further in Section 2.2.2). When this wall was constructed it was recognised that realignment would occur to the front of the site either though deliberate intervention or though a natural failure of the present sea defences.

For the proposed 'managed' realignment, this new wall will be extended along the length of the north bank of the island and then the land fronting these walls will be inundated (see Section 2.2.2). This scheme will greatly enhance the protection along this side of the island. Not only will the new wall will be wider and higher than the existing wall (New Wall >25m wide and +5.3mODN (Ordnance Datum Newlyn) Existing Wall often <10m wide and +4.7mODN) but will be further protected by the areas of new coastal habitat created in front which will act to reduce tidal flow speeds and wave effects. The enhancement of the existing defences and the subsequent realignment across this north bank area is supported by the recommendations of the Environment Agency's Flood Management Plan for the estuary (Halcrow/EA 2003).

This Strategy recognises that following realignment the Crouch will have a more sustainable shape (i.e. with a will have a greater area and more fringing habitats). The Strategy also highlights that if breaching is allowed to occur naturally, the whole of

Wallasea Island will flood and this will have 'a significant long-term detrimental impact on estuary hydrodynamics due to the significant increase in the estuary channel shape, potentially leading to natural widening of the downstream reaches to the mouth of the estuary complex and increased stress on existing defences'.

2.2 Scheme Design

2.2.1 Introduction

The design of the Wallasea Island realignment scheme has been developed by Mark Dixon (DEFRA Project Manager) and Wallasea Farms Ltd based on Mark's experience of previous realignments in Essex and Wallasea Farms' previous experience (in 2002) of constructing a counterwall at the centre of the north bank of the island (see next Section). It has also been informed by the results of the modelling work undertaken by ABPmer (2004b) which was used to refine scheme design details such as breach widths, breach locations, channel locations and the alignment of a series of proposed mitigation island features. Further details about the design of the scheme and the proposed methods for its construction and subsequent 'operation' are presented below.

2.2.2 Counterwall Alignment

Wallasea Island lies at the junction of the Crouch and Roach Estuaries and the proposed realignment will involve the construction of a new seawall set back from the north and northeast fringes of this island. This will be followed by breaching of the existing seawall at six locations to allow inundation of the site by tidal waters and thus, to facilitate the creation of new intertidal mudflat and saltmarsh between the new and existing seawalls (a total area of 108ha). Figure 2 shows a generic outline scheme design showing the location of the counterwalls, the breaching sites and the areas over which the realignment will take place. A further more detailed scheme plan is illustrated in Figure 3 and cross sections of the key design features are illustrated in Figure 4.

As noted above, the landowner (Wallasea Farms Ltd) has previously constructed a new seawall and there is an area of 54ha between this wall and the existing coastal defences which has been 'fallow' since its construction and which will form part of the realignment site. This existing wall and the area in front are referred to here as 'Wall A' and 'Area A' respectively. Given the alignment of Wall A and the other works proposed for the realignment (see below) Area A will be divided into two hydrodynamically discrete sections (i.e. areas with water flows into and out of the estuary but with no flows to neighbouring sections within the realignment site itself). These are referred to as 'Area A (west)' which is approximately 9ha in size and 'Area A (east)' which is approximately 41ha as shown in Figures 2 and 3. Together the 50ha covered by these two areas comprises just under half of the total area of the site.

To meet the full compensation requirements, and create a total area for realignment of around 108ha, the scheme includes construction of a second wall ('Wall B') to the east (see Figure 3). The area in front of this wall ('Area B') covers 58ha of currently actively farmed arable land and it will be hydrodynamically separate from the adjacent Area A. Thus overall, there will essentially be three discrete realignment areas which will each have an open exchange of water with the adjacent estuary but with no flows into neighbouring sections of the wider realignment site. It is proposed that the breaching work will be pursued in three stages with each of the three areas being flooded in sequence from west to east (see Section 2.3). Detailed measurements of the habitat area and water volumes within these three areas are presented in Table 2.

Table 2: Habitat Area (ha) and tidal volume (m^3) in the three areas of the realignment site

	Tidal Height	Area A (west)	Area A (east)	Area B	Total
Area	MHWN	5.8	31.4	48.2	85
	MHWS	9.2	40.2	57.5	107
	HAT	9.4	40.7	58.2	108
Volume	MHWN	76,110	257,455	453,627	787,192
	MHWS	139,302	594,480	953,342	1,687,124
	HAT	176,366	756,281	1,184,867	2,117,514

2.2.3 Sediment Recharge for Saltmarsh Habitat Creation

The aim of the proposal is to create predominantly mudflat habitats (86 ha of the site is to be mudflat while the rest (22ha) is to be saltmarsh) and the topography of Wallasea is suitable for this because almost all the land is at a relatively low elevation. The majority of the land is at an elevation of around +1.2m ODN and, given an appropriate flow regime, mudflat habitat generally occurs between the Mean Low Water (which is at +0.6m ODN in the Crouch) and Mean High Water Neap tidal levels (which is at +1.85m ODN in the Crouch).

To additionally create areas of saltmarsh (which occurs above Mean High Water Neap tide level) it is proposed that landscaping will be undertaken at the top of the shore. In this area the land will be elevated through the beneficial use of dredge arisings along a 45m wide strip immediately seawards of the new and proposed seawalls. This recharge will raise the ground elevation to around +3.3m ODN at first but with subsequent settlement to around +2.7m ODN which is just below the MHWS level (which is at +2.85 ODN in the Crouch). Further details about the ground elevations at which different saltmarsh species develop relative to the tidal levels in the Crouch estuary are shown in Figure 5. This new elevated strip of land will have the dual benefit of providing the height of land required for saltmarsh development (and thus meeting compensation requirements for saltmarsh lost at Fagbury Flats) while also enhancing the coastal protection afforded by the new seawalls.

The dredge arisings will be held in place initially with a temporary clay bund that will be constructed using material sourced on-site which will enable the sediment to settle out and to provide substrate for the subsequent saltmarsh colonisation. To achieve the required extent of saltmarsh it is estimated that 560,000m^3 of sediment will be needed.

As the realignment area will be divided into three hydrodynamically discrete areas (as described in Section 2.2.2) the bunded recharge areas will also be divided into three such areas (i.e. Area A (west), Area A (east) and Area B). The sediment will be pumped ashore and into these areas from a Trailer Suction Hopper Dredger (further detail about recharge methods are presented in Section 2.3.2) and will be deposited between the clay bund and the new counterwalls in each of the three recharge areas. The clay bund is designed such that it will erode away by internal wave action over a period of several (approximately 5 to 10) years. However, during the first two years of that period annual halophytic plants are expected to have established across the recharge area and complete colonisation by perennial plants is expected after five years. This prediction is based on monitoring of sites in at Horsey and Shotley where following similar fine sediment recharge work, natural systems have developed relatively rapidly. (Mark Dixon DEFRA Project Manager, and Stefan Bolam CEFAS pers. comm.).

It has been highlighted by EN (Stephen Ayliffe pers. comm.) that functional saltmarshes require good drainage and therefore the recharge area will need to be able to be drain well after each tidal inundation. Such regular drainage is likely to be facilitated by the natural formation of the deposited material because as it settles this material will naturally develop an undulating topography. The height variability of the mounds and troughs created will be in the region of 1-3m and as the larger Spring tides flow over this area, new creeks will also form as the water tries to find its way out. As the tide ebbs away there will also be a weiring effect over the clay bund and this is expected to create weak spots though which the ebbing tide should preferentially drain and start new creeks in the saltmarsh and across the adjacent mudflat.

2.2.4 Breach Locations

Following completion of the wall and the reshaping of the site, it will be necessary to breach the seawall at selected points to allow tidal inundation. Based on an initial evaluation of the site by the DEFRA project manager (Mark Dixon); the results of extensive monitoring work that has been carried out on previous realignment schemes (e.g. Abbotts Hall, Blackwater) and the results of the detailed numerical modelling studies (ABPmer 2004) it has been concluded that six breaches are required with a total width of 590m. These breaches (see Figure 3) are to be placed at the following locations: -

(1) Breach 1 (Overland Point): - 60m wide;

(2) Breach 2 (Grassland Point): - 100m wide;

(3) Breach 3 (Fleet Point East): - 100m wide;

(4) Breach 4 (Ringwood Point): - 210m wide;

(5) Breach 5 (Barrington Point)- 60m breach;

(6) Breach 6 (Barrington Point East) - 60m breach.

It has been confirmed though modelling that this number of breaches at these locations is needed to ensure that the tide is able to fully inundate and drain the site during each tidal cycle and also, that there is a sufficiently fast circulation of water throughout the site to facilitate the creation of sustainable mudflat habitat. In relation to the three hydrodynamically discrete area described in the previous section, Area A (west) will be inundated though Breach 1; Area A (east) will be inundated though Breaches 2 and 3 and Area B will be inundated though Breaches 4, 5 and 6 (see Figure 3).

2.2.5 Mitigation Measures

A key requirement of the EIA process is to identify whether there is a need for appropriate mitigation measures and monitoring work based on the findings of the assessment process. It is of note however that, within the existing design, DEFRA already includes proposals to mitigate for the losses of freshwater or brackish water habitats that will occur following inundation. These mitigation measures are: -

(1) Creation of Borrow Dyke behind Wall B: - To mitigate for losses of freshwater/brackish habitats within the realignment site (including borrow dykes and drainage channels and also open water-filled lagoons or 'scrapes' that were created when material for the Wall A construction was excavated) as well as impacts to species supported by them, new equivalent habitat will be provided through the creation of the borrow dyke habitat behind Wall B (Borrow Dyke B).

(2) Creation of Island Features across Areas A (east) and B: - To mitigate for impacts to roosting/breeding water birds as well as for possible losses of important plant species within the realignment site seven island features are to be created within the new coastal habitat. These will be elevated well above the Highest Astronomical Tide (HAT) level to ensure that they are exposed at all states of the tide. In total there will be seven islands and these will be numbered 1 to 7 from west to east (see Figure 3).

(3) Excavation of a lagoonal habitat next to Island 7: - To enhance the value of Island 7, a lagoon/scrape is to be excavated directly adjacent to it. It is hoped that this habitat will support an invertebrate and fish food resource for waterbirds (especially terns) that may nest or roost on this island.

Borrow Dyke Habitats

To identify the best design for Borrow Dyke B, advice was taken from RSPB, BTO, and EN. This advice was informed by lessons learned following the construction and maintenance of Borrow Dyke A (the one already in place behind Wall A). From his observations in the field, Jeff Delve (BTO) noted that this Borrow Dyke A had a relatively high value to feeding birds when the shallow inner berm habitat between the dyke and the new wall was just covered by the naturally fluctuating water levels (as was originally the case after the construction). However, the bird interest declined when the middle channel was subsequently deepened to allow more water to flow to the sluice. Based on these findings, as well as further recommendations from Jeff Delve and discussions with RSPB and EN, a conceptual design for Borrow Dyke B was agreed that will make it less susceptible to changes in water levels and will maximise its value to invertebrates, waterbirds (inc. avocet) and, possibly, water voles.

It is proposed that this borrow dyke, which will connect directly with Borrow Dyke A, will be 22m wide and, rather than have a relatively simple and uniform channel, as is found at Borrow Dyke A (and the other dyke features that are a widespread feature of the local coastline), it will be excavated in a manner which ensures that its shallow water berm will have a rough and variable topography. This berm will then form a series of shallow pools of varying depths with mini channels connecting to the middle deeper channel. These habitats will change on a seasonal basis as water levels naturally rise and fall within the berm due to climatic changes and, in this context, the presence of the deeper middle channel should ensure that the dyke does not dry out during times of drought and therefore, that some habitat for aquatic invertebrates remains available at all times. On the long section view, higher "dams" will be left in place to maintain water levels over the shallow berms. If space permits and the borrow dyke is wider in sections then the creation of mini islands could provide breeding areas for redshank or possibly avocet.

A 30cm high "cliff" in the borrow dyke will also be created on the landward side of the dyke to provide potential water vole habitat although the brackish nature of the ground water may limit colonisation by this species. It is of note that Borrow Dyke B will not have access road extending along its landward side (as is the case for a small proportion of Borrow Dyke A) therefore, there will not be any traffic disturbance from the occasional visitors to the site. Instead the only potential disturbance will be from the occasional walkers along the seawall and from activities undertaken as part of site maintenance and, to a lesser degree, from agricultural activities. Such disturbance is expected to be very low (see Section 8.6.5) and it is expected that this shallow-water wetland towards the middle of Wallasea and away from any sources of disturbance could provide a "honey pot" habitat for breeding and migrating waders (Jeff Delve BTO pers. comm.). In so doing this Borrow Dyke B habitat will help to mitigate for impacts to protected species as a result of the realignment (including animals and plants listed in Schedules 5 and 8 of the Wildlife and Countryside Act 1981, as amended in 2000, or

European Protected Species listed in Schedules 2 or 4 of the 1994 Habitat Regulations).

To illustrate the design further Figure 4 shows a possible cross-section though Borrow Dyke B. However, it should be noted that the finer details of the design will be dependent upon the build requirements and the location of suitable construction materials.

Island Features

As part of the scheme design, island features are to be created within Area A (east) and B. In construction terms these islands will be used as a location for the deposition of materials excavated during the breaching works. However, they will also be deigned so that they enhance the ecological/ornithological value of the site (i.e. by providing possible nesting, roosting and/or loafing areas).

The tops of these islands will be set at a height of +4m ODN (this is 0.75m above the highest astronomical tide (HAT) level) and, with a view to encouraging different bird species, they will have different surface substrata. On Islands 1,2, 4 and 5 the muddy material from the breaches will be placed on the top to facilitate the development of a grass/vegetation surface. To encourage nesting and roosting birds (especially little terns), Islands 3 and 6 will have a 400mm covering of gravel (with a filter cloth under-layer to prevent excessive vegetation growth) and Island 7 will have 400mm cover of cockle shells. The use of cockle shell was suggested by the RSPB (Malcolm Ausden pers comm.) because it has been found that this substratum can discourage gulls roosting/nesting and thus will leave this island relatively undisturbed for species such as little terns.

Where possible, and if suitable materials are available, then an “apron” of cobble/pebble-sized materials from the breaches will be placed around the base of the islands. This would be included because this substratum could be colonised by epibenthic species (periwinkles, mussels etc.) and thus they may provide suitable feeding areas for waders that feed on such organisms (e.g. turnstone, oystercatcher and ringed plover).

As the inclusion of islands can have the effect of reducing flow speeds in some areas, careful consideration has been given to ensuring that their extent, alignment and location does not significantly interfere with flows across the site. This was a particular concern for the larger Area B site where the intertidal distance will be greatest and, as such, there will be an increased potential for areas of reduced flow (where high levels of sediment deposition will occur). Therefore, in this part of the site the islands were aligned and positioned so that they facilitated the flow into otherwise sheltered areas of the sites.

2.2.6 Additional Design Considerations

In addition to the counterwall construction, mitigation habitat creation and the breaching works, the following other factors will be included in the design: -

(1) Drainage Channels through breaches to existing borrow dyke: - To ensure an effective flow of water throughout the site, 10m wide channels will be cut through the centre of the breaches (and set at –1.4ODN which is just above the Mean Low Water Mark). These will be linked back to borrow dykes within the realignment area so that the water will flow directly into the borrow dyke then across the site.

(2) New deeper drainage channel at Breach 2: - At Breach 2 an extra channel will need to be excavated to link the 10m channel through the breach back to an existing field drainage channel. The seaward sections of this existing field drain (which without intervention would act to take the ebbing water away to the east of Breach 2) will be filled in.

(3) Blocking Field Drainage Ditches within the site: - To modify flow and ensure that it predominantly travels over the majority of the site and is not overly constrained in the existing borrow dykes and drainage channels, the landward and seaward ends of the existing field drains will be filled in. This will also limit slip plane formation and will result in the ditches forming temporary saline pools (which are likely to be filled in over time)

(4) H&S Preparatory works before breaching: : - Prior to breaching and tidal inundation in each of the three areas of the realignment site there will need to be a number of measures undertaken to ensure the safety of the contractors. These are outlined in Section 2.3.2.

No changes are envisaged to land use outwith the area of the proposed realignment site and associated mitigation areas. For instance there are no proposals to change the access road layout behind the site. Currently the access road leads from Grapnells Farm east to Wall A then runs along the back of Borrow Dyke A for about 500m before turning south to the centre of the island. This road layout will not change (as noted in Section 2.2.5) and there will be no extension of the road behind the existing or proposed borrow dykes; however, in future, construction plant and occasional maintenance vehicles will have access to the full length of the seawall by passing along the flattened berm between the borrow dyke and the new seawall.

2.3 Construction Methods

2.3.1 Introduction

The construction phase can be separated into the following four key stages: -

(1) Stage 1: - The earthworks for the construction of Wall B and the excavation of Borrow Dyke B;

(2) Stage 2: - The sediment recharge works for the saltmarsh habitat creation work;

(3) Stage 3: - The preparatory works that will be needed for Health and Safety reasons before breaching can commence;

(4) Stage 4: - The breaching works.

To inform the EIA process, the proposed methods for carrying out each of these stages are summarised in Sections 2.3.2. Further details about the Construction Schedule, the Pollution Risk Assessment requirements and the Health and Safety considerations are also presented in Section 2.3.3 and 2.3.5 respectively. The methods presented can only be indicative at this stage because it is recognised that details of the works will need to be refined and agreed with the engineering contractor that is eventually commissioned to undertake these works.

2.3.2 Construction Methods Stages 1 to 4

Stage 1 - Earthworks for Wall and Borrow Dyke Construction

The new counterwall (Wall B) that is to be built as part of this proposal will be constructed in the same manner as Wall A. It will be built from suitable spoil materials that will be excavated on-site from the land on either side of the new wall (i.e. from 'Area B' on the seaward side and from the ditch excavation works that are to be carried out to create Borrow Dyke B on the landward side).

Where the build materials are obtained from within the realignment area (soil investigations will be undertaken to demonstrate where suitable material can be obtained) it is envisaged that hollows or 'scrapes' will be created. These scrapes will be limited to a depth of 1.2m below existing ground level will and be retained in place so that shallow saline pools will be created following tidal inundation. The pools created in these areas are likely to support distinct populations of invertebrate and waterbird species when compared with the periodically exposed intertidal mudflat and saltmarsh areas and could be particularly valuable locations for the survival and development of fish species (especially juveniles).

These works are likely to be carried out by one Principal Contractor. To indicate the potential size of the operations it is expected that there will be a resident engineer, 15 operators plus one foreman with the following plant: four 30-tonne excavators; one 13-tonne excavator; one Bulldozer; six 15-tonne dump trucks and one Roller (although scrapers may be used as an alternative to the some of the excavators and dump

trucks). The site offices for the works will be located adjacent to the existing Wallasea Farms office at Grapnells Farm.

Stage 2 - Sediment Recharge Works for saltmarsh habitats creation

Following completion of the clay bund in front of Walls A and B and prior to the sediment pumping works, a 1.90m width Enkamat geotextile will be placed above the topsoil level on the seaward side of the seawall between a height of +2.1 and + 4m ODN. This is designed to facilitate the establishment of vegetation and prevent storm wave scour of the new seawall during the first two years following inundation.

The recharge sediments will be sourced from maintenance dredge arisings collected at the Port of Harwich. The type of materials from this source will be normal harbour clay/silt mixture with approximately 30 – 40% of sediment finer than 0.2µm, 80 – 95% finer than 0.63µm and 100% finer than 1.50µm. There is also the possibility that a very small amount of shell and gravel from underlying strata will be present and the material cannot be guaranteed to be completely free of minor harbour debris.

The licence to dredge at Harwich is subject to separate environmental safeguards, part of which will entail an assessment by the relevant authority of the dredging work on its own merits, together with Food and Environment Protection Act (FEPA) licensing. As part of the dredging licence, there is the requirement to consider beneficial use of the material and the creation of saltmarsh at Wallasea would fulfil the relevant criteria. These arisings will be relatively uncontaminated as the FEPA disposal licence also includes a requirement to establish that sediments have low levels of pollutants prior their use (with the requisite sediment quality analyses for such licensing needing to be undertaken by CEFAS).

The sediment will be transported to the site by a 3683m^3-capacity trailer suction dredger. This dredger will be moored at suitable deeper-water locations in front of the realignment site (possibly in front of breaches at Overland, Grassland, Fleet, Ringwood and Barrington Points). At the mooring points a 'spudded' (i.e. self mooring fore and aft) barge will be moored as tight as possible on the seawall and this will be used to connect the dredger to the sediment discharge pipeline that will release the sediment into the bunded recharge area. The discharge pipes will be laid along the crest of the existing and new seawalls. Any damage to the crest of the new wall will need to be made good by the dredging contractor. The arisings will need to be allowed to de-water (where water used to pump the sediments is allowed to drain off) and this will require limited removal of the clay bund prior to recharge works (to allow passage of the draining water) followed by bund re-instatement on completion of each section.

Measures will be put in place to ensure that the material is of sufficient quality and particularly, that it has an appropriate bulk density. The material will be dredged with the intention of producing loads with an average in-hopper density of 1.25t/m^3 but, in any 7-day period, one load of less than this hopper density may be placed on the

realignment site however, any subsequent loads of less than 1.2t/m^3 would be diverted for sea disposal.

The dredger will operate on each high tide (i.e. up to 2 cargoes per day) and for 7-day weeks over a total of 80 days with the dredging and recharge operations being undertaken in two 40-day phases. Phase 1 will be pursued from November 2005 to December 2005 (for 40 days, weather dependent]) and Phase 2 will be from February 2006 (again for 40 days). Phase 2 may commence at a later date depending on dredge location and material quality with completion no later than July 2006. Regular contact will be maintained with Crouch Harbour Authority and Baltic Wharf to ensure unhindered navigation of other river users.

The precise locations at which the dredgers are moored, the locations of the discharge points and the specific mechanism by which the dredge arisings are de-watered the site will be determined based on the advice of the contractor that is commissioned to carry out these works. In the case of the sediment de-watering, for instance, it is possible that the contractors may chose to leave the eastern and western extremes of the bunded areas open so that water can drain though these areas during the recharge works. Alternatively gaps may be placed at intervals along the length of the bunds to allow the recharge water to exit the bunded areas. Whichever approach is adopted these gaps will be filled with clay materials after completion of the sediment deposition.

The deposited sediment is expected to settle out rapidly within the realignment site because it will be 'de-gassed' on the dredger prior to release and will therefore, be pumped in as a thick slurry. The water that emanates from the sediment after deposition will then pass across the realignment site where the existing vegetation will have been be left in situ to act as a sediment trap. Any remaining sediment in suspension will then pass firstly, into the field ditch system and then into the existing borrow dyke before finally exiting into the estuary via the sluice. Therefore, there will be a long settlement period and no release of this recharged sediment is expected. This conclusion is based on previous experience of sediment recharge works at Horsey Island in the Walton Backwaters; Pewet Island and Maldon in the Blackwater Estuary and at Shotley on the Orwell Estuary which, over the last 10 years, has been subject to independent monitoring by CEFAS. (Mark Dixon DEFRA pers. comm.). It was also found during these previous similar sediment recharge works that opportunistic and temporary bird feeding by waders on invertebrates is likely to take place within the bunded area on the commencement of pumping (as invertebrates are released from within the sediment). A similar response is expected at Wallasea.

Stage 3 - H&S Preparatory works before breaching

The preparatory works that will need to be undertaken within the realignment areas prior to the breaching will include all the additional design features that were listed in Section 2.2.6 (e.g. channel blocking and the excavation of the new channel through

Breach 2). In addition to these site design elements, the following safety-related work will also need to be undertaken before any of the breaching works can take place: -

(1) The construction of a Land Bridge: - The scheme design includes a land bridge connecting the existing seawall with the new seawall between Area A (west) and A (east) to provide an exit route for contractors working in Area A.

(2) The construction of six access ramps: - At each breach site a ramp will be constructed (using on-site earthworks material) from ground level to the top of the existing seawall to provide an exit point for plant and staff on the completion of breach works.

(3) The construction of temporary crossings: - Across the existing borrow dyke temporary crossing will be constructed to allow access to the wall for the breaching works.

(4) Temporary storage of island surface materials: - To ensure that the materials which will make-up the surface of the island (i.e. gravel and cockle shell for the top of islands 3, 6 and 7.) are readily accessible in advance of breaching, these will be imported by road or sea to the site and stored temporarily at accessible locations near the relevant islands.

Stage 4 - Breaching works

The works undertaken at all six of the breaches will be subject to the same tidal limitations, working schedules and safety restrictions. The work for each breach will take place over two days during a Neap Tide period. On the first of these two days the top of the wall may be removed down to the Spring Tide level (MWWS 2.85m ODN) or alternatively, to the level of the next tide plus 500mm depending on tidal height prediction. On the second day works shall not commence until the ebb tide has started and they will then have to be completed by low water (i.e. within a 6-hour period). The works will be undertaken sequentially for each of the three component areas starting with Area A (west) then Area A (east) and finally, Area B. In this way the contractors will be able to start with the smallest area first and work up to the largest area with the aim of gaining practical experience though the project. Detailed descriptions of the extent and location of the six breaches are presented in Figures 6 to 10 and further information about the construction works to be undertaken at each breach site are reviewed below.

(1) Area A (west): - Breach 1 (Overland Point) will be the first to be breached (Figure 6). The excavated material from the breach will be placed loosely (i.e. not compacted) on either side of the breach in an area adjacent to, and landward of, the existing seawall. Therefore, unlike other areas no island features are to be created in Area A (west) with the excavated materials.

(2) Area A (east): - When Area A (west) has been completed the Breaches 2 and 3 (Grassland and Fleet Points respectively) in Area A (east) will then be breached (Figures 7 and 8). It is intended that this should be done during the same Neap tide cycle. The excavated material from Breaches 2 and 3 will be used to form Islands 1, 2 and 3. On these islands the old revetment will be placed on their seaward side to offer structural protection on the flooding tide and also to create a boulder/cobble substratum that could be a potential extra feeding habitat for wader species that feed on rocky shore epibenthos (e.g. little plover, turnstone, oystercatcher).

(3) Area B: - The breaching works in Area B will require the extensive removal of the old redundant seawall which lies to the seaward of Breaches 4, 5 and 6 in this area (Figures 9 and 10). It will also require the removal of the existing saltmarsh and foreshore areas between the old seawall (i.e. the outer wall breached during the 1953 floods) and the existing seawall that is to be breached. This work must be completed before any works to the breaches commence. The material excavated from these will be used to form four island features (Islands 4, 5, 6 and 7). Breaching to the three locations on Area B at Ringwood and Barrington Points will have to be completed within the same period. As this is the most critical operation sufficient plant plus standby plant must be available. As a guide based on previous sites, and subject to Contractor's advice at a later date, it is expected that a minimum of eight 20-tonne excavators, ten 15-tonne dump trucks and three bulldozers will be required over the two days of final breach works.

2.3.3 Construction Timing/Schedule

Taking each of the key construction stages, the overall timescales for the works are as follows:

(1) The Stage 1 earthworks construction is scheduled to commence in May 2005 with completion by November 2005. From May to July 2005 works will be confined to Area B to limit disturbance to nesting birds on Area A.

(2) The Stage 2 sediment recharge works will commence from mid November 2005. This start date will be dependent on the availability of suitable material but this work should be completed by July 2006 at the latest.

(3) The Stage 3 site preparatory work will commence in May 2006 and must be completed by September 2006 to enable breaching to be finished by October 2006 (i.e. before winter period) for health and safety reasons.

(4) The Stage 4 breaching work will commence no later than 1 October 2006 with the breaching of Overland Point (Breach 1) being undertaken first as a

trial to enable the contractor to fully assess his plant requirements and give plant operators experience.

A Gantt chart showing the propose programme is shown in Table 3.

Table 3: Draft Outline Construction Programme

	2005									2006								
Activity Description / Month	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O
Construction of Wall B																		
Construction of bund in Area B																		
Construction of bund in Area A																		
Borrow dyke habitat creation works																		
Sediment Recharge works							Undertaken in two 40-day periods											
Pre-breach preparation in Area A																		
Pre-breach preparation in Area B																		
Breaching in Area A (west)																		
Breaching in Area A (east)																		
Breaching area B																		
NB – Area A has to be breached before Area B for Health and Safety reasons to give the contractor and plant operators the learning experience and limit risk.																		

2.3.4 Risk Assessment for the Prevention of Spillages

Before commencing the work, the Contractor will need to present an agreed Method Statement with proposals to manage spillage risks and minimise environmental impact. The following elements are expected to form part of such a Method Statement: -

(1) Any plant which leaks any fuel, lubricant or hydraulic fluid will not be used. Daily inspections of plant will occur to ensure faults are highlighted and plant fixed or removed from service.

(2) All plant will be maintained to ensure efficiency and to minimise emissions.

(3) All plant will be steam cleaned prior to delivery to the site.

(4) All fuel and oil storage will be undertaken away from watercourses, fully bunded (with no outlet) to 110% of the volume stored and maintained in a secure and clean manner. Delivery and vent pipes will terminate within the bund. A responsible person will supervise all deliveries and fuelling operations. Mobile refuelling units, when not in use, will be parked in a secure area and within a bund.

(5) All refuelling or servicing of plant will be carried out in designated locations away from watercourses that have been identified to the Supervisor.

(6) All refuelling will be supervised and will be carried out by pumping through a trigger type delivery nozzle. All outlet valves will be locked when not in use.

(7) An adequate supply of oil absorbent materials will be readily available on site at all times (e.g. in cab of plant).

(8) Any spillage will be immediately contained, removed from site and disposed of to a licensed tip, the Supervisor being promptly informed. The Contractor will maintain on site an adequate supply of oil absorbent material and oil retention for such emergencies.

(9) All temporary sewerage facilities will be connected to the public foul system. Where these are not readily available then a sealed tank without an overflow pipe will be provided.

2.3.5 Health and Safety Issues

The highest priority will be given to health and safety requirements throughout the construction works and any subsequent interventions that are required during the 'operational' phase of the project. In particular the Construction (Design and Management) Regulations (CDM Regulations), which apply to this project, will be adhered to. The measures needed to ensure that the risks to third parties and construction staff are minimised will be set out in a Method Statement and Risk Assessment that will be developed by the Contractor and agreed with the Client in advance of any work commencing. However, at this stage it is possible to highlight a number of residual risks and control measures that will be needed.

(1) Before commencing work on site all site personnel will attend a site-specific induction that will be given by the contractor which will review the Method Statement and Risk Assessments. This will, in particular, identify the dangers of working near plant and water and the key environmental issues.

(2) There will be a temporary diversion of the public footpath on the existing seawall during those construction works that involve tying Wall B with the existing Wall A. On completion of the proposed Wall B and prior to breaching there will be a permanent footpath diversion. These diversions are required to ensure access routes are available to the public at all times and to ensure the safety of every user. Diversion orders will be obtained from Essex County Council.

(3) Public access to the working site area will be prevented. Effective barriers (e.g. 1.8m high herras-type fencing) will be erected between the working area and the public footpath. Pedestrian warning signs will be placed around the perimeter of the site at regular intervals indicating the presence of a construction site and the imposing danger if the boundary is breached. All

signs (including those on footway diversions) will be kept clean, safe and legible

(4) The working areas will be defined to allow construction works and farming operations to occur separate from each other.

(5) The site compound will be properly secured, material lay-down areas and plant areas will be clearly defined in line with current health and safety regulations.

(6) Site access/egress routes will be laid out and signed to ensure the public and other road users are aware of site entrance/exit and the potential for large or slow plant movements.

As recorded in the Scoping Report (ABPmer 2004a), no significant impacts to the local traffic flows or to the noise and air quality conditions are expected from this construction work because the sediment required to create the saltmarsh area will be brought in by sea and the material to construct the seawall will sourced from site. Therefore, there will be no need for a large-scale importation of materials by road and traffic increase will be confined to site workers and plant accessing the site

2.4 Operational Methods (Management and Monitoring)

2.4.1 Site Management

The management of the site during the construction period will be pursued as a joint venture between Wallasea Farms Ltd and DEFRA. An independent Wallasea Project Management Team (WPMT) comprising representatives from EN, EA, RSPB and CEFAS will be responsible for overseeing the project's environmental quality and project objectives. Wallasea Farms will be responsible for the design, construction, and future maintenance of the new seawall. DEFRA will be responsible for the scheme design, management of construction works within the site (i.e. the recharge, site preparation and breaching) and the environmental monitoring of the site over a five year period following after inundation.

A new footpath will be placed along Walls A and B to replace the one on the existing walls that will be lost by the realignment (this will be subject to a Footpath Diversion order). The new footpath will be designed such that it is an improvement on the existing path and will include discreet low-level site interpretation/information boards at its start, middle and end. Access onto the site or large areas of the existing seawall (which is to be breached) will not be permitted to the general public partly to discourage wildlife disturbance and partly for H & S reasons. As the site is remote, very few visitors from the public are expected, although there will probably be a curiosity factor during the initial 6 months after breaching leading to relatively high

numbers of visitors during this period. To stop the public accessing the breached wall fencing is to be placed at appropriate locations on this wall.

A seawall maintenance/grass cutting regime will be pursued whereby only the top 1m is cut on the seaward face in order to allow the grass to act as an energy dissipater during storm wave events. This will also have the conservation benefits as acting as a habitat for reptiles and small rodents, particularly voles and shrews which in turn will provide a food source for overwintering raptors (e.g. harriers.).

There will be a right of navigation across the realignment site although, this again is expected to be of limited appeal due to the shallow water depths and tide constraints which will limit the amount of time that navigation will be possible. Experience on all other Essex realignment sites has shown that a small number of vessels will visit in the first 2 weeks following breaching but then very rarely thereafter. The Crouch Harbour Authority who by Act of Parliament control navigation, shipping, moorings and speed limits in the Crouch and Roach estuaries will control navigation over the site at high water.

Shooting and wildfowling will not be permitted on the new wetland although it will continue in its present form within the estuary (i.e. to the seaward side of the new wetland site). Existing sport fishing is also likely to continue in its currently low numbers, due again to site remoteness with access to the site being controlled by Wallasea Farms Ltd.

2.4.2 Site Success Monitoring Programme

As an integral part of the overall programme of works, DEFRA has also included proposals for monitoring of the realignment sites after the breaching has taken place. This monitoring programme has been agreed by the WPMT and is designed to determine the ecological value of the habitats created and to confirm whether the site meets the compensation targets. This programme has also been developed with reference to the recommendations presented in the 'Habitat Quality Measures and Monitoring Protocols' document (DEFRA/EA, 2004) which sets out proposed programmes for standardising the monitoring of managed realignment schemes. The results of the monitoring will be checked against pre-determined compensatory targets (see Section 2.5.1) to gauge the success of the compensatory measures.

(1) Birds. Monitoring required for 5 winters (October to March) after breaching. For the first year, surveys will be once per month and thereafter twice per month. Each survey will be undertaken over 6 hours from either HW to LW and LW to HW (i.e. on flood and ebb tides respectively). Progress to be reviewed after year five. No control site required, but reference made to existing and previous estuary bird monitoring to provide baseline. Monitoring will include assessing disturbance factors and impacts.

(2) Invertebrates. Twice a year in October/late September and March. Locations to be decided after scheme design to ensure correct locations.

(3) Vegetation. Extent of vegetation to be mapped once per year by aerial photos/EA data/satellite, with quality control by fixed-point photography on defined transects marked by posts (including ground shot). May require analysis of species abundance.

(4) Sediments. Sediment accumulation to be measured twice per year by bamboo cane methods with overall site height changes calculated by use of EA's LIDAR information. Particle size by sampling at same time as invertebrates but once per year.

(5) Hydrodynamics. Breach development to be monitored twice per year, width by reference to fixed posts, depth by photo with reference to scale marker, and breach currents once per year from boat on flood and ebb for first two years. Other hydrodynamics, e.g. results of ADCP, tidal height/cycle impacts and water quality may be required.

(6) Replacement brackish water habitat. Borrow dykes to be monitored post breach once per year for 5 years for salinity, invertebrates and plants, with one pre-breach baseline survey on existing dykes.

(7) Protected species. Reptiles, amphibians, and voles to be monitored pre-breach, with post monitoring for three years followed by a review.

In addition to this site development monitoring work there will also be a need for additional monitoring to be undertaken for 'impact verification' purposes. The requirements for this impact verification work, based on the findings from this impact assessment, and the best methods for integrating these two strands of the overall monitoring programmes are identified in Section 17.2.

2.5 Review of Alternatives to the Proposed Scheme

2.5.1 Alternative Locations for Realignment

Prior to the selection of Wallasea Island as the preferred site for delivering the required compensatory coastal habitats an extensive and detailed review of suitable locations was undertaken. At the outset of this site selection process, and to enable suitable alternatives to be identified, the specific design objectives for the proposed realignment scheme were firstly identified and these were as follows:

(1) To provide intertidal habitat for the number and range of bird species displaced as a result of the loss of Lappel Bank and Fagbury Flats.

(2) To offset any impacts to the originally proposed Medway and Stour & Orwell SPAs caused, respectively, by the developments at Lappel Bank and Fagbury Flats (e.g. adverse impacts of modified physical processes).

(3) To ensure that the compensatory measures themselves do not have an adverse impact on the geomorphological or ecological functioning of the area in which they are located.

(4) To construct a self-sustaining system (or systems) which can evolve in response to natural, physical, chemical and biological changes and which is able to maintain the bird populations for which it was created over a period of at least 50 years.

(5) To provide compensatory measures for the loss of wetland functions (if any) which cannot be adequately replaced.

The ultimate aim of the compensatory measures is to deliver all of these objectives within the limits imposed by natural variability and to identify a site that could meet these criteria the detailed site selection process was undertaken in a series of iterative stages as follows:

(1) Stage 1 (Nov 1996 to Jan 1998): - An initial site selection process by EN and the EA during which 93 sites were identified as being potentially appropriate and nine potential suitable candidate sites were selected for further consideration.

(2) Stage 2 (Oct 1998 to Oct 2002): - A detailed comparative review, by ABPmer and the British Trust for Ornithology (BTO), of the nine candidate sites identified in Stage 1. Following this review Weymarks (on the Blackwater) was identified as the preferred site going forward (ABP Research 1999; ABPmer 2002).

(3) Stage 3 (Nov 2002 to April 2003): - To confirm whether there were any other suitable sites and, specifically, any better alternatives to the Weymarks site, a further extended site selection process was undertaken by ABPmer. This involved a comprehensive and objective review of the potential sites throughout the GTENA flood plain area. In total 31 such sites were identified and a second shortlist was identified of five new sites (including Wallasea) that warranted further consideration (ABPmer 2003).

(4) Stage 4 (April to August 2003): - A second detailed comparative review (using the same methods as for Stage 2) of the five candidate sites identified in Stage 3 was undertaken jointly by ABPmer and BTO (ABPmer 2004a).

(5) Stage 5 (August 2003 to January 2004): - Following the Stage 4 review, three preferred sites were identified that warranted further consideration. These sites were at Weymarks and at two locations on Wallasea Island. To inform the selection of a single preferred site from these three options, preliminary numerical modelling studies were carried out for each option. This work was used to determine the physical effects of these schemes and to check whether they could provide suitable conditions for the requisite mudflat and saltmarsh creation (ABPmer 2004b).

Throughout the above process, the PMG considered the study findings and advised on the sites to be selected and on the work to be undertaken. Following completion of Stage 5 the Wallasea North Bank site was identified as a viable alternative to Weymarks and therefore the PMG took this option forward for further consideration. Subsequent to this decision, a public consultation was undertaken to identify the view of the local community as well as statutory and non-statutory authorities. This consultation was carried out jointly with the EA as part of their publication of the Draft Crouch-Roach Flood Management Strategy (Halcrow/EA 2003). Following this consultation the Wallasea North Bank site was selected ahead of the Weymarks option for the following reasons: -

(1) In total 75% of responses received for the Wallasea public consultation supported the proposal whereas less than 30% supported the Weymarks site.

(2) Realignment at Wallasea is supported by the Environment Agency's Flood Management Plan for the estuary (Halcrow/EA 2003) while the policy at Weymarks is currently "hold the line" pending completion of a formal flood management Strategy for the Blackwater which has yet to be produced.

(3) A Risk Analysis identified a 60% risk of project failure before the construction stage at Weymarks whereas at Wallasea the equivalent risk was 5%.

From all the site selection work undertaken it is evident that Weymarks could be a very effective coastal realignment site and one which, given its topography and location at the mouth of the Blackwater, would not only have provided the necessary quality and extent coastal habitats but would also have had a particularly benign impact upon the adjacent estuarine environment (ABPmer 2004b). However, Weymarks emerged as the lesser of the two options following the consultation and the risk assessment work for reasons which included: the potentially high archaeological value of the site; the potential effects of the scheme on footpath access to an adjacent beach; the possible indirect effects of the scheme on the beach feature and the proximity of the Bradwell power station.

By contrast the additional benefits to the Wallasea site were that the landowners (Wallasea Farms Ltd) had already recognised that it was not economically feasible to protect the land on the north bank though enhancement of the existing defences.

Therefore, as discussed previously, they had already constructed a new seawall (Wall A) at the centre of the island's north bank to protect the valuable farmland. This existing wall will be used as part of the proposed realignment works as described in Section 2.2.

Based on the above considerations and the final recommendations of PMG/DEFRA, on 4 March 2004 Ben Bradshaw the Minister for Nature Conservation announced that the Wallasea North bank site would be the Government's proposed option for the compensation requirements.

2.5.2 Alternative Designs at the preferred location

In addition to considering the possible different locations for the realignment, a number of alternative scheme designs were considered for this preferred location. In particular the effects of altering the number, width and location of the breaches or the number, shape and location of the islands were considered in detail. This was done through a combination of site visits, numerical modelling work and consultations. This process is summarised below.

The first stage of the design process involved the development of preliminary scheme design that was then used as the basis for further analysis and design refinement (ABPmer 2004b). For this preliminary design the main breach locations were identified based on: the shoreline topography; the location of weak points in the existing defences and the need to avoid where possible the direct loss of existing saltmarsh habitat. On this basis it was concluded that one breach was needed in Area A (west), two breaches were needed in Area A (east) and either one, two or three breaches were needed in Area B.

The second stage in the process involved determining the minimum total width and depth of breaches within each of the three areas of the realignment site (ABPmer 2004b). This was achieved through the application of a specifically designed empirical model that considers the volume of the water passing through the breaches on each tide along with a wide range of interacting physical variables to identify the preferred breach structure. These interacting variables included: site surface area, tidal period, wind speed, fetch length and the characteristics of the sediments in the adjacent intertidal areas.

Once the minimum breach width and depth were established the options for meeting these width requirments with either four, five or six individual breaches (i.e. the three breaches in Area A but with either one, two or three breaches in Area B) were considered though modelling trails. These trials showed that the best flows through the site were provided by a six-breach approach (i.e. with three separate breaches in Area B). The location and width of these three Area B breaches were then refined further as part of the modelling work.

The modelling work was also used to refine the location and alignment of the proposed island features. This work was undertaken to ensure that the islands were positioned in a way which allowed for an even flow of water across the site and did not create either areas of high flow speed that would cause localised scouring or areas of relatively stagnant water which would promote localised accretion. In total a ten different designs were considered before the preferred scheme (with six breaches and seven islands) was adopted.

Overall the final design was therefore selected based on a range of factors including:

(1) The breaches are appropriately positioned to provide the requisite flows through the site based on the location relative to each of the three component areas of the site (Area A (west), Area A (east) and Area B);

(2) The breaches are positioned to minimise the losses of saltmarsh habitat in front of the existing seawall. All breaches except for Breaches 5 and 6 have no significant areas of saltmarsh in front of them. Breaches 5 and 6 do have saltmarsh between the old and the existing seawall (see Figures 9 and 10) and the width of these were tested (though hydrodynamic modelling trails) and kept as narrow as possible while also ensuring that they allow sufficient flows through and across the site.

(3) The breaches are positioned to integrate well with the existing foreshore alignment and, in particular to minimise impact to the intertidal mudflats. This was especially relevant at Breaches 1, 2 and 3 in Area A where is was decided that the removal of prominent headlands or 'Points' will ensure that the narrow intertidal areas either side of the breaches continue along a relatively unaltered parallel alignment with the seawall. This will ensure that no significant creeks will form across the intertidal after realignment (as would be the case if breaches were set into embayments).

(4) The breaches are positioned such that they do no affect any other infrastructure. This was relevant for Breach 3 which was located deliberately to the east of a proposed underground power cable alignment (see Section 16).

(5) The breaches are positioned such that they don't adversely affect other interested parties. For example, the option of including a breach from Area B directly into the Roach was considered. While this may have helped to optimise the flow through Area B, this option was rejected because it would block access to the 'beach' area at the northeast corner of the island and the RNLI want this to be maintained for safety reasons. Also this approach would have increased the likelihood of any effects from the scheme being extended into the Roach estuary.

(6) The islands are located such that they do not create areas of high and low flow but instead result in a relatively even flow across the majority of the site.

Alternative Designs for the mitigation habitats

In addition to considering the best design for the scheme itself, the optimal designs of the mitigation habitats (i.e. proposed Borrow Dyke B and the island features) were also identified through consultations with RSPB, BTO and EN. Details of the designs identified following this consultation are described above in Section 2.2.5.

3. Legislative Framework

The following sections review both the assessment and legal consent requirements for this proposed realignment scheme.

3.1 Assessment Requirements and Legal Considerations

3.1.1 Environmental Statement

For this proposal planning permission will be required from Rochford District Council under the Town & Country Planning Act 1990. In addition, the proposal is classed as an infrastructure project comprising coastal works capable of altering the coast under 10m of Schedule 2 of the Town and Country Planning Act (EIA) Regulations 1999, therefore a formal Environmental Statement (ES) is required. This document with its associated appendices represent the requisite ES document and it will accompany the planning application along with other relevant consent applications as discussed below.

3.1.2 Appropriate Assessment

Where proposed developments are located close to, or within, areas of conservation importance that are designated or proposed under the Birds and Habitats Directives (hereafter European Sites) and/or the Ramsar Convention, the requirements of Regulations 48 to 53 of the Conservation (Natural Habitats & c.) Regulations 1994 apply. In essence, this requires the designated Competent Authority to determine whether any development, which is not connected with or necessary to the management of the European site, is likely to have a significant effect on an internationally designated site (SPA, cSAC and/or Ramsar area) and, if so, to undertake an Appropriate Assessment (AA) of the effects in view of the site's conservation objectives. The AA needs to take account of the in-combination effects of the development on the protected area in association with other relevant projects and plans. Where it cannot be demonstrated that a project will not have an adverse effect

on site integrity, the project can only proceed if it can be demonstrated that there are no more suitable (less damaging) alternatives and the project must proceed for imperative reasons of over-riding public interest. In addition the Secretary of State is required to ensure that adequate compensation is provided to protect the overall coherence of the Natura 2000 network.

There is a possibility that an AA will be required for this proposal to evaluate the impacts to the Crouch Roach Estuary SPA and Ramsar and Essex Estuaries cSAC. This is because each of these three designated areas extends into the proposed realignment site (their contiguous landward boundaries lie along the landward edge of the borrow dyke behind the existing seawall). Therefore, tidal inundation will have a direct effect on the parts of these designated sites that lie between the existing seawall and the landward edge of the borrow dyke. In particular it has been highlighted by EN during the scoping process (ABPmer 2004a) that the borrow dyke habitats support Ramsar invertebrate and plant interest species and these will clearly be affected by the realignment works.

The formal requirement for an AA would, however, need to be confirmed by Rochford District Council (the Competent Authority in this case) based on further consultations with EN. If an AA is needed, it is intended that the information required by RDC to produce this will be contained within this ES. To facilitate the production of an AA Appendix B of this report presents an 'AA Signalling Document' which highlights the information requirments for an AA and also indicates where in this ES that information can be found.

3.1.3 Species protection

As part of this assessment there is also a need to determine whether any species protected under the Wildlife and Countryside Act 1981 and/or the Habitats Regulations will be affected by this proposal and if so what works are required to avoid or mitigate such impacts.

3.2 Consents and Licenses

In addition to the above assessments and protected species considerations, the following consents and licences will be required to accompany the planning application. This list has been derived through consultations with the appropriate parties including EN, EA, CEFAS and the CHA. These consultations were pursued though a combination of specific meetings and correspondence as well as through regular meetings of the Wallasea Project Management Team which includes representatives of the key statutory authorities (see Section 5.1.1). The resulting list of consent requirments is as follows: -

(1) Consent from the Environment Agency under the Land Drainage Act 1991 as existing drainage systems and coastal defences are to be affected. It has

been agreed in consultations with EA that a single Land Drainage application will be required to cover all the works required. This application will include an agreement about the future maintenance of the seawall (which is to be continued by Wallasea Farms Ltd.) along with details of the maintenance schedule. The EA has also requested that details of the timings of the works are described and a detailed method statement included in this application. These details are all included in this ES.

(2) Written approval from the Environment Agency Flood Defence Committee, under the Water Resources Act 1991, for any proposed works affecting tidal flood defences.

(3) A footpath diversion order under the Highways Act 1980 or the Town & Country Planning Act 1990.

(4) Permission from CHA though a Works Licence application. This has been applied for and a determination is expected on the December 2004.

Those consents that have been considered but not required, as confirmed through consultation, are as follows: -:

(1) It has been agreed with the Marine Environmental Consents Unit (MECU) that construction or sediment deposition licences under Part 2 of the Food and Environment Protection Act (FEPA) 1985 are not needed. With respect to the sediment recharge works, although a formal FEPA consent is not required (because the arisings will not be deposited below MHW), the quality of the material is still to be double-checked and subject to FEPA-standard studies as if a consent was being applied for. This will ensure that sediment quality criteria for the arisings are met and is to be separately pursued by the dredging contractor.

(2) It has been agreed with the MECU that consent under Section 34 of the Coast Protection Act (CPA) 1949 (as amended by Section 36 of the Merchant Shipping Act 1988) for construction, works below mean high water Springs (MHWS) or for temporary blocking of navigation during the recharge operations is not needed. This consent is to be obtained via the Works Licence from CHA (see above)

(3) A waste management licence or an exemption under Regulation 17 of the Waste Management Licensing Regulations 1994 (Schedule 3, paragraph 9). For such exemptions there is a limit of 20,000m^3 per hectare for deposition of materials and under existing designs the deposit of recharge materials will be below this total.

(4) A discharge consent under Water Resources Act 1991. This consent was not required because there will be no discharge from the site to the estuary. The dredge arisings for instance will be dewatered entirely within the realignment site such that there will be no release into tidal waters.

(5) The EA has confined that a water abstraction licence (for the water used as part of the recharge works) is not needed because the scheme involves altering the coast to allow "natural" abstraction.

4. Planning Policy Context

Planning in the UK is undertaken at several levels, to ensure an integrated approach to the planning both within and across areas. As such, Planning Guidance at all levels of relevance to the proposal therefore needs to be assessed to enable the plans for such areas to be taken into consideration. The documents referred to are given below:

(1) PPG9 – Nature Conservation, 1994 (currently under review)

(2) PPG16 - Archaeology and Planning, 1990.

(3) PPG25 – Development and Flood Risk, 2002.

(4) RPG9 – Regional Guidance for the South East, 2001.

(5) The Essex and Southend-on-Sea Replacement Structure Plan.

(6) Rochford District Local Plan.

(7) Roach and Crouch Flood Management Strategy.

(8) The South Essex LEAP.

(9) Coastal Habitat Management Plans.

(10) Crouch Harbour Management Plan.

4.1 Planning Policy Context

4.1.1 Regional Government Guidance

The Government provides national and regional guidance to be taken into account when preparing development plans and for deciding individual planning applications. These Planning Policy Guidance Notes (PPG) and Regional Planning Guidance (RPG)

essentially shape the strategies and policies within County Structure and Local District Plans.

The PPG's relevant to the proposed development are:

PPG 9 Nature Conservation, 1994.

PPG 9 gives guidance on how the Government's policies for the conservation of the UK's natural heritage are to be reflected in land use planning, embodying the Government's commitment to sustainable development and to conserving the diversity of the UK's wildlife.

As noted in Section 3.1.2, the proposed development will potentially impact on the Essex Estuaries European Marine Site and if it is considered to have a significant effects it could subject to an Appropriate Assessment (AA) in accordance with Regulation 48 of the Habitats Regulations. This AA, if needed, will be produced by the Rochford District Council (RDC) as the Competent Authority in this case. This ES includes all the information that will be needed for production of an AA (as indicated in Appendix B).

PPG 16 Archaeology and Planning, 1990.

PPG 16 sets out Government Policy in terms of how archaeological remains should be treated within the planning process.

An archaeological assessment of the proposed development has been completed (by Essex County Council Field Archaeology Unit) and the result of this work is presented in Section 11. In summary this study concluded that the archaeological potential of the realignment is low and that those remains, which may be present, are of minor importance.

PPG 25 Development and Flood Risk, 2002.

PPG 25 sets out the requirements to undertake a flood risk assessment for a proposed development. It states that flood risk should be a consideration at all stages of planning and development, stressing the need to act on a precautionary basis, taking into account climate change. In this case the flood defence requirments for Wallasea Island have been thoroughly addressed within the Roach and Crouch Flood Management Strategy (Halcrow/EA 2003) and this strategic assessment recommends abandonment and realignment along the north bank. Further details about these recommendations and details about how the new defences will greatly improve the existing levels of flood protection are presented in Section 12.

The RPGs relevant to the proposed development are:

RPG 9 Regional Planning Guidance for the South East, 2001.

RPG 9 covers the period to 2016, to provide the framework for the longer term future. Its prime aim is to provide a framework within which local authority development plans can be prepared, together with a spatial framework for other strategies and programmes.

As regards planning in the countryside, the following points apply to the Wallasea scheme:

(1) Priority should be given to protecting areas designated at international or national level either for their intrinsic nature conservation value, their landscape quality or their cultural importance.

(2) The Region's biodiversity should be maintained and enhanced with positive action to achieve the targets set in national and local biodiversity action plans through planning decisions and other measures.

(3) The landscape, wildlife, natural character and built heritage qualities of the coastal zone should be protected and enhanced, especially those areas designated as Heritage Coast.

(4) Opportunities should be provided for leisure and recreation in, and access to, the countryside in ways which retain and enhance its character.

(5) Valuable characteristics of soil and land should be protected.

The points given above have been considered during the planning and design of the Wallasea scheme, to ensure that the proposal sits within the Planning Guidance for the area.

4.1.2 Local Government Guidance

The Essex and Southend-on-Sea Replacement Structure Plan

The Essex and Southend-on-Sea Replacement Structure Plan sets out the strategic planning policies of the Joint Structure Plan Authorities (Essex County Council and Southend-on-Sea Borough Council) for the development and use of land in the area. Chapter 6 of the Plan covers the conservation of the natural resources of the coastline, the objectives for which are as follows:

(1) To protect, conserve and enhance the special landscape, nature conservation and heritage qualities of the undeveloped coastline.

(2) To prevent new developments in coastal areas being at risk from flooding, erosion and land instability.

(3) To balance and reconcile interests in sensitive coastal areas.

In order to protect the coastal areas, a 'Coastal Protection Belt' has been described, which includes Wallasea Island. The aim behind the belt is to protect the coastline from development. Should development be permitted, it should not 'adversely affect its open and rural character, its landscape character and marine sites of nature conservation importance, buildings and areas of special architectural, historic and archaeological importance, fisheries and shell fisheries'. Chapter 6 also has a requirement to ensure flood and coastal defence needs are met.

Rochford District Local Plan

The proposed development site is located within Rochford District Council's area of authority. The Council has a statutory duty to provide a district wide Local Plan, adopted in 1995, providing a framework for development. The Plan is intended to set out the Councils policies for future development and hence the realignment scheme will need to comply with the Plan. The objectives of the Local Plan are aimed to complement those of the Essex and Southend-on-Sea Replacement Structure Plan detailed above. Chapter 8 of the Plan covers rural conservation, with the strategy being to:

(1) Identify and protect areas of importance for agriculture, nature conservation and landscape;

(2) Maintain the viability of farm holdings;

(3) Safeguard visually important trees and woodland; and

(4) Encourage the improvement of areas of poor landscape quality.

Specifically relating to 'coastal development', the Plan states that 'The local Planning Authority will give priority to the protection of the rural and undeveloped areas of the coastline and inlets. No application to develop will be considered unless it is shown that the development needs a coastal location and will not adversely affect the open and rural character of the coastline, or its wildlife'.

The Second Deposit Draft of the Replacement Local Plan also directly supports realignment works. It includes Policy NR114 relating to the 'Creation of Intertidal Habitats' which states that the creation of new intertidal habitats will be permitted provided it can be demonstrated through consultation with the appropriate bodies that the benefits of the proposed new habitats clearly outweigh the resultant loss of other natural habitats, agricultural or other land.

Roach and Crouch Flood Management Strategy

Within the Essex Shoreline Management Plan (SMP) (Mouchel, 1997), the recommendation given for the Roach and Crouch coastal unit was to hold the line in the short term, until a modelling and monitoring programme were completed to consider the physical impacts of various sea defence policies in the estuaries as a whole. In the longer term, the hold the line policy was only considered to be applicable in certain areas, with realignment or abandonment in other areas. Following the publication of the SMP, the Essex Seawall Management Strategy (ESWMS) was produced to assess the economic viability of maintaining and improving the seawalls. The report also concluded that a better understanding of coastal processes was required.

In response to the SMP and ESWMS, a Flood Management Strategy was then produced (Halcrow/EA, 2003). The study included a detailed assessment of the physical processes, flood risk, environmental issues and economics relating to flood management in the Roach and Crouch. This Strategy strongly recommends realignment on the north bank of Wallasea Island (see also Section 12)

The South Essex LEAP (Local Environment Agency Plan)

LEAPs were drawn up across the jurisdiction of the Environment Agency, to highlight the duties and powers placed on it within that area. In particular, this tends to include issues such as sustainable development and improvements to the environment. Although LEAPs are no longer issued, the documents provide a considerable amount of information on the areas covered and hence the South Essex LEAP has been sourced.

The South Essex LEAP was split into 3 characteristic areas, of which Wallasea falls within 'the alluvial marshlands of Dengie, Foulness, Canvey, Tilbury and the valleys of the Rivers Crouch and Mardyke'. The document contains general information on the existing environment and the human activities ongoing in the area.

Coastal Habitat Management Plan (CHaMP)

CHaMPs were initiated to quantify habitat change, in terms of loss and gain, along stretches of the coastline with a view to preventing future losses. The Essex coastline was one of the areas initially investigated, which has resulted in a large amount of information being available on the status of the coast. The reports found that the coastline has been subject to considerable historical reclaim, together with the associated construction of coastal defences. The total reclaimed area was estimated as being 42% of the intertidal that existed 2000 years ago (English Nature, 2002). The combination of coastal defences and intertidal reclaim limited the ability of intertidal habitats (such as saltmarsh) to move landwards as sea levels rise, a process termed 'coastal squeeze'. As sea levels continue to rise, such loss is likely to continue.

Specific to the Crouch, such losses of upper intertidal sediment (including saltmarsh) over the next 50 years were estimated at 135ha.

In developing a response to such losses and gains, the CHaMP identified several management options, as summarised below:

(1) Managed realignment. Benefits include a more sustainable sea defence, decreased maintenance costs and increase in intertidal habitat. Potential dis-benefits include loss of land with agricultural/conservation importance and alteration to coastal processes.

(2) Breach retreat. Where tidal access is allowed through one or more breaches in the existing defences.

Crouch Harbour Management Plan

The Management Plan was prepared by the Crouch Harbour Authority in 1996. It was subject to considerable consultation and although it takes into account relevant planning guidance, the issues addressed generally fall outside the remit of the planning system. It is not intended to be an estuary management plan. The Harbour Authority has considerable jurisdiction over the Rivers Crouch and Roach, owning or leasing large areas of the riverbed. The document is an additional source of information available on the rivers (including the environment), together with the recreational and commercial activities of relevance to the rivers.

The document details a number of Policies, which apply within the jurisdiction of the Harbour Authority. Those of relevance to the Wallasea scheme are summarised below:

(1) Proposed flood defence schemes shall be technically, environmentally and economically sound.

(2) Any proposal for flood defence will be assessed within the Harbour Authorities statutory duties set out in the 1974 Act.

(3) Works within the Rivers Crouch and Roach will not be granted in designated areas unless the works will not significantly damage the conservation interests for which the sites have been designated.

(4) Any activities detrimental to the area will be strongly resisted.

(5) Dredging licences for capital and maintenance dredging will be granted if appropriate after consultation with the EA and DEFRA, where the Harbour Authority is satisfied that the removal will not be detrimental to the estuary or flood defences.

(6) Support will be given to relevant bodies to secure/protect/record archaeological sites as relevant. Full consultation will be undertaken where appropriate with respect to licence applications.

Thames Gateway Management Area

The Rochford District is also a proposed area for recreation and nature conservation (a 'Green Grid' area) under the Thames Gateway scheme. The Green Grid project is a long-term strategic initiative that aims to develop a network of open spaces and habitats throughout the South Essex Thames Gateway area. It is considered that the combined environmental and recreational (see Section 13) gains provided by this realignment proposal will help to meet the objectives of this initiative (Shaun Scrutton RDC pers. comm.).

5. Assessment Approach

This EIA has been informed by the results of several detailed consultation exercises. These consultation exercises included an extensive review of opinions that was undertaken by DEFRA prior to the selection of Wallasea Island as the preferred compensation site (see Section 2.5). Further details about the consultations as well as details about other information used, and survey work undertaken, for this assessment are presented below.

5.1 Consultations

The advance DEFRA consultation work was undertaken from the 1st September 2003 to 5th January 2004 and was lead by Mark Dixon (DEFRA Project Manager). This process involved a series of written correspondence, meetings with interest groups (e.g. Crouch Harbour Authority and Rochford 100 Wildfowlers Club) and two public presentations. The public presentations were held on 15th and 16th September 2003 and were carried out jointly with the EA as part of their publication of the Draft Crouch-Roach Flood Management Strategy (Halcrow/EA 2003).

Following the selection of Wallasea as the preferred site, a Scoping Report was then produced (ABPmer, 2004a) which identified the issues to be discussed as part of this EIA. The issues were identified through the consultation previously undertaken and from the experience of the consultants undertaking the work. This report formed the focus of further for a second round of consultations with EN, EA, RSPB, CHA and CEFAS to fill gaps and agree the further requirments for the assessment.

A full list of the individuals and organisation contacted is presented in Appendix C and the outline views expressed are presented as Appendix D. These views are also summarised in Table 4. Further details about the consultations and the issues

addressed after the selection of Wallasea and during the scoping and assessment process were as follows: -

(1) Meeting with Shaun Scrutton of Rochford District Council Planning Department on 22 April 2004 to provide advance notice of the proposed Planning Application, identify any issues arising from the previous construction of Wall A and ultimately to agree approach to the scoping process.

(2) Meeting with Simon Barlow, John Daniels and Frank Saunders of the EA on 7 June 2004 to obtain advice and agree methods in relation to: legal consent requirements, water quality effects and the effects of the proposed recharge works respectively.

(3) Consultations with Roger Morris of EN to agree the requirments of the baseline ecological survey work.

(4) Consultations with Pat Connell of Essex County Council and Peter Murphy of English Heritage who confirmed the scope and requirments for the archaeological assessment work.

(5) Meeting with BTO Wallasea site surveyor (Jeff Delve) to discuss the design of the Borrow Dyke B mitigation habitat (30 June 2004).

(6) Meeting with RSPB (Helen Deavin) and EA (Will Akast and Andrew Hunter) to review scoping report and agree the requirments for the ES (4 August 2004)

(7) Formal written consultation with RSPB, EN and EA to agree to the findings of the scoping report and the requirments for the ES. As part of this consultation advance details of the survey results were included to provide details about the ecological status of the proposed realignment site and its environs.

(8) Meeting with Shaun Scrutton, Mike Stranks and Lorna Maclean of Rochford District Council Planning and Ecology Departments on 1 September 2004 to discuss project progress and consider the initial findings of the impact assessment and the key issues to be addressed in the ES.

(9) Meeting on 1 October 2004 with EN, RSPB, EA and CEFAS (as part of the Project Management Team) to discuss project progress and the key findings from the hydrodynamic modelling work and the Environmental Impact Assessment.

In addition to these meetings and written correspondence this EIA also drew upon the views expressed during the first round of consultation for the Crouch and Roach Management Plan. In particular, Carol Starkey the Crouch and Roach Officer noted that a number of views had been expressed regarding the future recreational value of

this site and the potential to use boats/dinghies within it. This issue is addressed in Section 13.

The following parties were also invited to express their views to Mark Dixon (DEFRA): Essex County Council, Essex Wildlife Trust, the Essex Reptile and Amphibian Group, WWF-UK, EA, EN, CEFAS, Essex Local Flood Defence Committees (LFDC), local oystermen, local wildfowlers, Ramblers Association, CHA, Royal Yachting Association (RYA), owners of Essex and Burnham marinas, owners of the Baltic Wharf and the Port of Harwich. In addition, Mark Dixon provided valuable input about the proposed methods for realignment and John Hesp (acting on behalf of Wallasea Farms Ltd) provided details about the works required for construction of the new seawall.

5.2 Information Sources and Assessment-Specific Studies

5.2.1 Information Sources

During the scoping process the following guidance documents and data sources were been identified as valuable sources of information to support the EIA process: -

Guidance Documents and Reports

(1) Roach and Crouch Flood Management Strategy (Halcrow & EA, 2003).

(2) Essex Coast and Estuaries Coastal Habitat Management Plan (CHaMP) (Posford Haskoning, 2002).

(3) Essex Shoreline Management Plan (SMP) (Mouchel, 1997).

(4) Environmental Report for the previous secondary seawall at Wallasea Island (Posford Haskoning, 2001).

(5) Essex Biodiversity Action Plan (Essex Biodiversity Partnership, 2002).

(6) English Nature's Regulation 33 Advice for the Essex Estuaries European Marine Site (English Nature, 2000).

(7) Crouch Harbour Authority's Harbour Management Plan (1996).

Existing data

(8) Environment Agency water quality data as presented within the Crouch and Roach Flood Management Strategy (Halcrow 2003). The EA water quality sampling locations are illustrated in Figure 11.

(9) Data obtained from regular Wetland Bird Survey (WeBS) core counts describing the abundance of waterbirds in the crouch estuary at high water. A map showing the main count areas for the core counts is shown in Figure 12;

(10) The results from a British Trust for Ornithology (BTO) low water bird survey of the crouch and roach estuary that was undertaken over the 1995/96 winter period. A map showing the count areas for this survey is shown in Figure 13;

(11) The results of an extensive series of ornithological surveys on Wallasea Island undertaken by Natural Resources Ltd as part of a Scottish Power windfarm feasibility study.

(12) Unpublished RSPB bird counts of Area A from winter surveys (in December 2002 and 2003 and in February 2003 and 2004) and spring surveys (in May and June 2003 and 2004). On each visit, counts of bird species and, in spring, of breeding pairs were taken across four counts sections A-D within the area (as shown in Figure 14).

(13) English Nature's Essex Estuaries Marine Nature Conservation Review (MNCR) biotope maps for the Crouch and Roach cSAC biotopes (English Nature 2000) which provides detailed plots of the estuarine littoral habitats based on existing data, supplemented by additional survey information data where required. These maps are shown in Figure 15.

(14) The Essex/Suffolk Estuaries Littoral Survey (NRA 1990) which included samples from the Crouch (to the north east of Wallasea and upriver) and Roach (south east of Wallasea).

(15) Studies undertaken on the benthic fauna of the Crouch relating to TBT by CEFAS (Rees et al, 2001, Rees et al, 1999 and Waldock et al 1999).

5.2.2 Project specific field surveys and desk studies

In order to fill gaps in the available data and provide a comprehensive understanding of the baseline conditions across the proposed realignment site, a number of site-specific studies were undertaken to progress the proposed scheme, as detailed below:

(1) Estuary bathymetric survey and detailed numerical modelling of the realignment scheme (ABPmer 2004b);

(2) Sediment characterisation and contamination survey (ABPmer 2004b);

(3) A benthic invertebrate and MNCR Phase 2 level survey of the intertidal habitats (ABPmer – this report)

(4) A fixed-point photograph survey (ABPmer - this report)

(5) Aquatic invertebrate survey (Godfrey, 2004);

(6) An Extended Phase 1 terrestrial habitat survey (EECOS, 2004);

(7) Reptile survey (EECOS, 2004);

(8) Archaeological assessment desk study (ECC Field Archaeology Unit, 2004);

(9) A Digital Terrain Model (DTM) and Geographic Information System (GIS) visualisation (ABPmer - this report).

Further details about the work undertaken for each of these studies are presented in the following sections.

Bathymetric survey and numerical modelling work

To support the EIA, ABPmer has separately the carried out a series of detailed numerical modelling studies to refine the design of realignment scheme and also to assess both the short-term and long-term effects on the hydrodynamic conditions within the Crouch and Roach estuaries (ABPmer 2004b). This work was undertaken directly under commission to DEFRA and the findings from this work have been used to inform this assessment. As part of this work an extensive bathymetric survey of the Crouch and Roach was undertaken (from 19 to 24 March 2004) to obtain a detailed map of the estuaries' topography (see Figure 16) with which to set up and run the numerical model. The numerical model was then applied to answer the following questions about the realignment proposal:

(1) What physical effects will the scheme have on the Crouch and Roach estuaries immediately after realignment?

(2) What physical effects will the scheme have on the Crouch and Roach estuaries in the longer-term (i.e. after periods of 10s to 100s of years)?

(3) How the site will function and will it meet a series of pre-determined site design criteria identified by the PMG to ensure that viable coastal habitats are created?

A copy of the executive summary from the modelling report (ABPmer 2004b), which summarises the findings of this study in full, is reproduced in Appendix F.

Sediment Characterisation and Contamination Survey

During the bathymetric survey, samples of water and sediment were taken to provide information about the baseline water quality and seabed characteristics of the estuaries which was necessary to interpret the modelling results.

Water samples were collected at 14 positions from Baltic Wharf to the entrance of the Roach and then along the Outer Roach to establish the suspended sediment concentrations in this part of the river. In addition, during the bathymetric survey and also during a separate benthic habitat survey (see following section), seabed sampling work was undertaken to characterise the intertidal and subtidal sediments around the site. The sampling locations are shown in Figure 17 (Sites S1 to S6 were sampled during bathymetric surveys and Site B1 to B7 were sampled during the intertidal benthic survey).

At these intertidal sampling locations undrained shear strength readings were taken and sediment samples were retrieved (6x intertidal, 3x subtidal) for laboratory analysis. All these retrieved samples were subject to Particle Size Analysis (PSA), at ABPmer laboratories, using a combination of Mastersizer laser diffractor and dry sieving techniques (depending upon the grain size). All the cohesive intertidal muds were also subject to further analyses of sediment plasticity (e.g. Atterburg parameter readings) and three intertidal samples were also subject to remoulded undrained shear strength analyses at single point compaction. These readings and measurements provided a comprehensive description of the composition, cohesiveness and physical stability (i.e. as indicated by erosion thresholds) of the intertidal muds. This information was needed to understand the physical effects of the flow changes (as described through modelling) on the integrity of the intertidal and subtidal habitats.

The intertidal sediments were also subject to contaminations analysis. A sample from each of the seven benthic survey site (B1 to B7) were subject to laboratory analyses, by Scientific Analysis Laboratories (SAL), for a full suite of contaminants including heavy metals (e.g. arsenic, lead, cadmium, copper, mercury, zinc and nickel), Tributyl Tins (TBTs), Total Petroleum Hydrocarbon (TPHs), Polycyclic Aromatic Hydrocarbons (PAHs) and Polychlorinated Biphenyls (PCBs). This information was needed to understand the potential, effects of the scheme on estuarine water quality (from resuspension of any contaminated sediments).

The PSA results from previous maintenance dredging at Harwich were also obtained to describe the type of sediment that would be used for the recharge work. This information was then used to interpret the potential effects of water over the recharge areas. Summary results of these sediment analyses are shown in Appendix G.

Benthic Invertebrate and MNCR Survey

The benthic survey was undertaken in June 2004 and involved a walkover survey of the intertidal mudflats around the realignment site and at 'control' locations to the west of the site in the Crouch and to the south in the Roach. The locations of the sites are shown in Figure 17. This survey had two objectives: to inform the impact assessment by more closely examining the intertidal communities and the ecological value of these habitats and also to set up a quantitative baseline description of the invertebrate communities which can form the basis of any post-realignment impact verification and site development monitoring that may be undertaken.

In total seven intertidal sites were sampled and at each site three replicate samples were taken for the laboratory-based identification of infaunal invertebrates using a 10cm diameter biological corer. The sites were selected such they described the visibly distinct habitat types in the area.

As well as sampling the open intertidal areas, single core samples were also taken from two sites (Sites SM1 and SM2) that were located within the creek system of the large saltmarsh areas between Breaches 1 and 2 and between Breaches 3 and 4 (Figure 17). A further single core sample was also taken from the sediment within the Borrow Dyke behind Breach 4 to characterise the benthic invertebrate assemblages of this habitat.

The retrieved sediment samples were returned to the laboratory, washed through a 500µm mesh sieve within 24 hours and temporarily preserved in 5% formosaline solution. The fauna were then sorted out from the sieve residue using a low power binocular microscope. All the macrofaunal specimens were then identified to species level (where practicable) and enumerated. The results of these infaunal community analyses were quantitatively reviewed with multivariate statistical analyses using PRIMER (Plymouth Routines in Multivariate Ecological Research) software. This statistical analysis was used to identify and describe any spatial and/or temporal trends (i.e. differences between different sample sites and different surveys respectively) in these invertebrate community data. An MNCR biotope code was assigned to each of the sites surveyed and to the area of the foreshore that they represent. The results of this survey are included in Appendix G

Fixed-point Photograph Surveys

During a site visit on 12 May 2004 photographs were taken at selected sites along the existing seawall to illustrate the baseline characteristics of the breach locations, intertidal habitats and the land within Areas A and B. For this site visit, GPS readings of the positions were taken. A selection of these photographs is shown in Figures 6 to 10 and further photographs taken during the assessment process are included on an electronic copy of the ES which is separately available.

Aquatic Invertebrate Survey Field survey

A survey of the freshwater, brackish water and terrestrial invertebrate populations across the realignment site was undertaken to describe both the general ecological interest of these habitats and to determine the presence/absence of any protected invertebrate species. This work was undertaken by a specialist invertebrate surveyor and taxonomist between 7-10 June, 2004, with samples collected by hand nets. In total 40 samples were collected from within the borrow dykes, field drains, the flooded scrapes within Area A and the lagoon in front of Area B.

A terrestrial invertebrate study was also undertaken on 11 June 2004. The site locations for this survey are shown in Figure 18 and the sample type (i.e. the habitat within which the sample was taken) at each site is shown in Figure 19. The full report of this work (Godfrey 2004) is presented as Appendix H.

Extended Phase 1 habitat survey

To evaluate the ecology of the wider site, outwith the existing borrow dyke features, a survey of the site was conducted by Essex Ecology Services Ltd (EECOS, 2004). This also included a review of the seawall and saltmarsh habitats located between the old and existing seawalls at the Breaches 4, 5 and 6 in Area B. During this survey work the following aspects of the site's ecology were considered:

(1) Distribution of Nationally Scarce or Rare plant species along the seawall and associated saltmarsh areas;

(2) Presence and distribution of legally protected species (water voles, badgers) that may be affected by the proposal;

(3) The general flora and fauna of the seawall and land between the existing walls and proposed new seawall.

The full EECOS report for these surveys including details of the methodologies and results are given in Appendix I.

Reptile Survey

In addition to the Extended Phase 1 habitat survey, EECOS carried out a detailed study of the reptile species (e.g. adders and common lizards) within the realignment site. The presence and estimated abundance of reptiles was evaluated along the sections of seawall (especially at the breach areas) and across a suitable habitat landward of the borrow dyke. Over these areas basking mats were laid down to attract reptiles (see Figure 20) and these mats were revisited on seven separate occasions. The full EECOS report for these surveys is presented in Appendix I.

Archaeological desk study

A desk-based archaeological evaluation of the Wallasea site was undertaken by the Essex County Council's Field Archaeology Unit. The study included a review of both the available literature and field survey information relating to Wallasea Island, together with other relevant data such as aerial photographs and historic maps. An assessment was then made of the potential impact of the proposed realignment on palaeoecological and archaeological deposits/features such as relict seawalls and deeper deposits including prehistoric and later buried land surfaces. The full report of this assessment is included as Appendix J.

Digital Terrain Model and GIS visualisation

Using a variety of data sources (including EA Light Detection and Ranging (LiDAR) images and detailed technical drawings of the propose counterwalls as provided by Bullen Consultants) and the results of the bathymetry survey, a Digital Terrain Model (DTM) of Wallasea and the adjacent estuary system was created using Geographic Information System (GIS) software. This DTM initially described the baseline vertical elevation (at 2m intervals spatially with a vertical accuracy $\pm$ 30cm) of the land and seabed and Walls A and B. These baseline elevations were modified such that it depicted all key aspects of the proposed scheme design (including breaches, islands, borrow pits, new defences, recharge and intertidal habitats) to provide a very accurate representation of the scheme design.

The further 3-Dimentional analysis of the scheme design and a photographic visualisation were then completed in ArcGIS software produced by ESRI. For this work, the scheme DTM was combined with a detailed aerial photo (50cm pixels) of the site. This photo was digitally manipulated to represent features of the completed scheme design and it was draped over the scheme DTM to produce a 3-Dimensional image of the site. This information was then used to visualise the water levels at various stages of tidal inundation. It was also used to produce a 3D fly-through visualisation of the scheme design and surrounding area. A CD containing this visualisation is included with this ES.

Table 4: Summary of views expressed during the DEFRA public consultation process.

Issue of concern	Further details about this issue where provided	Section of ES where Addressed
Effects of loss of food-producing land	Issue raised as general concern	Section 14
Increase in flood risk as a result of realignment	Issue raised as general concern	Sections 11 & 14
Impact on navigation from physical changes within the estuary	The concerns expressed revolve around the possibility that the scheme may lead to increases in erosion/siltation and hence would constitute a navigation hazard (specifically through siltation), with the need to ensure that the entrance to the Crouch from the Roach is protected from silting to ensure safe passage for vessels. The area has a thriving and internationally recognised yacht and dinghy-racing tradition, which uses all the navigable waters, and should not be reduced or impaired by the scheme. There was also concern that an alteration to the existing profile of the estuaries could affect commercial trade, with a potential knock on effect of a reduction in the management of the estuary.	Sections 6 & 12 & Appendix F
Impact on hydrodynamics	Concerns regarding the hydrodynamic changes resulting from the proposal included the possibility that mud eroded from the exposed marsh may cause other areas to silt up, potential increasing in tidal speeds in the estuary, cause more water to enter the river system, affect the water flow in the area especially in the Roach, alter the tidal prism, or enlarge the outer estuary channel. There are already concerns regarding on-going problems with silting and erosion in the river and hence a thorough hydrological study was requested. Areas of particular interest include the north side of the River Crouch	Sections 6 & Appendix F
Effects on Branklet Spit	Several consultees raised the issue of the existing sand/stone bar that is building on an east/west line on the mouth of the Roach (referred to both as 'Branklet' or 'Brankfleet' Spit). There is concern that the remaining seawall and public access to the Spit and the adjacent shingle beach must be maintained, as it is used by small vessels.	Section 12.2.3
Disturbance from lorry movements through Canewdon.	Issue raised as general concern	Section 2.3.5
Seawall design and management issues	The condition of the existing seawall and the need to breakdown existing defences was raised as a concern, including the perception that the plan for Wallasea to 2054 seems to be to allow the remaining walls to deteriorate and the whole Island to be flooded. Further information was requested on the links between the new Wall B and the existing Wall A - is the new seawall going to be continued from that already constructed?	Sections 2.1.2 & 2.2.2
Views expressed on the future of existing wildfowling	Local wildfowling clubs were very interested in the project and expressed concern about maintaining their existing wildfowling rights, while extending the rights/managing the new wetland (including to control poaching, clear up man	Sections 12.2.4

Issue of concern	Further details about this issue where provided	Section of ES where Addressed
activities.	made high tide litter, keep out jet-skis/power boats, monitoring etc). Should the land change hands (i.e. to DEFRA), queries were raised as to how it would affect the sporting rights – for example, will clubs be offered the opportunity to buy or lease the rights. The proposal overlaps one of the clubs conservation areas on the Crouch and extends along one of the favoured shooting stretches.	
Views expressed against continuance wildfowling of this activity	Opposition to wildfowling was also made during consultation, including hopes that the proposal will prevent shooting. Specifically, the concern that permitting wildfowling on the site would be unwise as it may increase the risk of the site failing to meet its objectives.	Sections 12.2.4
Construction of the new seawall	Detail on the strength of the proposed Wall B was requested, with a suggestion that the breaches could be lined with rock/old revetment	Section 11
Impacts on cycle routes and footpaths.	The scheme was seen by many as an opportunity to improve cycle routes and footpaths, including links by sea to other areas (especially the Burnham/Wallasea ferry). Of particular concern is whether the route of the footpath will be maintained to permit continued access. The issue of access to the site itself was also raised, including the possibility of constructing a bird hide. A more 'sociologically' aware approach was requested.	Section 12.2.3
Impacts on features of archaeological interest	The need for a desk-based assessment of the archaeology was suggested so that the scheme can be designed to avoid damage to Listed Buildings.	Section 10
Potential future use and development of the recharge area.	Several consultees raised the issue of the proposed recharge works, with concerns including the fact that the mud will not make saltings but instead will become a beach for boaters to land on, the source of the mud, if it will cause disturbance elsewhere and the need to import mud.	Section 12.2.4
The need for baseline data, monitoring and mitigation as party of the assessment process.	Request for analysis of the existing wildlife of the site, with the potential importance of invertebrate fauna to be investigated by survey, with specific concerns for reptiles, water voles and great crested newts. The agricultural nature of Wallasea makes it less likely that reptile species are found there, however the seawall, ditches and other water bodies at Wallasea will require surveying before works are carried out. It was stated that if not sustainable, such habitats should be recreated elsewhere and should reptiles be found, the scheme should aim to mitigate for impacts to them in the design. As regards mitigation, it was requested that the scheme should need at least 5 years monitoring and that the action to take if the scheme does not develop as required should be defined.	Section 5.2 & 2.4.2
Potential for development of target and other habitat	Requested input on how the habitat is expected to develop. Could the area not be allowed to develop into brackish water reedbeds?	Section 2.2

Issue of concern	Further details about this issue where provided	Section of ES where Addressed
Effects on existing bird usage of Area A	Noted that an area of wet pools formed between the walls following construction of Area A's new seawall in 2002, which was subsequently levelled – seemed a shame as avocets looked interested and it was attracting waders. Also of note are the corn buntings that use the current set aside, particularly in the eastern area, and whether the area is likely to encourage visiting geese that could feed on the farmer's fields.	Section 8.6.6
Need to set bird targets to measure realignment success	Raised a request for habitat and bird targets to be set based on those lost at Lappel and Fagbury Flats and that ideally the compensation should be as close as possible to that lost. The impacts to the adjacent SPA should be considered.	Section 2.4.2
Impacts to underground power cables	Concerns about underground power cables crossing Wallasea and that flooding the area may prevent access. Of particular relevance is that the cables on land are not protected sufficiently to endure permanent or semi-permanent flooding. However, replacement of the cables is being investigated, with the main concern relating to the possibility that the area north of the seawall could be flooded before the cables are replaced.	Section 15
Impacts on EWT nature reserves	As a landowner, EWT has concerns regarding potential impacts to nature reserves at Lion Creek, Lower Raypits, Blue House Farm & Woodham Fenn.	Section 8.6.4
Need to obtain relevant land ownership consents	The River Crouch along the northern boundary is not Crown so agreement needs to be with the owners. The foreshore of the Roach to the east is Crown and will therefore need consent, but there are previous consents that may complicate the issue.	Section 3.2

5.3 Impact Assessment Methodology

5.3.1 Introduction

To facilitate the impact assessment process a standard analysis methodology has been applied. This framework has been developed by ABPmer based on information collated from a range of sources including: the regulations, statutory guidance, consultations and the company's previous EIA project experience. The key guidance and regulations that have been drawn upon include:

(1) The criteria listed in Annex III of the EC Environmental Assessment Directive (85/337 EEC as amended by 97/11/EC);

(2) The assessment process developed by statutory conservation agencies to provide advice on operations within European Marine Sites (English Nature, 2000).

(3) An Environmental Risk Assessment approach developed by ABP Research (ABP Research, 1997);

(4) The guidance provided in Schedule 3 of the Town and Country Planning (Environmental Impact Assessment) Regulations 1999.

For this framework, the environmental issues are divided into distinct 'receiving environments' or 'receptors' and the effect of the proposed realignment scheme on each of these is considered by describing in turn: the baseline environmental conditions of each receiving environment; the 'impact pathways' by which the receptors could be affected; the significance of the impacts occurring and the measures to mitigate for significant adverse impacts where these are predicted. Where appropriate, the future changes occurring to a receiving environment if the proposed realignment does not take place (i.e. the 'do nothing' scenario) are also presented.

With respect to the determination of impact significance, it is recognised that this necessarily requires an element of subjectivity. This is because to make a robust and objective determination would require an understanding of functioning at every level of an environmental system and would need to include a quantitative knowledge of the responses to change. Such an understanding is rarely, if ever, available due to the complexity of environmental systems. It is also recognised that an EIA necessarily needs to examine the potential impacts on a range of different receiving environments and no single assessment method is appropriate across the range of disciplines encountered. Therefore, the method of evaluating impacts will potentially change for different receptors.

Given the above considerations, and in view of the fact that for many environments the key processes in an evaluation are similar, there is considered to be a benefit in identifying an agreed framework, which can be applied for the assessment process.

ABPmer has developed such a framework in an attempt to ensure that a consistent approach is taken for all EIA projects. This Impact Assessment Framework (which is presented in the following sections) is designed to incorporate the key criteria and considerations without being overly prescriptive.

5.3.2 Impact Assessment Framework structure

The framework is divisible into the following four iterative stages: -

(1) Identify both the environmental changes from the proposal activities and the features of interest (i.e. receptors) that could be affected.

(2) Understand the nature of the environmental changes in terms of: their exposure characteristics, the natural conditions of the system and the sensitivity of the specific receptors.

(3) Evaluate the vulnerability of the features as a basis for assessing the nature of the impact and its significance.

(4) Manage any impacts, which are found to be significant and require the implementation of impact reduction/mitigation measures.

The considerations at each of these stages are summarised in Figure 21 and are described more fully in the following sections.

5.3.3 Stage 1 - Identify features and changes

The construction and operational phases of the development will clearly result in a range of 'changes' that will affect the receiving environment. Therefore, the first step is to identify those changes that are likely to occur and the receptors that might be affected (which are together referred to as the Impact Pathway). Examples of potential Impact Pathways include the following: -

(1) The direct loss of, or damage to, a particular habitat or species (e.g. mudflat, saltmarsh);

(2) Indirect damage to, or modification of, a particular habitat or species (e.g. from changes in the hydrodynamic and/or sediment transport regimes of the local environment resulting in the erosion of saltmarsh or sedimentation over oyster beds);

(3) Changes to the water quality conditions in the surrounding area (e.g. from elevated suspended sediment concentrations, increased water-borne contaminants and/or reductions in dissolved oxygen concentration) with associated consequences for a particular habitat or species (e.g. migratory fish);

(4) Disturbance of species during construction (e.g. the effects of construction noise on bird populations);

(5) Alteration to an existing recreational amenity (e.g. the relocation of a footpath)

This aspect of the assessment has been pursued through the scoping process during which a Scoping Opinion was adopted and agreed with the Planning Authority (RDC) in consultation with key statutory and non-statutory authorities (see Section 5.1). The key features and changes identified are presented in Table 1.

The magnitude of the impacts via these pathways depends upon a range of factors including the duration, frequency and spatial extent of the impact and the sensitivity and importance of the receptor. These issues are reviewed in the next section.

5.3.4 Stage 2 - Understand Change and Sensitivity

An impact can only occur if a receiving environment is exposed to a change to which it is sensitive. Therefore sensitivity is described here as the relative intolerance of a habitat, community or species to a given change (i.e. the inability of a receiving environment to tolerate the levels of predicted changes to which they are exposed).

For this assessment of sensitivity there is a need to consider a range of factors including the resistance/adaptability of habitats, communities and species and their ability to return to their former status once conditions over time (i.e. following impacts of a limited duration). Therefore, sensitivity incorporates both the ability of a habitat, community or species to cope with, and recover from, change.

This stage essentially provides a benchmark against which the changes and levels of exposure can be compared. In some cases it may be applicable to compare the anticipated change or exposure against either baseline conditions or other relevant thresholds (e.g. established EQSs for water or sediment quality).

5.3.5 Stage 3 - Impact Evaluation

Once the impact pathways and receptor sensitivities are understood, the likelihood of a feature being vulnerable to an impact pathway is then evaluated. The vulnerability of a receptor is derived from the relationship between its anticipated levels of exposure and its response characteristics. Where exposure exceeds receptor sensitivity/tolerance levels then vulnerability exists and an adverse impact may occur. Conversely, where a

change occurs to which a receptor is not sensitive, then no direct impact can occur. The degree to which exposure exceeds sensitivity will indicate of the predictability, or certainty, of the impact.

Assessing how the vulnerability will manifest as an actual impact on a receptor, and making a judgement about the significance of the impact, requires knowledge of other factors such as the receptor's spatial extent and ability to recover. These factors, together with knowledge of receptor importance, can be applied to assess the overall significance of any impact.

For instance, a receiving environment may have a high or low vulnerability, but whether this potential impact is 'significant' may depend on other factors, such as its ability to recover, the duration of the change (temporary or permanent), the receptor's relative 'importance' (either to the ecosystem or in terms of statutory designations and legal protection) and the scale of the habitat/population affected.

The significance statement provides a summation of the evaluation process and considers both adverse or beneficial impacts, which may be categorised as being either insignificant or of Minor, Moderate, or Major Significance. Estimating and categorising the significance of an impact is the stage that probably incorporates the greatest degree of subjectivity. It would be inappropriate to apply a rigid framework for the actual categorisation of the significance level as this will tend to be a judgement-based decision. However, adverse impacts will be those which are judged to be undesirable or 'adverse'. The concern they raise will increase from adverse impacts of Minor Significance, which may tend to be tolerable, through to Moderate and Major Significance, which will require some form of impact reduction or mitigation measure (see next section). Beneficial impacts are those impacts that are judged to provide some environmental, economic and/or social gain.

5.3.6 Stage 4 - Impact Management

As a project is conceived and developed and as the impact assessment is progressed, it will become apparent that some impacts are likely to be 'significant adverse' and will require mitigation. This invokes an iterative process in which the impact can be designed-out by changing the works (either before or during the assessment process) and integrating mitigating measures into the proposal. Such measures can take the form of: monitoring requirments, constraints on the proposal and/or the construction process as well as measures for the enhancement of a relevant habitat or receptor.

A particular form of control involves the use of 'environmental thresholds' against which the changes resulting from the activity can be monitored and managed. Within the assessment procedure the use of mitigation measures will alter the risk of exposure and hence will require significance to be re-assessed and thus the 'residual impact' identified. This feedback process by which significance is assessed without and then with mitigation is illustrated in the flow diagram that is presented in Figure 21.

5.3.7 Project Specific Considerations

The framework summarised above is generic and designed to be applied to all proposals. However, certain project-specific factors often need to be taken into consideration. In this case it should be noted though that any judgements which are made about the ecological and nature conservation impacts, and residual impacts, need to be made based on a clear understanding that the scheme is designed to provide compensatory mudflat and saltmarsh habitat which were lost during previous port developments at Lappel Bank and Fagbury Flats. Therefore, when considering the ecological impacts of this proposal, the ecological gains brought about by the creation of mudflat and saltmarsh (and the associated benefits for feeding and roosting waterbirds) cannot be seen as contributing to the mitigation of such impacts. However, as described in Section 2.2.5, there are elements of the scheme that are additional to the compensatory measures and are designed to both enhance the ecological value and mitigate for the ecological impacts of the realignment work. These three elements are the existing Borrow Dyke A (behind Wall A); the proposed Borrow Dyke B (behind Wall B), the seven island features and the lagoonal habitat adjacent to island number 7.

6. Physical Environment

6.1 Baseline

The Crouch and Roach Estuaries (Figure 1) together represent a macrotidal, coastal plain system. Coastal plain estuaries were formed during the Holocene transgression through the flooding of pre-existing valleys in both glaciated and unglaciated areas (JNCC, 1997). The typical characteristics of such estuaries are: a large width-depth ratio (dependent on rock type); low river flows relative to the volume of the tidal prism and low fluvial sediment transport. Low freshwater flows and tidal dominance are both key characteristics of the Crouch and Roach which have large tidal ranges, reaching up to 5.7m at Burnham on a Spring tidal range (Pethick and Stapleton, 1994), with a well-mixed and vertically homogenous hydrography (i.e. no major spatial change in the salinity, temperature etc. of the water column).

The Crouch extends for approximately 30km from its tidal limit at Battlesbridge Mill to Holliwell Point. It is a shallow valley between ridges of London Clay that is almost entirely defended by seawalls. As part of the FutureCoast estuary review (DEFRA 2002) generic definitions were assigned to different systems and the Crouch was referred to as a 'Type 4a' estuary because it is a single spit enclosed estuary with intricate branching. It converges with the River Roach at the northeast corner of Wallasea Island (Wallasea Ness), approximately 5km upstream from the estuary mouth. The Roach then extends for approximately 15km from its confluence with the Crouch to its tidal limit at Rochford and is bordered by areas of brick earth, loams and sand/gravel patches. The combined area of both estuaries is approximately 2,750ha,

of which some 1,540ha is intertidal (Buck, 1993), and they drain into the Outer Thames area between two large areas of reclaimed marsh (i.e. the Dengie Peninsula to the north and the islands of Foulness, Potton and Wallasea to the south).

In terms of the estuary tidal regime or its 'tidal asymmetry' (i.e. relative dominance of either flooding or ebbing tides), the Crouch-Roach system was originally thought to be flood-dominant (Mouchel, 1997) and hence, that there is a tendency for the import and deposition of coastal sediments. However, according to the estuary report from the FutureCoast study (DEFRA 2002) and the preliminary modelling work that was done for the Wallasea proposal (ABPmer 2004b) it is evident that the system is in fact ebb-dominant overall. Therefore, the estuary is currently a weak source of sediment (i.e. a net exporter) to the coast. However, as also noted in the FutureCoast study, the cross sectional area to tidal volume ratio appears to indicate that it is a well-balanced sedimentary system, and the mouth width is average compared with the channel length.

As much of the intertidal area of both estuaries has been reclaimed, they have relatively deep, narrow channels with comparatively small strips of intertidal habitat (Mouchel, 1997). The total intertidal resource comprises predominantly mudflat with narrow fringes of saltmarsh that are showing evidence of erosion in a number of areas (Halcrow/EA 2003; University of Newcastle 2001; Pethick and Stapleton 1994) and particularly at the outer part of the estuary mouth where it is bounded to the south by Foulness Island (DEFRA, 2002). Such erosion leads to a tendency to undercut the flood defences and, in an unrestricted estuary, the response would be towards a wider, shallower channel. However, the hard sea defences mean that sea level rise will result in an increase in velocity and tidal height, leading to an increase in stress on the defences and an increased probability of overtopping (Mouchel, 1997).

Data from the Roach and Crouch Flood Management Strategy (Halcrow/EA 2003) describe how the saltmarsh habitat in the estuary has been subject to erosion (over the period 1998 to 2000) with the changes being as follows: stable saltmarsh 265.6ha; eroding saltmarsh 41.6ha and accreting saltmarsh 19.9ha. This study also showed that the exposed saltmarsh areas on the north bank of Wallasea Island are subject to erosion whereas previously they had been defined as being healthy (based on the Backshore General Health Index). This finding is confirmed by local observations which have indicated that the leading edge of the saltmarsh is in retreat even though brushwood polders have been placed in front of this habitat that have served to reduce erosion of the mudflat habitat (Ron Pipe pers comm.). It should be noted however that these findings are based on a relatively short period in time and may not be representative of the longer-term behaviour of the estuary. Furthermore, they relate to a period of worst-case conditions at the peak of the nodal tidal cycle (18.6 years) when tidal range is at a maximum. However, it is evident from the findings presented in the Flood Management Strategy, that the Crouch and Roach are not in equilibrium in their present forms and are still responding to previous interventions (i.e. land reclamations, seawall breaches etc.) and that changes are still taking place including sediment

erosion in the middle of the Crouch and sediment accretion in its upper reaches. The Strategy predicts that full equilibrium may take more than 100 years. It is because the estuaries are considered to be in this unsustainable condition that realignment at Wallasea has been proposed as this will increase the extent of intertidal and fringing habitats and increase the estuaries' ability to accommodate sea level rise and limit the impacts associated with coastal squeeze.

The maximum flow ratio in the estuaries is very low and the river discharges into both the Crouch and Roach are considered to be negligible. Although the discharges range from 0.39 to 18.4m^3/s (DEFRA 2002) the mean flow is at the lower end of this scale (Halcrow/EA 2003). Tidal flow in the area adjacent to Wallasea reaches 1m/s (1.94 knot) on the ebb and 0.9m/s (1.75 knot) on the flood as taken from a single point measurement at 60% depth during the Spring tide (Pethick and Stapleton, 1994). Offshore waves are not a dominant hydraulic forcing condition in the Crouch because the majority of the waves approaching the estuary will be influenced by the extensive intertidal areas at the mouth. This means that is it only waves approaching from the northeast (where there is a large fetch length) that are likely to enter the estuary mouth. However, waves entering from this direction will still not be able to penetrate a significant distance for two reasons: -

(1) The directional spread of the sea state means that only some of the energy is directed into the estuary;

(2) As the waves propagate into the channel they will be refracted onto the banks.

It has been suggested though, that these waves do however reach the north-eastern tip of Wallasea Island and contribute to the erosion of saltmarsh in this area (Pye and French, 1993). Previous work (IECS, 1991) has also suggested that internally generated wind-waves contribute to the erosion of the saltmarshes along the River Crouch, and that tidal flow alone will not induce erosion.

In addition to the physical characteristics of the estuary, it is also of note that the system is of national and international conservation importance and is classified as Sites of Special Scientific Interest (SSSIs), Special Protection Areas (SPAs) and Ramsar Sites by virtue of the abundance and diversity of habitats, species and waterbird populations that they support. Further details about these conservation designations are presented in Section 8.2.

To summarise the characteristics of the Crouch and Roach a number of physical and ecological statistical descriptors of this system are presented in Table 5.

Table 5: Summary characteristics of the Crouch and Roach Estuaries

Location	Total Area (ha)	Intertidal Area (ha)	Shore Length (km)	Channel Length (km)	Tidal Range (m)	Estuary Type	Human Population	Total No Waterfowl
Crouch - Roach	2,754	1,536	158.5	29.6	5.0	Coastal Plain	20,000	25,849
Source: Physical Data from Buck (1993) and JNCC (1997); Waterbird data from Cranswick et al., (1997))								

6.2 Impact Evaluation

6.2.1 Key Impact Pathways

As described in Section 5.2, a bathymetric survey of the Crouch and Roach estuaries and detailed numerical hydrodynamic modelling studies were undertaken to evaluate the short-term and long-term effects of the scheme physical conditions within of the estuary. The results of this work have been used to support the assessment of the physical impacts and a full copy of the Non-Technical Summary from this report is reproduced as Appendix F.

The modelling work was also used to refine the design of the realignment scheme (e.g. by identifying the best location and overall width of the breaches etc.) and ensure that it was optimised both in terms of the functioning and sustainability of the site itself but also in terms of minimising the impacts to the adjacent estuary. Other factors such as social and economic issues that were identified through the preceding consultation process were also addressed (as discussed in Section 2.2. The need to optimise the design in this manner was highlighted in the preliminary modelling work (ABPmer 2004d) and in the Scoping Report.

The Scoping Report additionally identified the following series of questions which needed to be answered by the numerical modelling studies in order to fully understand its impact on the physical conditions within the estuary. These questions were as follows:

(1) How will the breaches, and the channels emanating from them, evolve over time and, in particular, how will the emergent channels affect: the local shoreline hydrodynamics, sediment transport pathways and foreshore morphology?

(2) What are the potential wider physical changes within the estuary and how might they affect the main features of socio-economic value in the estuary such as: oyster lays, yacht moorings and vessel navigation and, in particular, is there any likelihood of increased flows, sedimentation or elevated suspended solid loads which could adversely affect these activities?

(3) How will the estuary as a whole respond over the longer term to the short-term water level and flow changes that are predicted to occur following realignment?

(4) How is the realignment site likely to evolve in response to tidal inundation and how will this affect the rate of *accretion/erosion of sediments within the site or the export/import of sediments to and from the estuary*?

(5) Will the water emanating from the breaches during ebb tide periods affect either the local moorings or other relevant features?

The questions reflect different potential impact pathways and the impacts via these pathways are reviewed below based on the modelling work. These results are also important for making informed assessments in respect of the other key EIA topics that will be influenced by any physical process changes (e.g. ecology, nature conservation, fisheries, navigation and recreation) and these are reviewed under the relevant subject headings.

6.2.2 Impact 1: Evolution of breaches, breach channels and effect on shoreline

Pathway

How will the breaches, and the channels emanating from them, evolve over time and how will they affect local shoreline hydrodynamics, sediment transport pathways and foreshore morphology?

Impact Significance

As part of the site design process (Section 2.2.) the breaches were positioned to minimise their direct effects on the local intertidal areas. Breaches 1, 2 and 3 in Area A were deliberately positioned at headland points to ensure that they integrate well with the existing foreshore alignment (i.e. there is almost no intertidal mudflat in front of these points to be directly affected and the narrow strips of intertidal mudflat to either side of the breach points will remain on their existing alignment). Breaches 5 and 6 in Area B (which cut through saltmarsh and saline lagoon habitat between existing and outer seawalls) have almost no intertidal area either directly in front or in adjacent areas that could be directly affected by the breaching works. Therefore, at these five breaches the only channels that will form will be within the boundaries of the breaches themselves (i.e. at the breach excavation points). At the large (210m wide) Breach 4 though an area of mudflat is located between the existing and old seawalls and at this site a channel will form both within the breach area and across this fronting intertidal area.

To gauge how the passage of tidal waters though the breaches will affect either the mudflat in front of Breach 4 or the channels within the excavated sections of all the breaches, the width and depth of the breaches were tested using in-house empirical

modelling techniques. These techniques were used in conjunction with the analyses of the intertidal sediment properties to check whether stable regime channels will form at the centre of the breaches. By comparing the erosion thresholds of the intertidal muds with the rates of tidal exchange at the breach widths, this work indicated that stable channels will form at the breach points. Indeed, the proposed breaches are much wider than the minimum width that is suggested by this modelling and, as such, they will dissipate the flow sufficiently to ensure that there is no significant scouring of the sediment. The modelling also shows that the breaches are sufficiently broad and deep that they will not impose significant physical stress on the sides of the breaches which might compromise the structural integrity of the walls at either side in the short term. However, it is clearly the case that, in the longer term, these walls will collapse due to: their existing poor condition; their future increased exposure to wave and tides and the lack of maintenance. Some minor realignment of the central channels within the breaches can be expected however (especially at the LW end of the longer channels that will run though Breach 4 and across the adjacent mudflat) as they align themselves to the local flow conditions. Such channel movement will though be localised and negligible.

Therefore, any direct effects of the breaching work on the intertidal habitats will be negligible and the channels emanating from the site through these breaches are expected to be very stable. Thus emergent channels will have very little direct effect on the local shoreline hydrodynamics, sediment transport pathways and foreshore morphology. Overall the effects are considered to be negligible

6.2.3 Impact 2: Short-term changes in estuary and effects of receptors

Pathway

What are the potential physical changes within the estuary and how might they affect the main features of socio-economic value?

Impact Significance

The numerical modelling work has indicated that, following realignment, most of the hydrodynamic changes in the estuary will be of a limited scale and duration although they can occur over a large proportion of the estuary. They occur as a result of the additional volume of water (on average about an extra 2%) that moves in and out of the estuary on each tide which is accommodated in the system by minor changes in flow speeds and water levels during flooding and ebbing tides. The water levels in the estuary for instance, show no change over the majority of the tidal cycle including periods of high and low water. However, slight increases occur on Spring tides during the times of maximum flow in and out of the realignment site (i.e. on flooding and ebbing tides). These changes occur as small (usually just ±1cm changes although increases of up to 2-3cm are occasionally observed) and short-lived events (typically no more than 30 minutes). These changes can have a large spatial extent, especially

on the ebb tide when they are observed along the length of the estuaries. However, as they are transient and are only observed briefly on larger tides (no discernable changes are expected on Neap tides) their effects on the estuary and its coastal defences are considered to be insignificant.

In terms of the flow speeds, increases of between 0.05m/s and 0.1m/s or 0.1 and 0.2 knots (representing 5 to 17% above baseline) are expected to occur on Spring tides with lower increases of up to 0.04m/s or 0.07knot on Neap tides (representing 8-10% above baseline). These flow speed increases are observed along the foreshore area fronting the site and across the estuary channel in sections of the estuary lying downstream of Breaches 3 and 6 (i.e. to the east of moorings and marinas). They occur during peak flood and ebb tide periods and are the result of the increased volumes of water flowing in and out of the realignment site. However they are relatively short-lived events (extending for around 20 to 30 minutes during the peak flows) and represent minor changes that will not be discernable in the estuary and are therefore considered to be insignificant.

These transient flow speed increases on ebbing and flooding tides will result in elevated Bed Shear Stresses (BBS) which are the frictional forces exerted by flowing water on the seabed. The BSS levels increase by a maximum of 0.17N/m^3 (or 9% above baseline levels) on Spring tides and by 0.05N/m^3 (or 13% above baseline levels) on Neap tides. Like the flow speed changes these occur as minor and transient events that are not considered to be sufficient to cause erosion of the seabed based on the detailed analyses of the composition of intertidal sediments (as used above to also determine breach channel stability). These sediment analyses indicate that a critical erosion threshold BSS of 1.83N/m^2 would need to be exceeded to promote erosion and this does not occur. Also the erosion threshold will be higher for subtidal sediments that are generally coarser and will be even less susceptible to erosion. For example, grab samples of the seabed sediment that were taken from the centre of the Crouch estuary during the bathymetry survey contained shells, stone and gravel with only 3-5% silt, whereas the intertidal areas typically have over 50% silt (see data in Appendix D).

The sediment transport model shows that there will be changes in sediment accretion/erosion (typically $\pm$0.01-0.05mm on a spring tide and almost none on a neap tide). Furthermore, the findings from fieldwork and historic changes in the estuary suggest that sediment availability and mobility is low and that changes will only occur on the larger tides. Hence these results represent an upper bound estimate of change due to the assumptions used within the model. On this evidence therefore, any effects on the erosion or accretion effects are predicted to be so small that they are unlikely to be detected by monitoring and as such can be considered to be insignificant.

The sediment transport modelling indicates that there will be no changes to the suspended sediment concentration in the estuary. Overall therefore these findings show that the short-term effects of the scheme of the physical conditions in the estuary

will be negligible and also that almost all the effects that are predicted will occur to the east (downstream) of moorings and marinas. Therefore, no effects on key socio-economic features are predicted although these aspects are reviewed in greater detail in relevant sections of this ES.

6.2.4 Impact 3: Long-term response of estuary

Pathway

How will the estuary as a whole respond over the longer term?

Impact Significance

The results of the regime modelling work have indicated that over the longer term (period of hundreds rather than tens of years) the estuary will widen and deepen slightly across an area extending from the area of the realignment site downstream to the mouth of the Crouch. Similar trends are predicted for the outer Roach. However, even over this period of time the expected losses of intertidal area are low (approximately 2ha in the Crouch and 0.5 hectares in the Roach). Not only is this change minor over the timescales predicted but they should be seen in the context of the future development of the estuary which, following realignment, will have an increased level of sustainability and a better ability to cope with sea level rise and impacts associated with coastal squeeze (Halcrow/EA 2003) (see also Section 11.2). Overall the effects are therefore considered to be of minor adverse significance.

6.2.5 Impact 4: Accretion and erosion of sediments within the site

Pathway

How is the realignment site likely to evolve in response to tidal inundation and how will this affect the rate of accretion/erosion of sediments within the site or the export/import/ of sediments to and from the estuary?

Impact Significance

After realignment suspended material may be imported in the short-term as the site initially adjusts to tidal inundation while over the longer term sediment accretion within the site is expected to continue though the natural movements of suspended sediments into and out of the shallow areas. Modelled observations indicate that there will be modest levels of such sediment accretion within the realignment site. Under Spring tidal conditions an accretion rate of 0.1mm/tide was predicted while over Neap tides no discernible sedimentation is predicted. As there is no movement on Neap tides, the maximum levels of accretion within the site are 3.5cm/year (i.e. mid-way between the zero change on a Neap and a theoretical 7cm annual change for only Spring tides). There is evidence, however, that the actual distribution between spring

and neaps will result in a lower rate and that sediment availability in the estuary is relatively low. It is therefore estimated that accretion will be between 1-3cm/year. Once this material (mainly silts not coarser sediments) enters the realignment site, there will be little opportunity for transportation out of the site. This accretion is expected to preferentially occur in the still deeper waters of flooded land drains, borrow dykes and scrapes.

The habitats are expected to remain relatively stable and are unlikely to be subject to erosion and scouring because of the low flow speeds within the site that, according to the model, do not exceed 0.5m/s. It should be noted that this conclusion is based upon a modelled worst-case condition in terms of potential to induce erosion of the bed because it is based on the transport of fine-grained silts and under Spring tide conditions. The lowest flows will be experienced at the top of the shore and over the recharge area. Here, the model indicates flows not exceeding 0.1m/s therefore there is not expected to be any resuspension of the deposited dredge arisings in these areas.

In terms of the impacts of the scheme on the wider estuary, because no export of sediment from the site is predicted, there are not expected to be any impacts on water quality conditions and sediment accretion/erosion (as indicated above). Therefore any impacts via this pathway are considered to be negligible.

6.2.6 Impact 5: Effects of water emanating from breaches

Pathway

Will the water emanating from the breaches during ebb tide periods affect either the local moorings or other relevant features?

Impact Significance

As previously summarised in Section 6.2.3, the hydrodynamic modelling work has shown that the breaches will cause transient and local increases in flow speeds within the Crouch of no more than 0.1m/s (0.2 Knot). These elevated flow features occur during periods of peak ebb and flood and are particularly observed downstream from Breaches 3 and 6 (the latter probably being created by the combined effects of water movements through the three Area B breaches). Such changes are however of a short duration (20-30 minutes) and of a limited scale (5% to 17% increase). This limited effect is due to the fact that careful consideration was given to the total width of the breaches such that they are sufficiently large to dissipate flows (flows do not exceed 0.5m/s in the breaches). The flows also occur to the east of the marinas and moorings, which are all located to the west of Breach 3. Therefore, there will be no visibly perceptible streaming of water in and out although measurable increases in flow may be recorded during brief periods and the impacts of these flows are considered to be negligible.

7. Water and Sediment Quality

7.1 Baseline

7.1.1 Water Quality

To describe the baseline water quality conditions within the Crouch and Roach Estuaries, monitoring data collected by the EA as part of their statutory monitoring programmes was obtained. EA sampling is undertaken at several pre-determined sample points in the Crouch and Roach that are visited at frequent intervals during the year. These sites include: the Essex Yacht Marina (to the west the proposed realignment site), North Fambridge (upper reaches of the Crouch Estuary), Ropers Farm (upper reaches of the Roach Estuary) East End Paglesham (near in Paglesham Reach) and Monkton Quay (in the outer Roach at Foulness). The position of these sites is shown in Figure 11 and a summary of the water quality data collected from these sites during 2001 is presented in Table 6. A more complete set of these water quality results is also included in Appendix G.

The data in Table 6 do not indicate that there are any major water quality problems associated with the section of the Crouch in front of Wallasea Island (as described by the results obtained from the Essex Yacht Marina). At this Essex Marina site, turbidity levels are relatively low and none of the measured determinands (with the exception of ammonia) exceed their respective Environmental Quality Standards (EQS) even at their maximum recorded levels.

At the other sites in the upper reaches of the estuaries, and also at the Outer Roach at Monkton Quay, some occasional EQS exceedences were observed. This included exceedence of the guideline levels for total coliforms (under both Bathing and Shellfish Waters) at Ropers Farm, Monkton Quay and East End of Paglesham. However, the imperative standard for bathing waters was not exceeded at any of the sites. At the East End of Paglesham the maximum recorded levels of copper exceeded the quality standards under the Dangerous Substances Directive and the zinc EQS was exceeded both at this site and at Monkton Quay in the outer Roach.

The mean recorded value for ammonia exceeded its EQS at all five of the survey sites although it is of note that the area is not highlighted under the Urban Waste Water Treatment Directive (UWWTD) as one which requires improvement to existing nutrient levels. This is attributable to the fact that the estuary has benefited from the investments made by Essex and Suffolk Water over the past decade in order to comply with effluent consents issued by the EA.

In the Crouch and Roach, maintenance of good water quality conditions is critical for the shellfisheries interests and therefore standards ensuring the quality of shellfishing

areas are imposed by the EU Shellfish Waters Directive (79/923/EEC) (implemented in the UK through the Shellfish Waters (Quality for Shellfish) Regulations 1995 and the Surface Waters (Shellfish) (Classification) Regulations 1997). In 1999, some 6.6km^2 of the Roach and Lower Crouch were designated as Shellfish Waters. The location of Shellfish Waters where fishing is known to occur is shown in Figure 22. These areas have been indicated by the Kent and Essex Sea Fisheries Committee (KESFC), and includes areas of mussel cultivation, oyster cultivation (including some native oyster, *Ostrea edulis*) and also the area covered by the River Roach Oyster Fishery Several Order.

Table 6: EA Water Quality Data for Crouch and Roach (January/December 2001)

Determinant	Min/ Max	Essex Yacht Marina	North Fambridge	Ropers Farm	Monkton Quay	East End Paglesham
Dissolved Oxygen (%)	Min	82.1		76◈⊙	89.6	89
PH - Maximum	Max	8.35	8.25	8.2	8.2	8.2
Turbidity - Maximum	Max	49	82.6	260	55.8	61.7
Suspended solids (mg/l)	Min		4.5		8.8	7.7
Suspended solids (mg/l)	Max		74		1274	495
Temperature	Max	20.5	21	22.3	22.5	22.6
Salinity	Min	25.62		32.56	26.53	25.43
Salinity	Max	32.44		32.56	33.39	31
BOD (mg/l)	Max	4		5.4	5.2	6.3
Ammonia (N) (mg/l)	Max	0.201✱	0.228✱	0.489✱	0.203✱	0.451✱
N Oxidised (mg/l)	Max	1.85	2.7	3.161	1.02	2.04
Orthophosphate (mg/l)	Max	0.155	0.323	0.555	0.136	0.397
Lead ug/l	Max	0.424	0.32	0.386	0.37	0.738
Mercury (ug/l)	Max	0.016	0.03	0.04	0.14	0.04
Cadmium (ug/l)	Max	0.042	0.051	0.07	0.044	0.046
Zinc (ug/l)	Max	5.11	9.55	5.6	10.4✱	10.✱
Chromium (ug/l)	Max	0.063	0.51	0.35	0.407	0.35
Nickel (ug/l)	Max	1.92	3.35	2.4	1.48	2.19
Copper (ug/l)	Max	3.18		2.59	1.93	7✚
Coliforms (no/100ml)	Max	81		892✱⊙	760✱⊙	924✱⊙

✚ - Exceeds water quality standards for List II substances under the Dangerous Substances Directive
◈ - Above or below guideline water quality standard under the Shellfish Waters Directive
⊙ - Above or below guideline water quality standard under the Bathing Waters Directive
✱ – Exceeds saltwater EQS

There are also several areas in these two systems that are designated as Shellfish Harvesting Areas under the EU Shellfish Hygiene Directive (91/492/EEC). This Directive requires testing of shellfish flesh to identify the 'Class' of the bed and sets standards for the level of treatment prior to sale for shellfish collected from the harvesting area. In 2003, all beds on the Crouch (Ostrea edulis) were designated as Class B (i.e. oysters must be cleansed by relaying in cleaner water for varying lengths

of time). A number of beds are present on the Roach for species including *Crassostrea gigas*, *O. edulis*, *Mytilus edulis*, *Mercenaria mercenaria* and *Tapes philippinarum*, all of which are Class B, except for *C. gigas* in Paglesham Pool which for a short period (1 June-31 August) is Class A (i.e. oysters can be sold direct for consumption).

7.1.2 Sediment

The results of the sediment contamination analyses, presented as dry weight concentrations, from samples taken at sites B1 to B7 (see Figure 17) are shown in Tables 7 and 8. These tables show the concentration of heavy metal, polyaromatic hydrocarbons (PAH) and polychlorinated biphenyls (PCB) which, in the absence of UK sediment quality standards, can be compared against Dutch quality standards for the disposal of dredged material (IADC/CEDA, 1997) and also the Canadian Interim Sediment Quality Guidelines (CCME, 1999).

The Dutch apply a tiered system with three contamination categories:

(1) Target Value (TV) - Indicates the level below which the risk to the environment is considered to be negligible, at the present stage of knowledge.

(2) Reference Value (RV) - Indicates the maximum allowable level of contaminants.

(3) Intervention Value (IV) - An indicative value, indicating that remediation may be urgent, owing to increased risk to public health and the environment.

The Canadian Interim Sediment Quality Guidelines (ISQGs) involve the follwiong two levels:

(1) Threshold Effects Levels (TELs- affecting the most sensitive species)

(2) Probable Effect Levels (PELs - likely to affect a range of organisms)

Further details about these standards and their relevance to UK impact assessments are presented in Appendix G. The results of the PSA analyses that were carried out on these samples are also illustrated in Figure 23. Figure 23 shows that the sediments predominantly comprise silts (75% or greater) although the percentage dominance of these finer sediments varies with shore height, location and exposure and some sites can have up to a 50% sand fraction.

Table 6 shows that, aside from Site B4 and B7, there were no exceedences of any of the Dutch or Canadian standards for heavy metals. At Site B7 (the control site on the south bank of Wallasea Island) and B4 (to the east of the proposed Breach 3) the concentrations were below both of the two Dutch Values and the Canadian PEL levels.

However, arsenic, copper and lead were present marginally above the Canadian TEL at site B7 and arsenic exceeded the same standard at B4.

In terms of PAHs and PCBs, as shown in Table 7, all samples were below Dutch Target Levels and the Canadian TEL (where applicable). The levels of TBT at all sites were, in fact, less than the detection limit of 10µgkg^{-1}, and hence fall below the CEFAS Action Level 1 for dredged sediment, and they were much less than 50µgkg^{-1} TBT which is considered to represent lightly contaminated sediments (Waite *et al.*, 1991).

Table 7: **Heavy metal** contamination in the benthic intertidal samples

Determinand\ Site	B1	B2	B3	B4	B5	B6	B7
Arsenic	6	6	5	11✚	7	6	10✚
Cadmium✕	<1	<1	<1	<1	<1	<1	<1
Chromium	12	12	8	11	10	11	21
Copper	12	10	6	7	7	9	19✚
Lead	20	18	15	8	15	16	33✚
Mercury✕	<1	<1	<1	<1	<1	<1	<1
Nickel	12	11	7	13	9	10	20
Zinc	53	48	33	34	38	44	85

NB - all expressed as mg/kg
✕ = Limit of detection above the Dutch Target Value and Canadian TEL (refers to heavy metals and PCBs);
✚ = Exceeds Canadian TEL (refers to heavy metals and PCBs)
◈ = Exceeds the Dutch Target Level

The contamination levels of Total Petroleum Hydrocarbons (TPHs) were in general below the detectable threshold, although occasional values of 5 and 10 mg/kg were recorded for two samples (Site B1 and B7). PAH contamination is given for individual compounds, the majority of which are listed on the Canadian interim sediment quality guidelines and exceedences were recorded for two of the compounds (Fluoranthene and Acenaphthene) at site B7.

In relation to the more stringent Canadian Standards, the samples at B4 and B7 would be categorised as having occasional (13-27% probability) adverse ecological effects but in relation to the Dutch standards no samples would be categorised as having adverse biological effects. It is clear though, that Site B7 on the south bank shows a higher level of contamination than the sites on the north bank of Wallasea. In some cases this is because the north banks sites have generally coarser sediment types and are thus less likely to adsorb pollutants (because the overall surface area of the sediments is lower). However, this cannot be the whole answer as some sites on the north bank (B1 and B2) have high silt content as well. The distinction is therefore, likely to stem from the differences in the intertidal hydrodynamic regime (the north bank has a smaller intertidal area that is subject to higher flow speeds with less opportunity for pollutant deposition) and historical pollution patterns and sources.

This work has shown though, that the chemical contamination of the sediment from locations sampled around Wallasea Island is relatively low and does not pose a significant risk to the marine environment.

Table 8: PAH, PCB and TBT contamination in the benthic intertidal samples

Determinand\ Site	B1	B2	B3	B4	B5	B6	B7
Naphthalene	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	0.03
Acenaphthylene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthene	<0.01	0.02	0.02	<0.01	<0.01	<0.01	0.03*
Fluorene	<0.01	0.01	0.01	<0.01	<0.01	<0.01	0.02
Phenanthrene	0.02	0.04	0.05	0.01	0.02	0.01	0.11
Anthracene	<0.01	0.01	0.01	<0.01	<0.01	<0.01	0.03
Fluoranthene	0.02	0.04	0.1	0.02	0.02	0.02	0.12*
Pyrene	0.02	0.02	0.1	0.01	0.02	0.02	0.1
Benzo (a) anthracene	0.01	0.02	0.06	<0.01	0.01	0.01	0.05
Chrysene	0.01	0.02	0.05	<0.01	<0.01	0.01	0.04
Benzo (b/k) fluoranthene	0.02	0.02	0.1	<0.01	0.01	0.02	0.06
Benzo (a) pyrene	0.01	<0.01	0.06	<0.01	<0.01	<0.01	0.03
Indeno (123-cd) pyrene	<0.01	<0.01	0.04	<0.01	<0.01	<0.01	<0.01
Dibenzo (ah) anthracene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total PCBs	<0.05	0.14	<0.05	0.27	0.07	<0.05	<0.05
Total TPHs	5	<1	<1	<1	<1	<1	10
Tributyltin	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

NB - all values expressed as mg/kg except Total PCBs in µg/kg
× = Limit of detection above the Dutch Target Value and Canadian TEL (refers to heavy metals and PCBs)
✚ = Exceeds Canadian TEL (refers to heavy metals and PCBs)
✳ = Exceeds interim sediment quality guideline (ISQG), CCME 1999 (refers to PAHs).

7.2 Impact Evaluation

7.2.1 Key Issues

The Scoping Report concluded that the proposed realignment scheme has the potential to affect the water and sediment quality conditions of the Crouch Estuary though the following two processes or 'pathways': -

(1) The mobilisation and resuspension of sediments and/or sediment-bound contaminants (e.g. metals, nutrients, organic material) from intertidal habitats in front of the breaches as the tide flows across these areas after breaching.

(2) The accidental release of pollutants (e.g. oil, or other substances) from plant and equipment following spillages and/or accidents during the construction phase of the scheme (including sediment release from the dredger during the recharge work).

The potential effects via these two impact pathways in light of the baseline conditions described in Section 7.1 and the physical process impacts predicted in Section 6 are reviewed below.

Within the Scoping Report two other possible methods of water/sediment quality impacts were considered but were identified as not needing further detailed consideration within the ES. These were:

(1) The release of sediments and sediment-bound contaminants into the estuary from the recharge materials that will be deposited in front of the seawalls to create areas suitable for saltmarsh colonisation.

(2) The export of sediments and sediment-bound contaminants from land that that will be inundated after breaching.

No significant impacts were expected from the former impact pathway for two reasons. Firstly, the dredge arisings will be subject to separate FEPA licensing prior to their use on site and as such the recharge materials will have to meet agreed quality standards before deposition. Secondly, all sediment deposited within the site, and/or all water released on site during the dewatering of this material, will be retained within the realignment area and will not be discharged into the estuary. As described in Section 2.3.2 this recharge sediment will be 'de-gassed' prior to release so that it will be deposited as a thick slurry. It will be placed at the back of the realignment site and in front of the new counterwalls (see Figure 3) and will be retained in position by a pre-constructed clay bund that will have suitably located outlets along its length to allow for the release of entrained water. The water released through these outlets will have to pass across a large area of vegetated land (which will act as a sediment filter), though a drainage ditch and into borrow dyke before exiting into the estuary via the sluice (this work will be done prior to breaching so there will be no open exchange with the estuary). Thus, there will be a long settlement period for sediment and no release to the estuary is expected.

With respect to the latter impact pathway (i.e. export of sediment and contaminants from inundated areas), while it is recognised that there may be high levels of some pollutants (e.g. agro-chemicals, nitrates and phosphates) within the realignment site, the areas to be inundated will be set aside for at least one year before tidal inundation in order to 'clean' the surface sediments. This set-aside period will ensure that any residues will be naturally diluted by rainwater prior to breaching. Also, any sediment that settled out during the dewatering of the recharge sediments (see above) will, as discussed, be FEPA licensed and will therefore have low contaminations levels. In addition, the results of the modelling work (see Section 6) indicate that the site will import not export materials (mainly silts not coarser sediments) and once such materials are drawn into the site there will be little opportunity for transportation out of the site. In this context, it is also important to note that the Flood Management Strategy (Halcrow/EA 2003) concludes if managed realignment is not pursued and

instead, natural breaching of the existing seawall on the north bank of Wallasea Island occurs in an uncontrolled manner, then there is a significant risk of contamination in the estuary from the release of land-borne contaminants.

Further to the above considerations it is also of note that mudflat and saltmarsh habitats both have natural effects on water quality conditions (e.g. through nutrient cycling) in coastal ecosystems. The new habitats created could act either as sources and sinks for nutrients and this balance may change over time as habitats mature. This is not expected to have a significant effect on the estuary and any effects arising are expected to be positive in terms of restoring the estuary to a more natural state.

7.2.2 Impact 1 Mobilisation of sediments and/or contaminants

Pathway

The mobilisation and resuspension of sediments and/or sediment-bound contaminants (e.g. metals, nutrients, organic material) from intertidal habitats in front of the breaches as the tide flows across these areas after breaching.

Impact Significance

The realignment scheme has been specifically designed, through the appropriate design and positioning of breaches, to have minimal direct impact upon the narrow strip of intertidal habitat fronting the site. Also the widths of the breaches are designed to be wider then needed, relative to the volumes of water that will need to pass through them, such that the channels through the breaches will have a stable configuration (see Section 6) and thus will not be subject to significant erosion. The modelling work summarised in Section 6 has also indicated that the transient flow speed increases occurring after realignment will not cause erosion of the intertidal habitats and that the level of suspended sediments in the estuary will not be increased significantly. Therefore, significant resuspension of sediments and/or contamination is not expected.

In view of these findings and the fact that the levels of sediment contamination in the intertidal area is low with no exceedence of either the Dutch or Canadian PEL standards (including at Breach 4 where there largest intertidal channels will be created) the overall impacts of the scheme are considered to be negligible in the short term. Furthermore, as the EA Flood Management Strategy has predicted significant contamination if managed realignment is not pursued the scheme can be seen as beneficial over the longer term. The overall impact is therefore deemed to be of minor beneficial significance.

7.2.3 Impact 2 Accidental release of pollutants

Pathway

The accidental release of pollutants (e.g. oil, or other substances) from plant and equipment following spillages and/or accidents during the construction phase of the scheme (including sediment release from the dredger during the recharge work).

Impact Significance

There will always be an element of risk from accidents and spillages in a construction operation. However, these will be minimised by ensuring that the construction methods, scheme designs and the contractual arrangements are pursued in an appropriate way and with the advance agreement of the EA. Summary details of these requirements are set out in Section 2.3.4. Therefore, it is not expected that there will be significant impacts from this process and should spillages occur then measures to clean up any impacts will be pursued. With these appropriate measures in place, the overall impact is deemed to be Negligible.

8. Nature Conservation and Ecology (Habitats and Species)

8.1 Introduction

The Crouch and Roach Estuaries are areas of high conservation value and, as a result, are designated under national and international nature conservation legislation. The boundaries of these designated sites extend to cover the intertidal and subtidal habitats adjacent to the proposed realignment site as well as the existing seawall, berm and borrow dyke habitats within the site itself. These designated sites are reviewed in Section 8.2 and the habitats and bird populations of the wider estuary are described in Sections 8.3 and 8.4. Section 8.4 also describes the bird populations within the realignment site itself.

The majority of the proposed realignment site, which is not designated, is described in Section 8.5 and in particular any protected species are identified. Across this area there is a clear distinction between Area A which is known to have accrued ecological value following the construction, in 2001, of Wall A and the cessation of farming activities across this area. Area B by contrast is still actively farmed land and thus the main areas of conservation interest in this part of the likely to be confined to the designated areas of the seawall and borrow dyke.

These detailed reviews of the realignment site and the surrounding estuarine habitats are designed to inform the assessments of the direct and indirect ecological impacts of the proposal which is presented in Section 8.6.

8.2 Designated Nature Conservation Sites

8.2.1 Introduction

The protected areas within the estuaries and along the adjacent coastline include the following designated sites:

(1) Special Protection Areas (SPAs): The Crouch and Roach estuaries and the Foulness Island area to the east of Wallasea Island are both designated SPAs under the EC Birds Directive (79/409/EEC). These two sites represent Phases 3 and Phase 5 respectively of the wider Mid Essex Coast SPA with the other constituent SPAs being: Dengie (Phase 1), Colne Estuary (Phase 2) Blackwater Estuary (Phase 4).

(2) Essex Estuaries cSAC and European Marine Site: The Crouch and Roach estuaries together with the Foulness, Dengie, Blackwater Estuary and Colne Estuary designated areas represent part of: the Essex Estuaries candidate Special Area of Conservation (cSAC) under the EC Habitats Directive (92/43/EEC). This cSAC and the component SPAs are collectively referred to as the Essex Estuaries European Marine Site.

(3) Wetlands of international importance (Ramsar Sites): The Crouch and Roach estuaries and the Foulness Island area constitute Phases 3 and 5 of the Mid Essex Coast Ramsar area as designated under the Ramsar Convention. As with the SPA phases, the other constituent Ramsar sites are the: Dengie (Phase 1), Colne Estuary (Phase 2) Blackwater Estuary (Phase 4).

(4) Site of Special Scientific Interest (SSSI): The Crouch and Roach, Foulness Island, Dengie foreshore, Colne Estuary, Blackwater Estuary and the River Crouch Marshes are all designated as Sites of Special Scientific Interest (SSSIs) under the Wildlife & Countryside Act 1981.

(5) Other National and Local Designations: The Dengie foreshore is a designated National Nature Reserve under the National Parks and Access to the Countryside Act, 1949. There are also Essex Wildlife Trust Nature Reserves at Lion Creek, Lower Raypits, Blue House Farm and Woodham Fen all of which are located up estuary along the Crouch from Wallasea.

Further details about these sites and their conservation interests are presented below.

8.2.2 Special Protection Areas

SPAs are sites that are designated under the EU Birds Directive (79/409/EEC) because they support wild bird populations of European interest. Those SPAs sites that could be either directly or indirectly affected by the proposed realignment are the Crouch and Roach and Foulness sites. As detailed above, these represent Phases 3 and 5 of the wider Mid-Essex Coast SPA site and the designated features of these two sites are summarised below.

Crouch and Roach Estuaries

The Crouch and Roach Estuaries officially qualifies as a SPA under Article 4.2 of the EU Birds Directive because it supports:

(1) Internationally important populations of overwintering populations of dark-bellied brent goose (*Branta bernicla bernicla*) representing at least 1.0% of the wintering Western Siberia/Western Europe population. The original citation quotes the abundance of 5,509 birds as recorded over the 5-year periods 1989/90 to 1993/94. However, the most recently published information (for period 1991/2 - 1995/6) indicates that the abundance is 3,074 individuals (JNCC 2004a).

(2) An internationally important waterfowl assemblage. The original citation quotes the abundance of 27,021 birds as recorded over the 5-year periods 1989/90 to 1993/94. However, the most recently published information (for period 1991/2-1995/6) doesn't indicate that the site qualifies on this basis (JNCC 2004a).

Copies of the original citation and the values from the latest published information are shown in Appendix K.

Foulness SPA

Under the most recent published information (JNCC 2004b) the Foulness site qualifies as SPA under Article 4.1 of the EU Birds Directive because it supports populations of the following Annex I species at levels of European importance:

(1) Avocet *Recurvirostra avosetta* (breeding) 46 pairs;

(2) Avocet (overwintering) 100 individuals

(3) Common tern *Sterna hirundo* (breeding) 220 pairs;

(4) Little tern *Sterna albifrons* (breeding) 24 pairs;

(5) Sandwich tern *Sterna sandvicensis* (breeding) 320 pairs;

(6) Bar-tailed godwit *Limosa lapponica* (overwintering) 7,639 individuals;

(7) Golden plover *Pluvialis apricaria* (overwintering) 3,359 individuals;

(8) Hen harrier *Circus cyaneus* (overwintering) 6 individuals.

The site also qualifies under Article 4.2 of the Directive by supporting populations of European importance of the following migratory species:

(1) Redshank *Tringa totanus* (on passage) 2,144 individuals;

(2) Dark-bellied brent goose *Branta bernicla bernicla* (overwintering 13,075 individuals;

(3) Grey plover *Pluvialis squatarola* (overwintering) 24,209 individuals;

(4) Knot *Calidris canutus* (overwintering) 40,429 individuals;

(5) Oystercatcher *Haematopus ostralegus* (overwintering) 11,756 individuals.

In addition, the site qualifies under Article 4.2 by regularly supporting at least 20,000 waterfowl. Over winter, the area regularly supports 107,468 individual waterfowl (5 year peak mean 1991/2 - 1995/6) including: Redshank, Curlew (*Numenius arquata)*, Black-tailed Godwit (*Limosa limosa islandica*), Dunlin (Calidris *alpina alpina)*, Lapwing (*Vanellus vanellus)*, Wigeon (*Anas penelop)*e, Shelduck (*Tadorna tadorna)*, Little Grebe (*Tachybaptus ruficollis)*, Knot, Grey Plover, Oystercatcher, Dark-bellied Brent Goose, Bar-tailed Godwit, Golden Plover, Avocet.

The above information is based on the latest published information and shows a number of changes from the original citation. Both the original and latest values are shown in Appendix K.

8.2.3 Essex Estuaries European Marine Site

In the UK, European sites have been designated under the Conservation (Natural Habitats &c.) Regulations, 1994 (Habitats Regulations). These Regulations implement the EU Birds Directive (79/409/EEC) and the EU Habitats Directive (92/43/EEC) respectively and allow for a network of Special Protection Areas (SPAs) and Special Areas of Conservation (SACs).

The Crouch and Roach constitute part of the wider Essex Estuaries European Marine Site (EMS), which is the second largest estuarine site on the east coast of England and is considered to be the best example of a coastal plain estuary system on the British

North Sea coast. The EMS is formed from a number of constituent sites including the Crouch/Roach and Foulness SPAs described above and the Essex Estuaries cSAC as well as the Colne Estuary SPA, Blackwater Estuary (including Old Hall Marshes) SPA, Dengie SPA and the Foulness SPA. The regional location and extent of these nationally and internationally designated areas are illustrated in Figure 24 and the local boundaries of the sites around Wallasea Island are shown in Figure 25.

Of these sites the proposed realignment has the potential to directly or indirectly affect the Crouch & Roach SPA, Foulness SPA and Essex Estuaries cSAC (ABPmer 2004a). The boundaries of the Crouch Roach SPA and cSAC areas cover the intertidal areas adjacent to Wallasea Island and also includes the seawall borrow dyke within the site. The main habitats along the north bank of the island include a narrow strip of intertidal mud, two large areas of saltmarsh backed by neutral grassland, the neutral grassland on the seawall itself and the borrow dyke areas behind the wall.

Essex Estuaries cSAC

The Essex Estuaries Site has been selected as a cSAC because it supports the following Annex I habitat features and sub-features under the EU Habitats Directive:

(1) *Salicornia* and other annuals colonising mud and sand.
- Glasswort (*Salicornia* agg.)/annual sea-blite (*Suaeda maritima*) community.
- Sea aster (*Aster tripolium* var. *discoides*) community.

(2) *Spartina* swards.
- Small cordgrass (*Spartina maritima*) community.
- Smooth cordgrass (*Spartina alterniflora*) community.

(3) Atlantic salt meadows *(Glauco-Puccinellietalia).*
- Low/mid-marsh communities.
- Upper marsh communities.
- Upper marsh transitional communities.
- Drift-line community.

(4) Mediterranean and thermo-Atlantic halophilous scrubs (*Arthrocnemetalia fruticosae*).
- Shrubby sea-blite (*Suaeda vera*) community.
- Rock sea lavender (*Limonium binervosum*)/ sea heath (*Frankenia laevis*) community.

(5) Estuaries.
- Saltmarsh communities.
- Intertidal mudflat and sandflat communities.

- Rock communities.
- Sub-tidal mud communities.
- Subtidal muddy sand communities.
- Subtidal mixed sediment communities.

(6) Mudflats and sandflats not covered by seawater at low tide.

- Mud communities.
- Muddy sand communities.
- Sand and gravel communities.

8.2.4 Ramsar Sites

Ramsar sites are wetlands of international importance, which are designated under the Ramsar Convention and, as with the SPAs, the Ramsar sites that could be directly or indirectly affected by the proposed realignment are the Crouch and Roach and Foulness sites. As detailed above, these represent Phases 3 and 5 of the wider Mid-Essex Coast Ramsar site. The designated features of these two sites are summarised below.

Roach and Crouch Ramsar

Despite the relatively narrow strip of intertidal mud along the large stretches of the banks of the Roach and Crouch estuaries, the site is used by a significant number of birds. Additional interest is provided by the aquatic and terrestrial invertebrates and an outstanding assemblage of nationally scarce plants. The site qualifies as a Ramsar site for a number of reasons, as given below.

(1) Ramsar criterion 1: - The extent and diversity of saltmarsh habitat which across all five Ramsar sites in the Mid Essex Coast complex represents 70% of the saltmarsh in Essex and over 7% of the UK as a whole. The site supports an assemblage of important plants and animals which are listed in Table 9;

(2) Ramsar Criterion 3: - This site supports a full and representative sequence of saltmarsh communities covering the range of variation in Britain;

(3) Ramsar Criterion 6: - The site supports internationally important overwintering populations of dark-bellied brent goose.

Other notable areas of the Ramsar Site include the few areas of saltmarsh that have not been embanked, namely Woodham Fen, White House Farm and the upper reaches of Paglesham Pool, which include areas of uninterrupted transitional habitat from saltmarsh to grassland. Stands of saltmarsh formed in areas where the seawalls

have been breached, including Bridgemarsh Island, Brandy Hole and North Fambridge Marsh are also seen as important areas of saltmarsh.

Table 9: Important plants and animals recorded in Roach and Crouch Ramsar site.

Status	Common Name	Latin Name
Nationally scarce plants	Slender Hares Ear	Bupleurum tenuissimum
	Divided Sedge	Carex divisa
	Sea Barley	Hordeum marinum
	Golden-samphire	Inula crithmoides
	Lax-flowered sea-lavender	Limonium humile
	Curved Hard Grass	Parapholis incurva
	Borrers saltmarsh Grass	Puccinellia fasiculata
	Stiff Saltmarsh Grass	Puccinellia rupestris
	One flowed glasswort	Salicorni pusilla
	Small cord grass	Spartina maritima
	Shrubby sea-blite	Suaeda vera
	Sea clover	Trifolium squamosum
	Spiral tasselweed	Ruppia cirrhosa
Nationally important invertebrates	Emerald damselfly	Lestes dryas
	Shorefly	Parydroptera discomyzina
	Solider fly	Stratiomys singularior
	Solider fly	Stratiomys longicornis
	Large horsefly	Hybomitra expollicata
	Beetle	Graptodytes bilineatus
	Beetle	Malachius vulneratus
	Ground lackey moth	Malacosoma castrensis
	Moth	Eucosoma catoprana
	Roesel's bush-cricket	Metrioptera roeselii
Nationally Important birds	Hen Harrier (over wintering)	Circus cyaneus
	Ruff (over wintering)	Philomachus pugnax

The saltmarshes contain a range of characteristic species, progressing from the lower marshes (dominated by glasswort *Salicornia spp*., annual sea-blite *Suaeda maritima* and sea aster *Aster tripolium*), through to the higher areas (dominated by common saltmarsh-grass *Puccinellia maritima*, sea purslane *Atriplex portulacoides*, common sea-lavender *Limonium vulgare* and thrift *Armeria maritima*). At the uppermost tidal levels and on seawalls sea couch *Elymus pycnanthus* dominates.

Species found on the seawalls are typical of such areas, including plants such as narrow-leaved birds-foot-trefoil *Lotus tenuis* and grass vetchling *Lathyrus nissolia*. Overall, the species found in the grassy areas of the seawalls within the Ramsar are considered to be typical of those found in old improved grazing marsh.

The brackish borrow dykes and pools adjacent to the seawalls are listed as being fringed by stands of the sea club rush *Bolboschoenus maritimus* or the common reed *Phragmites australis* and lesser reedmace *Typha angustifolia*. Other species occurring across the area include the fennel pondweed *Potamogeton pectinatus* and the beaked tasselweed *Ruppia maritima*.

Foulness Ramsar

Foulness is located seawards of the Roach and Crouch, forming part of an open coast/estuarine system with grazing marsh, saltmarsh, intertidal mudflats and sandflats. A number of nationally rare and nationally scarce plants, together with nationally and internationally important populations of breeding, migratory and wintering wildfowl are found on the site. The site qualifies as a Ramsar site for a number of reasons, as given below.

(1) Ramsar Criterion 1: The extent and diversity of saltmarsh habitat, with all 5 Ramsar sites in the Mid Essex Coast complex represent 70% of the saltmarsh in Essex over 7% of the UK area. Further, the site supports a number of nationally rare and nationally scarce plant species, together with Red Data Book invertebrates, as summarised in Table 10.

(2) Ramsar Criterion 3: The site contains extensive saltmarsh habitat with some areas supporting full and representative sequences of saltmarsh plant communities.

(3) Ramsar Criterion 5: Over winter, the site supports an assemblage of wildfowl of international importance.

(4) Ramsar Criterion 6: The following waterfowl species occur at levels of international importance, as given below: bar-tailed godwit (overwintering); dark-bellied brent goose (overwintering); grey plover (overwintering); knot, (overwintering); oystercatcher (overwintering) and redshank (overwintering).

Other notable areas of the Ramsar Site include its mudflats, sandflats, saltmarsh, brackish water lagoon, freshwater and grazing marsh. The site includes both pioneer saltmarsh communities, with *Spartina maritima*, *Salicornia perennis* and *Suaeda vera*, together with mature saltmarsh, characterised by *Atriplex pedunculata*. Further habitat types present include species rich perennial saltmarsh and drift-like communities with *Suaeda vera* and *Zostera* beds. Areas of brackish water are dominated by *Bolboschoenus maritimus*, with grazing marsh dominated by *Alopecurus geniculatus*, *Hordeum secalinum* and fescues.

8.2.5 Sites of Special Scientific Interest

The Wildlife and Countryside Act 1981 (as amended by CRoW Act, 2000) provides the national framework for nature conservation in Great Britain. The Act provides for the designation and management of Sites of Special Scientific Interest (SSSI). The Crouch/Roach Estuaries SSSI and Foulness Island SSSI are located near the proposed realignment site and could therefore be directly or indirectly affected by the proposal. Further details about these sites are presented below.

Crouch and Roach Estuaries SSSI

The Crouch and Roach Estuaries SSSI includes areas of saltmarsh and mudflat in the Crouch and Roach, together with areas of grazing marsh and a freshwater reservoir. The site was notified in 1955 (with subsequent revisions). The intertidal area of the estuaries is relatively narrow, however it does support a significant number of birds together with the saltmarsh and grazing marsh and regularly supports internationally important numbers of wintering dark-bellied brent goose and nationally important numbers of black-tailed godwit, shelduck and shoveler. The site is also important for the assemblage of aquatic and terrestrial invertebrates and an outstanding assemblage of nationally scarce plants. Unit 44 of this SSSI extends along the length of the island's north bank. This 53ha area is considered to be in unfavourable and declining condition, due to the effects of coastal squeeze, which has been partly remediated by recharge works at its western end.

Table 10: Important plants and animals recorded within the Foulness Ramsar site.

Status	Common Name	Latin Name
Nationally Important	Pedunculate sea-purslane	Atriplex pedunculata
	Bermuda grass	Cynodon dactylon
	Slender Hares Ear	Bupleurum tenuissimum
	Divided Sedge	Carex divisa
	Sea Barley	Hordeum marinum
	Golden-samphire	Inula crithmoides
	Lax-flowered sea-lavender	Limonium humile
	Curved Hard Grass	Parapholis incurva
	Bulbous Meadow-grass	Poa bulbosa
	Annual beardgrass	Polypogon monspeliensis
	Borrers saltmarsh Grass	Puccinellia fasciculata
	Stiff Saltmarsh Grass	Puccinellia rupestris
	Spiral tasselweed	Ruppia cirrhosa
	One flowered glasswort	Salicornia pusilla
	Small cord grass	Spartina maritima
	Shrubby sea-blite	Suaeda vera
	Sea clover	Trifolium squamosum
	Suffocated clover	Trifolium suffocatum
	Dune Fescue	Vulpia fasciculata
	Narrow-leaved Eelgrass	Zostera angustifolia
	Dwarf eelgrass	Zostera noltii
Birds of National Importance	Avocet (breeding and overwintering)	Recurvirostra avosetta
	Common Tern (breeding)	Sterna hirundo
	Little Tern (breeding)	Sterna albifrons
	Sandwich Tern (breeding)	Sterna sandvicensis
	Black-tailed Godwit (overwintering)	Limosa limosa islandica
	Curlew (overwintering)	Numenius arquata
	Dunlin (overwintering)	Calidris alpina alpina
	Golden Plover (overwintering)	Pluvialis apricaria
	Greenshank (overwintering)	Tringa nebularia

Status	Common Name	Latin Name
	Hen Harrier (overwintering)	Circus cyaneus
	Little Grebe (overwintering)	Tachybaptus ruficollis
	Shelduck (overwintering)	Tadorna tadorna
	Spotted Redshank (overwintering)	Tringa erythropus
Nationally Important Invertebrates	Emerald Damselfly	Lestes dryas
	Moth	Aethes margarotana
	Ground Lackey	Malacosoma castrensis
	Large horsefly	Hybomitra expollicata
	Hoverfly	Lejops vittata
	Dance fly	Poecilobothrus ducalis
	Solider fly	Stratiomys longicornis
	Shorefly	Parydroptera discomyzina
	Hoverfly	Paragus albifrons
	Ground beetle	Tachys scutellaris
	Water beetle	Berosus spinosus
	Lagoon sand shrimp	Gammarus insensibilis

Foulness Island SSSI

The Foulness Island SSSI includes extensive intertidal sand/silt flats, saltmarsh, beaches, grazing marshes, rough grass and scrubland. It was notified in 1956 (with subsequent revisions) and includes a Local Nature Reserve at Shoeburyness. The site extends from the north shore of the Thames to the Crouch/Roach SSSI in the north. Its flats are of national and international importance as winter feeding grounds for nine species of wildfowl and wader, with the islands, creeks and grazing land forming an integral part of the site as sheltered feeding and roosting areas.

8.2.6 Local Wildlife Trust Sites

In addition to the nationally and internationally designated sites listed above, a number of local wildlife trust sites are also present in the Crouch and Roach estuarine system. Further details about these sites are presented below.

Lion Creek Wildlife Trust Nature Reserve

The Lion Creek Wildlife Trust Nature Reserve is a former creek located between Wallasea Island and the continuing southern bank of the Crouch covering some 16 acres. It has been cut off from the estuary by a seawall, being bounded by seawalls on 3 sides, and rough grassland with scrub. The creek contains brackish water and is host to numerous saltmarsh plants such as sea lavender, golden samphire and sea spurrey. The habitat grades to one that is less saline influenced with species such as: sea couch, false oat, birdsfoot trefoil and sea clover. Invertebrate species present include the Essex skipper and brown argus butterflies and the Roesel's and short winged conehead bush crickets. A number of birds are found to the margins, including hen harrier and short-eared owl.

Essex Wildlife Trust at Lower Raypits

The Essex Wildlife Trust at Lower Raypits is located just up estuary from Lions Creek. It includes saltings, permanent pasture and seawalls and lies primarily within the Crouch Estuary SSSI. The dykes and seawalls support nationally scarce plants such as: beaked tasselweed, sea barley, curved hard-grass and grass vetchling, with invertebrate species such as the scarce emerald damselfly and Roesel's bush-cricket, together with birds such as hen harrier and short-eared owl.

Blue House Farm

The Essex Wildlife Trust Reserve at Blue House Farm is a working farm, consisting primarily of coastal grazing marsh and arable land. The site is located just outside North Fambridge, on the north bank of the Crouch. It falls within both the River Crouch SSSI and the Essex Coast Environmentally Sensitive Area. The fields surrounding the farmhouse are used as winter feeding grounds for species such as brent goose and wigeon, with hares and skylark frequently seen. The deep water 'fleets' provide an important area for waterfowl including tufted duck, little grebe, teal and shelduck. Invertebrates found include the hairy dragonfly, scarce emerald damselfly, with mammals including water vole.

Woodham Fen

Further up-estuary at Woodham Fen is a further Essex Wildlife Trust Reserve. The site lies between two small creeks on the north bank of the Crouch, near South Woodham Ferrers. To the south of the site is saltmarsh, with a transitional zone to rough grassland to the north. The site has a wide range of saltmarsh species including sea wormwood, slender birds foot trefoil, grass vetchling, wild carrot and crested hair-grass. Numerous birds are found on the site, including: reed bunting, yellow wagtail, meadow pipit, teal, common and jack snipe, rock pipit and kingfisher.

8.2.7 Other Designations and Species Protection

Species Protected under the UK and EU Law

In addition to the protection afforded to habitats and species through the designation of sites for nature conservation some habitats and species that are afforded protection under the Wildlife and Countryside Act 1981, as amended, and under the Habitats Regulations. This is known to be a particularly relevant consideration for Area A which supports Avocets which are protected under Schedule 1 of the Wildlife & Countryside Act. This is because Area A has accrued ecological value following the construction of Wall A and the subsequent cessation of farming activities across this part of the site. A Phase 1 Habitat Survey of Area A carried out prior to construction (Posford Haskoning, 2001) of the new wall showed that, because the site was then predominantly farmland, only the seawall and the borrow dyke behind it that were of moderate wildlife value.

Common lizard (protected under Section 9 of the Wildlife and Countryside Act 1981) for instance was recorded on the seawall. Since construction of Wall A, the site has become a good location for breeding birds and in particular for breeding avocets and 12 occupied nests were recorded in May 2004 (Chris Tyas RSPB pers. comm.), which have colonised the scrape/lagoon habitats that were created within this area.

Essex Biodiversity Action Plan

Further non-statutory protections are afforded to UK habitats and species though the application of the Biodiversity Action Plan (BAP) which has been implemented to protect biodiversity in line with the 1992 Convention on Biological Diversity (CBD). The Essex BAP was issued in 1999 in response to the national biodiversity planning process and focuses on the issues relevant to Essex. The document covers 10 key habitat areas, 5 species of birds, 9 species of invertebrate, 6 species of mammal and 3 plant species.

Essex as a county has one of the highest population densities in the UK and has close links to London. There are pressures coming from the high population and also from industry and intensive agriculture. There are, however, numerous important habitats for wildlife in Essex, including the coasts, with the associated estuaries, inlets, creeks and coastal habitats ranging from saltmarsh, mud and sandflats, shingle and the associated coastal grassland, ditches, seawalls and borrow dykes. Within the Essex BAP, the following are potentially relevant to the Crouch/Roach area

(1) Cereal Field Margins: - The Cereal Field Margin habitat relates to the area of land between the field crop and the field boundary. Species associated with such habitat include the brown hare, pipistrelle bat, grey partridge, skylark, linnet, reed bunting, corn bunting, tree sparrow, turtle dove, broad–leaved spurge, corn buttercup, corn cleavers, cornflower, corn parsley, field gromwell, shepherds needle, spreading hedge-parsley and rough marshmallow.

(2) Brown Hare: - The brown hare has an Action Plan in Essex and is known to occur at Wallasea, having been spotted during the bird surveys

(3) Water Vole: - Water voles are found on the banks of slow flowing rivers, streams and ditches, together with still water such as lakes, ponds and dykes. No positive sign of water voles was noted during the site specific survey (EECOS, 2004)

(4) Reedbeds: - BAP reedbeds are defined as being dominated by *Phragmites* and covers both fresh and saltwater habitat. Reedbeds are a rare habitat in Essex and are generally found as isolated patches along the coast. Species known to occur in the habitat in Essex include the red databook flame wainscot, obscure wainscot, twin-spot wainscot and reed dagger. The

bearded tit and cetti's warbler are also confined to reedbeds. Areas of *Phragmites* have been found in the freshwater areas within Area A.

(5) Saline Lagoons: - Saline lagoons are essentially bodies, natural or artificial, of saline water partially separated from the adjacent sea. They retain a proportion of their water at low tide, and may develop as brackish, fully saline or hypersaline habitats. The flora and fauna of the lagoonal habitat is very specialised, reflecting the distinctive water chemistry, and 10 species of invertebrate and plant associated with lagoons are given special protection by the Wildlife & Countryside Act 1981.

(6) Fishers estuarine moth: - The species has only been recorded in the UK in Essex, with its distribution limited by the presence of its larval food – hogs fennel. No record of its presence was noted during the site specific surveys

(7) Grey partridge: - The species is the only native partridge in the UK, occurring in arable fields, rough pasture, heaths and moorland. The species has been found at Wallasea.

(8) Skylark: - The skylark is a common, widespread bird, found in a variety of habitats. It breeds on the ground. Its numbers have severely declined in recent years. The species has been found at Wallasea.

(9) Song thrush: - The song thrush is a common, widespread bird, found in a variety of habitats including woods, fields and gardens. There has been a steady decline in its numbers.

Essex Coast Environmentally Sensitive Area

The Essex Coast Environmentally Sensitive Area (ESA) extends over some 28,600ha of coastal grassland and associated arable areas of the estuaries and creeks of Hamford Water and the Rivers Stour, Colne, Blackwater, Crouch and Thames (in the vicinity of Canvey Island). The area supports extensive areas of grazing marsh and river valley grassland, together with a wide range of wildlife. Wallasea Island itself is not included in the ESA, although Foulness to the east, the Islands to the south, the land to the west and some of the land to the north is included.

8.3 Baseline Estuary Habitats

8.3.1 Introduction

From available information and the results of surveys undertaken specifically for this assessment (see Section 5.2) the following sections review the baseline ecological characteristics of the estuarine habitats surrounding Wallasea Island. This includes

the intertidal and subtidal habitats, saltmarshes, other coastal habitats and the fish populations of the Crouch and Roach Estuaries.

8.3.2 Estuarine Intertidal and Subtidal habitats

As described in greater detail within Section 6.1, the Crouch and Roach estuaries are 'canalised' systems characterised by narrow intertidal mudflats often flanked by reclaimed land and saltmarsh. The most extensive area of saltmarsh is at Fambridge and Bridgemarsh Island. The latter is a formerly reclaimed marsh but, since 1927, small breaches in the seawall have allowed flooding by seawater, so that it has reverted to saltmarsh with small areas of intertidal mud (Buck, 1993).

Intertidal habitats

The types of intertidal mudflat 'biotopes' (essentially distinct habitat types with associated invertebrate communities that are assigned distinct and descriptive MNCR codes according to Connor et al., 1997) in the estuaries have been described in previous NRA and EN surveys. The NRA surveys showed that there were three biotopes around Wallasea Island that are typical of estuarine mudflats. To the south east of Wallasea Island (North Horseshoe Corner), the biotope was LMU.HedOl (*H. diversicolor* (ragworm) and oligochaetes in low salinity mud shores), while to the north east of Wallasea Island (Wallasea Ness area) there was a slightly different species assemblage categorised as LMU.HedScr (*H. diversicolor* and *Scrobicularia plana* in reduced salinity mud shores). Just upriver along the Crouch (to the west of Wallasea), the biotope was LMU.HedMac (*H. diversicolor* and *M. balthica* in sandy mud shores).

The intertidal estuarine biotope distributions were described in more detail by EN (2000) and the resulting MNCR biotope maps are shown in Figure 15. These maps again show that the foreshore is a mixture of LMU.HedOl (on the north bank of Wallasea an on north bank areas of the Crouch in front of the proposed realignment site) and LMU.HedScr (on the eastern and southern banks). LMU.HedScr also occurs further upstream on the south bank of the Crouch while on the north bank the ragworm/oligochaete assemblage grades into SLR.EphX (ephemeral green and red seaweeds on variable salinity or disturbed eulittoral mixed substrata) due to changes in the substratum (these are sub-feature 'rock communities' of the cSAC). Towards the outer estuary at Foulness Island the intertidal, on both the north and the south banks of the Crouch, grades into LMU.HedMac (*H. diversicolor* and *M. balthica* in sandy mud shores).

Subtidal habitats

In contrast to the intertidal biotopes, the information on the subtidal habitats is only available for selected patches of the estuary (EN 2000) but around Wallasea Island the biotope IMU.AphTub (*Aphelochaeta marioni* (marine bristle worm) and *Tubificoides* spp. (oligochaete) in cohesive mud) has been recorded. This habitat is known to be

located at the mouth of the Roach Estuary and also across an area extending from the Essex Yacht Marina to approximately the area of Breach 1 (see Figure 15). This biotope is found in stable muds in both reduced salinity and fully marine conditions. Similar types of subtidal habitats may be present in patches in front of the realignment site and certainly the majority of the Crouch is believed to support this typical estuarine community (EN 2000). However the other biotope that is likely to be present is something similar to IMX.CreApH *(Crepidcula fornicata* (slipper limpet) and *A. marioni* in infralittoral mixed sediments*)* because it is also known, that mixed sediments are interspersed with muddy sediments throughout the Crouch (EN 2000) and the samples of the surface sediment, taken at three sites in this area during the bathymetry survey, showed that the seabed was composed of a well-mixed and relatively stable coarse-grained substratum (with a range of sand, gravel and shell sized sediments) rather then muds.

This biotope probably then changes towards the mouth of the estuary to something closer to IMX.Ost (*Ostrea edulis* (native oysters) on shallow sublittoral muddy sand) as wild oysters become more abundant. This increased oyster abundance is evidenced by the wild harvesting of this species that occurs across a large stretch of the outer Crouch from the northeast corner of Wallasea Island to the estuary mouth (see Section 9.1).

The status of the subtidal habitats in the Crouch has been reviewed by CEFAS who carried out a series of surveys relating to the distribution of infauna and epifauna following the decline in TBT concentration in the estuary (Rees et al, 1999, Waldock et al, 1999 and Rees et al, 2001). The studies showed that the Crouch supported a moderately diverse faunal assemblage including species such as. Ostrea edulis, *Crepidula fornicata*, *Carcinus meanas*, *Crangon crangon*, *Pagurus* spp. and *Asterias rubens*. Although TBT concentrations had declined, it was concluded that complete recovery had yet to occur although it was noted that there was an improvement in the numbers of periwinkle species and re-laid oysters that was attributed to the decline in TBT. In a separate study (Hiscock 1998) the numbers of invertebrate species (including Baltic tellins, slipper limpets, starfish, shore crabs and shrimps) were found to have increased from 37 to 63 from 1987 to 1992 and this was also linked to the TBT decline.

8.3.3 Intertidal Mudflats Surrounding Wallasea Island

The results of the June 2004 benthic survey provide a detailed, and quantitative, description of the intertidal invertebrate assemblages within the mudflat habitats around the island. The full results are presented in Appendix G and a summary of the invertebrate abundances at each of the survey locations (Site B1 to B7) is presented in Table 11. Figure 26 also shows the results of multivariate statistical analyses that were carried out on these data and which can be used to separate the sites into distinct biotopes.

Organisms abundance and habitat types

Table 11 shows that all the sites sampled have relatively impoverished (i.e. low numbers of species and low organism abundance) communities. This finding is expected and indicates that the sites are subject to 'stresses' induced by physical disturbance from tidal scour (NB in other estuarine habitat areas salinity changes can impose a comparable, but physiological, stress on communities but such variations do not occur at these sites). The highest organism abundance levels were observed at sites B5 and B6 which were situated in front of the proposed Breach 4 and in the Roach respectively. At these sites there is an organism abundance of around 25,000/m^2 which is a moderate abundance level when compared with larger more stable mudflat habitats that can often support in excess of 100,000/m^2. It is however, a comparatively high abundance in a local context and is considered to be indicative of the more sheltered and less physically disturbed conditions that exist in these areas (especially between the old and existing seawall at Breach 4).

Across the other more exposed sites (B1-B4 and B7) organism abundance is generally less than 3000/m^2 as a result of the physical disturbances caused by regular cycles of erosion and deposition under changing tidal conditions. The effects of scour at these sites is evidenced by the differences between those sites on the upper/middle shore areas (B1, B2, B6 and B7), where, typically, more stable conditions occur, and those at sites which are exposed to stronger tidal flows by virtue of being either on the low shore (Site B3) or in regions with a particularly narrow intertidal zone (Site B4). The upper/middle shore areas had organism abundance levels of around 2,500-3000/m^2 while the exposed area (Sites B3 and B4) had highly impoverished assemblages with only around 500-1000/m^2. The demarcation between the upper and lower shore occurs as a visibly distinct sediment change from soft but comparatively stable mud on the upper/middle shore to a soft fluid and mobile mud (that is a poor medium of the settlement and establishment of marine invertebrates) on the lower shore. This change in sediment type can be seen of photographs of the shoreline (see particularly Photos A and C in Figure 6).

The distinction between upper and lower will also be affected by the presence of the brushwood polders (see Photo C in Figure 6 or Photo A in Figure 7) that are in place specifically to create more stable conditions on the upper shore (and protect saltmarshes from erosion). On-site observations suggest that these areas will have similar invertebrate assemblage (with organism abundances of around 3000/m^2) to other upper shore areas. The distinction between upper and lower shore communities is only evident in areas to the west of Fleet Point (between Sites B3 and B4). From Fleet Point eastwards (and including Site B4) the mudflat is only present as a very narrow feature that will have an impoverished community similar to those at Sites B3 and B4 and which extends along the front of the saltmarsh area (Photo C in Figure 7). By Breach 4 (Site B5) there is almost no exposed mudflat present in front of the old seawall and, aside from a small patch to the east of Breach 4, none was visible during

the field survey which was undertaken on a moderate Spring Tide (See Photos B, C, E and F in Figure 10).

Table 11: Abundance (m^2) of benthic invertebrates at the intertidal sampling sites.

Taxa/Site Number	B1	B2	B3	B4	B5	B6	B7
Nemertea		1					
Nematoda	1		1	1	8	18	1
Eteone flava/longa (polychaete)	1		1		2	7	
Hediste diversicolor (ragworm)	24	20			5	47	38
Nephtys hombergii (polychaete)	2		4	1		4	
Pygospio elegans (polychaete)	2	42		3	44	16	
Streblspio shrubsoli (polychaete)	2		15	2		50	
Manayunkia aestuarina (polychaete)		1			6		
Heterochaeta costata (Oligochaete)							5
Tubificoides benedii (Oligochaete)	8				12	369	6
Tubificoides pseudogaster (Oligochaete)	3					5	
Enchytraeidae sp.. (Oligochaete)		3					6
Juv. Corophium sp. (mud shrimp)					2	4	1
Collembola sp.							1
Hydrobia ulvae (mud snail)		1		2	33		
Ventrosia ventrosa (mud snail)					1		
Retusa obtusa (gastropod)					2		
Juv. Tellinacea sp. (bivalve)	1				28		
Macoma balthica (Baltic tellin)						1	
Abra tenuis(bivalve)	9	1			395	3	
Scrobicularia plana (peppery furrow shell)	1				1	2	4
Abundance per site (3 cores)	54	69	21	9	538	526	62
Abundance per m2	2571	3286	1000	429	25667	25048	2952
No of taxa	11	7	4	5	13	12	8

MNCR biotope codes

In terms of the species composition and biotopes of these areas, they are very similar those biotopes already described by NRA and EN. However, because the sites are clearly subject to varying degrees of natural physical impacts, they do not form stable assemblage structures and as a result do not form clearly definable biotopes. In general terms however, almost all the upper shore sites (including Site B1, B2, B6 and B7) can be most closely likened to the biotope LMU.HedScr. Site B5 is distinct from the others by virtue of having a relatively high numbers of both molluscs (*S. plana*, *Abra tenuis*, Tellinacea sp., *H ulvae* and annelids (*P. elegans*, H. *diversicolor* and oligochaetes) and as such is similar to LMU.HedMac.Pyg (H. diversicolor, M. Balthica and *P. elegans* in sandy mud shores). The other, more exposed, upper shore sites were almost all annelid dominated (including *Streblospio shrubsolii*, *P. elegans* and *Nepthys hombergii*) with only occasion *S. Plana* and other mollusc and/or bivalve species.

The low shore communities (at Sites B3 and B4) were instead most closely associated with LMU.HedStr (polychaete community, including *Streblspio shrubsoli,* that is characteristic of strong tidal flows but low salinity variation). This low shore community has not previously been identified for the Crouch. These different community types are defined by the results of multivariate statistical analyses the plots produced from which are shown in Figure 26.

8.3.4 Saltmarshes on Wallasea Island's north bank

The intertidal areas around Wallasea Island have two large areas of Atlantic salt meadow (EN 2001). One lies between Overland and Grassland Points and the other is between Fleet and Ringwood Points (see Figure 3). The former is rich in sea purslane (*Atriplex portulacoides*), sea arrow-grass (*Triglochin maritimum*), annual sea-blite (*Suaeda maritima*), common sea-lavender (*Limonium vulgare*), lax-flowered sea-lavender (*Limonium humile*), golden samphire (*Inula crithmoides*), sea aster (*Aster tripolium*) and saltmarsh grass (*Puccinellia* spp.) (Posford Haskoning, 2001).

There are also areas of saltmarsh habitat between the existing and old seawall in front of Area B (an area previously recharged by dredged sediments). The habitats in front of Breach 4 to 6 were surveyed during the EECOS and ABPmer Surveys and the following was recorded: -

(1) Breach 4: - In front of this breach there is a small patch of sea purslane and common saltmarsh grass at the western end; a narrow strip of sea purslane along the base of the wall and an area of *Salicornia* (covered, at the time of survey, by a growth of *Enteromorpha* sp algae) at the edge of the central creek).

(2) Breach 5: - In front of this breach there is an enclosed area of middle to upper saltmarsh vegetation characterised by sea couch, sea purslane, common saltmarsh grass, shrubby sea blite, sea aster, golden samphire, cord grass, common sea lavender and lax flowered sea lavender. An area of glasswort was also evident towards an area of open mud.

(3) Breach 6: - This breach is fronted by a stand of saltmarsh to the west, a lagoon to the east. The saltmarsh area included sea aster, sea purslane, common and lax flowered sea lavenders, common saltmarsh grass, glasswort and greater sea spurrey.

8.3.5 Other estuarine habitats and species on north bank

The other major coastal habitats and species outside the boundaries of the realignment site (as defined by the existing seawall) are as follows:

Brankfleet Sand/Shingle Spit

The northeast corner of Wallasea Island (Wallasea Ness), there is a coarse sand and shingle spit feature (Brankfleet spit) that is know to be used by locals as an amenity area (see Section 12.2.4). No benthic samples were taken in this area as this habitat is not expected to support many invertebrate species, indeed large areas of it are expected to be essentially barren. The biotopes for this area are a mixture of LGS.BarSh (Barren Shingle or gravel shores) and LGS.BarSnd (Barren coarse sand shores) depending on the substratum. The vegetation in this habitat included sea rocket (*Cakile maritima*), sea beet (*Beta vulgaris* ssp. *Maritima*), annual sea blite (*Suaeda maritima*) and shrubby sea blite *Suaeda vera* (EECOS 2004).

The Concrete/Blockwork Seawall

Along the length of the site the base of the seawall has a dense covering of fucoid algae (predominantly *Ascophyllum nodosum* (95%) with occasional (5%) *Fucus vesiculosos*). Above this is a narrow band of typical upper shore species (*Fucus serratus and Pelvetia canaliculata)*. Immediately above this fucoid zone in some sections there is a band of *Enteromorpha* Spp. (opportunistic green algae). A few bushes of the nationally scarce shrubby sea blite and sea wormwood (*Seriphidium maritimum*) have been recorded in areas where the structure allows their growth (Posford Haskoning, 2001, EECOS 2004).

Saltmarsh creek mudflat

The results of the benthic survey (see Appendix G) show that at the two saltmarsh creek sites sampled (Site SM1 and SM2) there is a low number of species (just 4 or 5 taxa) at abundances that are similar to the adjacent upper shore habitats (i.e. around 3000-4000/m^2). The main species were ragworm (*H. diversicolor*) and the bivalve (*A. tenuis*). These low diversity, low abundance nature of these community types indicates that these sites (as with the other intertidal mudflat habitats) are subject physical stress/disturbance. This is confirmed by on-site observations that the surface sediments varied from soft fluid to more consolidated mud during different site visits. This these areas are subject to regularly changing sedimentation patterns and surface sediment conditions under different tidal and climatic conditions.

Saline Lagoon.

As noted in previous section, a lagoonal habitat is present in front of Area B (enclosed between the old and existing seawalls) with its western edge located at the centre of Breach 6. Surveys of the invertebrate fauna (Godfrey 2004) showed that this habitat supports typical marine invertebrate species such as: *Hydrobia ulvae*, *Alderia modesta* (sea slug), *Carcinus maenas* (shore crab) and *Idotea chelifer* as well as two species that were not found in aquatic habitats elsewhere on the site: *Melitta palmata*

(gammarid shrimp) and *Praunus flexuosus* (opossum shrimp). Further details about the aquatic inveterate at other locations within the site are presented in Section 8.5.6.

Estuarine Fish/Shellfish Populations

The Essex estuaries are known to support a range of fish species including: grey mullet, twaite shad, smelt, sprat, eels and flounder and in total 25 species have been recorded in the Crouch. Bass also spawn offshore and then complete their three-year development to adulthood within the estuaries (EN, 2000). However, it is notable that migratory species such as allis or twaite shad are not included on the cSAC citation nor are the Essex estuaries listed as having spawning populations of the allis or twaite shad (Maitland and Hatton-Ellis, 2003). The Roach or Crouch are not listed among the 78 rivers in England and Wales as salmon rivers that were identified in a recent joint EA and CEFAS as a potential salmon stock/fisheries (EA & CEFAS, 2003). The Crouch and Roach are both valuable estuaries in terms of theirs shellfishery resource (especially for *O. edulis* and *M. edulis* species*)* and further details about these populations and their associated fisheries are presented in Section 9.1.

8.4 Baseline Bird Populations

8.4.1 Introduction

Using available data as supplied by WeBS, BTO, RSPB and Scottish Power as well as results of surveys undertaken specifically for this assessment (see Section 5.2) the following sections review the baseline ornithological interests of the proposed realignment site and of the surrounding coastal habitats. For this review the following aspects are considered in turn:

(1) The winter roosting populations in the estuary and in Area B;

(2) The winter and spring waterbird populations in Area A;

(3) The winter and spring terrestrial populations in Area A;

(4) The breeding populations in Area A and B;

(5) The feeding populations in intertidal areas surrounding Areas A and B and across other estuarine areas.

8.4.2 Roosting populations in estuary

Roosting Populations Across SPA

The available WeBS core count data and waterbird abundances that are quoted within the SPA citations (for the Crouch and Roach and for Foulness) both describe the

abundance of waterbirds in the estuaries at high water (i.e. when roosting between tides). A summary of the published core counts, as presented in the latest WeBS annual reports (from Cranswick et al., 1997 Pollitt et al., 2003), is shown in Table 12 and includes the total annual abundance of birds in the estuary as well as the abundance of those species which, by virtue of being present at nationally or internationally important abundance levels, are also published in the annual report.

Table 12: Summary of WeBS core count information for the Crouch and Roach

	96-97	97-98	98-99	99-00	00-01	Average 96/97 to 00/01	Citation Abundance ◈
All waterbirds (total)	19,483	24,419	22,171	25,156	24,733	23,192	27,021
D-b brent goose ✚⦿	5,292	5,644	2,452	5,488	4,446	4,664	5,509
Black-tailed godwit ×	87	416	236	252	272	253	NA
Golden plover×	(890)	1,218	4,455	1,730	3,889	2,823	NA
Lapwing✱	(2,200)	7,440	5,696	5,962	6,537	6,409	NA

✚ = Overwintering species cited in Crouch and Roach SPA;
⦿ = Present in Internationally Important Numbers
× = Present in Nationally Important Numbers
✱ = Present in numbers of greater than 5000 in the absence of National Importance levels
◈ = Abundance as recorded in citation dated July 1998 (In latest accounts D-b brent goose = 3,074 and the total waterbirds not quoted as exceeding 20,000 - JNCC 2004a)

Table 12 shows that the Crouch and Roach have consistently supported over 20,000 waterbirds on an annual basis over the period from 1997-98 to 00-01. It also indicates that these estuaries support both internationally important numbers of dark bellied brent geese (as indicated in the SPA citation) as well as nationally important numbers of black-tailed godwit and golden plover. Lapwing are also quoted in the WeBS counts as they are present in abundances of more than 5000 birds.

Roosting Populations Across Middle/Outer Estuary

It is not possible, from the published data, to establish the roosting abundance of each species in the Crouch and Roach or to separately describe the Foulness site (beyond the information presented in the SPA/Ramsar citations (see Section 8.2). This is because the accounts are not published for species where they occur below levels of international, national importance or other threshold values. Furthermore, the annual reports do not separately present data for the adjacent Foulness area. Therefore, to provide a more detailed description of the roosting populations around the proposed realignment area, raw data for the Inner and Middle Crouch estuary WeBS count areas (see Figure 12 for map of area) were obtained from BTO. Also, the results of winter bird surveys on Wallasea Island that were undertaken by Natural Resources (on behalf of Scottish Power) were also collected.

Form the WeBS counts, Table 13 shows the peak monthly total for all species recorded in these areas between 1998 and 2003. In addition, Table 13 shows the maximum abundance of each species within these two count areas in any given month over the same five-year survey period.

Table 13: Peak monthly total for all species recorded in the Inner and Middle Crouch Estuary during WeBS core counts (1998 to 2003).

Year	Peak Monthly Total	Month of Peak	Spring Peak	Autumn Peak	Winter Peak
98/99	7610	(JAN)	405	1440	9042
99/00	7891	(JAN)	827	2769	9900
00/01	7816	(JAN)	1134	4478	9583
01/02	7079	(DEC)	N/C	3801	10846
02/03	10914	(FEB)	855	4345	12349
Mean	8262	NA	805	3367	10344

The results in Table 14 show that the main species roosting in these central sections of the Crouch include dark-bellied brent goose, lapwing, golden plover and black-tailed godwit (as also recorded in Table 12) along with large numbers (more than 1000 individuals present) of dunlin, wigeon, and teal (all with over 1000 individuals). The other species recorded in moderate numbers (close to or exceeding 100 individuals) were curlew, pintail, shelduck, mallard, coot, Canada geese, grey plover, redshank and oystercatcher.

Table 13 provides a good description of the recent trends in the Inner and Middle Crouch Estuary and shows that the peak numbers have increased over the five-year period described. The most recent survey peak values (for the 02/03 period) were around 130% of the values recorded in 98/99 (an increase of around 3000 birds). However, this information is not enough to conclude that the SPA is in a favourable condition (i.e. supporting a larger number of roosting birds than when originally cited. Indeed, the data for the whole estuary extends only to the 00/01 winter and at this time abundances were still lower than the original citation levels and so the SPA as a whole may be in unfavourable condition.

The WeBS survey data describe total bird abundances over the whole of each count sections and therefore cannot be used to identify the locations of, and bird abundances at, regularly used roost sites within these areas (Alex Banks BTO pers. com.). It is known though from the results of a survey of the Crouch and Roach that was undertaken in 1995/96 (Cranswick et al 1997) that flocks of lapwing and golden plovers roost to the west of Bridgemarsh Island; golden plovers also regularly use the Bridgemarsh area and another site on the north side of Foulness Island while grey plover were widespread in reasonable numbers with no specific roosting area. The specific roosting activities on Wallasea Island are reviewed below.

Table 14: Maximum monthly abundance of waterbird species in the Inner and Middle Crouch Estuary during WeBS core counts (1998 to 2003).

Species	Month	Year	Count	Species	Month	Year	Count	Species	Month	Year	Count
Waders				Wildfowl				Little Grebe	SEP	1999	11
Lapwing	JAN	1999	3165	Wigeon	FEB	2003	2687	Red-breasted Merganser	DEC	1998	8
Dunlin	JAN	2000	1650	Brent Goose (dark-bellied) ✚	JAN	2000	2010	Ruddy Duck	MAY	2000	6
Golden Plover	JAN	2002	1590	Teal	OCT	2001	1008	Bewick's Swan✕	MAR	2002	4
Curlew	JAN	2003	428	Pintail✕	DEC	2002	385	Garganey✕	MAY	1998	3
Redshank	SEP	2000	258	Shelduck	DEC	1999	277	Whooper Swan✕	FEB	2003	3
Black-tailed Godwit	JAN	2002	210	Mallard	JAN	2002	254	Black-necked Grebe✕	NOV	2001	2
Oystercatcher	MAR	2000	191	Coot	JAN	2001	175	Goosander	FEB	2002	2
Grey Plover	JAN	2000	122	Canada Goose	NOV	2001	148	Kingfisher✕	FEB	2003	2
Ringed Plover	OCT	1998	110	Shoveler	NOV	2001	91	Black Brant	NOV	2002	1
Snipe	DEC	2001	44	Greylag Goose✕	OCT	2000	78	Black Swan	AUG	2000	1
Whimbrel✕	MAY	1999	44	Gadwall	OCT	2001	46	Goldeneye✕	DEC	2001	1
Avocet✕	APR	2002	20	Moorhen	SEP	1999	34	Great Northern Diver✕	JAN	1999	1
Ruff⊙✕	SEP	1998	15	Cormorant	DEC	2001	30	Pink-footed Goose	DEC	2002	1
Turnstone	JAN	2000	14	Little Egret	SEP	2002	30	Red-throated Diver✕	JAN	2000	1
Common Sandpiper	MAY	2000	9	Mute Swan	OCT	2000	28	Spoonbill✕	DEC	2000	1
Greenshank✕	SEP	1998	8	Tufted Duck	MAR	1999	19	Water Rail	DEC	1999	1
Green Sandpiper	MAR	1999	6	Pochard	FEB	2001	18	Terns			
Spotted Redshank	JUN	1999	3	Barnacle Goose	MAR	2003	17	Common Tern	MAY	1999	12
Bar-tailed Godwit	OCT	2000	1	Grey Heron	AUG	2000	16	Arctic Tern	JUL	2000	2
Curlew Sandpiper	OCT	2001	1	Great Crested Grebe	MAR	2000	15	Little Tern✕	JUL	2000	1

✚ = Overwintering species cited in Crouch and Roach SPA;
⊙ = Overwintering species cited in Crouch and Roach Ramsar site;
✕ = Species listed under Schedule 1 of the Wildlife & Countryside Act 1981
NB These data give the maximum monthly abundance recorded over a 5-year survey period and are presented to indicate the relative abundance of the species that are present within the Inner and Middle Crouch Estuary areas only.

Table 15: Number of waterbirds in proposed Area B and Borrow Dyke B during Natural Resources high tide surveys (Sept 2003 to April 2004)

	23-35.9.03	7-8.10.03	28-29.10.03	11-12.11.03	19-20.11.03	3-4.12.03	19-21.12.03	4-7.1.04	23-24.1.04	5-6.2.04	25-26.2.04	8-9.3.04	4-5.4.04
Golden plover	118	2	99	2	116	23	73			86		10	
Ringed plover	14	119	45				116	42	44	79			
Lapwing	1		1	142	253		106			29		6	
Merlin						1							
Dunlin		28	63				345	287	17	246			
Turnstone		1		44	2		4	16	1	2			
Curlew			4		1	1	3	1		7			
Redshank			1	1	4	1	3	6	3	4			
Grey plover				2			22			7			
Black-tailed godwit					6	5	14						
Bar-tailed godwit						2	3						
Little Egret					1			2	4				1
Knot							1						
Oystercatcher										1			
Total	133	150	213	191	383	33	690	354	69	461	0	16	1

Table 16: Number of waterbirds in area 200m to south of proposed Borrow Dyke B during Natural Resources high tide surveys (Sept 2003 to April 2004)

	23-35.9.03	7-8.10.03	28-29.10.03	11-12.11.03	19-20.11.03	3-4.12.03	19-21.12.03	4-7.1.04	23-24.1.04	5-6.2.04	25-26.2.04	8-9.3.04	4-5.4.04
Golden plover			55				50						
Merlin	1												
Redshank										2			
Little Egret									1				
Total	1	0	55	0	0	0	50	0	1	2	0	0	0

Roosting Populations on Realignment Site

To provide a description of the roosting populations on Wallasea Island itself the results from the Natural Resources surveys that were taken specifically at high water during the 2003-04 winter are compiled in Tables 15 and 16. The first thing to note is that no waterbirds were recorded roosting within Area A and therefore the data presented in these two tables relate, respectively, to Area B and to the strip of land extending 200m to the south of the proposed Wall B alignment. The latter area was included as this strip of land could be affected by disturbance during either the construction of the new counter wall or the sediment recharge works.

Table 15 shows that between 0 and 690 birds were recorded in Area B during the 13 surveys undertaken. This represents approximately 3% of the total number of birds in the Crouch and Roach (based on the SPA citation) although many of these birds may well also be part of the much larger Foulness population. The most commonly recorded species were dunlin, golden plover, ringed plover and lapwing of which more than 100 individuals were regularly recorded (the maximum number recorded was 345 dunlin). Turnstone, grey plover and black-tailed godwit were also occasionally present at abundances of between 10 and 50. Other species such as bar-tailed godwit, redshank and curlew were incidentally present (i.e. <10 individuals occasionally observed. On two occasions flocks of around 50 golden plover were also recorded in the strip of land to the south of the Wall B alignment. No dark bellied brent geese were recorded (the only individual species identified within the Crouch and Roach SPA citation) although they are know to occasionally make use of winter wheat for feeding (Jeff Delve BTO pers comm.).

None of these species are present throughout all surveys and there are no discrete areas that are regularly used by those species that are recorded therefore, there does not appear to be a regularly used roost on this site over the winter period. There is a general trend for birds to preferentially use the north east corner of the island and areas behind the borrow dyke near the proposed Breach 4 location (Ringwood point). However, the adjacent fields are also occasionally used both at high tide and under other tidal conditions. The variability of their spatial distribution and the lack of any fidelity to a specific area is best illustrated by the maps shown in Appendix L.

These findings generally confirm observations that have been made by Jeff Delve (BTO surveyor pers com.). He has observed good numbers of lapwing (hundreds rather than thousands) and, occasionally, golden plover, although big flocks are generally found over Foulness. These species are occasionally joined by curlew and redshank on high tides but not as a regular high tide roost. Jeff also notes that the shingle bank at the point and the point itself usually holds 'tens' of Ringed Plover, oystercatchers and dunlin but that numbers rarely high.

Although no waterbirds were observed in Area A during these surveys, a nocturnal hen harrier roost was recorded at the centre of the fields Area A (east). Between 2 and 7

were observed here during the October to December surveys but there were only occasional sightings after this time.

8.4.3 Waterbird populations in Area A

The results of RSPB surveys describing the abundance of waterbird species in Area A during the winter (December 02 and 03 and February 03 and 04) and Spring (May and June 03 and 04) are shown in Tables 17 and 18 respectively.

Table 17: Waterbird species recorded in Area A during winter RSPB surveys

Bird Species	Dec-02	Feb-03	Dec-03	Feb-04	Maximum
Little egret	1		2	1	2
Grey heron	1		1		1
Shelduck◈			1	5	5
Wigeon			5		5
Teal			131	197	197
Mallard			58	4	58
Sparrowhawk			1	1	1
Hen harrier✚✱×	1			1	1
Ringer plover	15	11			15
Golden plover✱		32			32
Grey plover✱◈	2				2
Lapwing	146	185			185
Dunlin	8				8
Snipe	3	1	1	1	3
Curlew			3	2	3
Green sandpiper×	1		1		1
Redshank✱◈	9	2	7	4	9
Black-headed gull	1	15			15
Common gull	1	1			1
Total	189	247	211	216	

✚ = Overwintering or passage species cited in Crouch/Roach Ramsar
✱ = Overwintering or passage species cited in Foulness SPA
◈ = Overwintering or passage species cited in Foulness Ramsar
× = Species listed under Schedule 1 of the Wildlife & Countryside Act 1981

Table 17 shows that over winter Area A supports good numbers of both teal (during the 2002/03 winter) and lapwing (approx. 3% of the Crouch Roach Population during the 2003/04 winter cf. Table 12). During the spring there are good numbers (up to 41 birds) of avocets present as well as occasional shelduck (up to 8 birds), redshank (up to 10 birds). Of those species listed, five (hen harrier, golden plover, grey plover, redshank and avocet) are cited within the Foulness SPA. However, it is not possible, on present evidence, to determine whether birds using this area are additional to populations of the Crouch Roach or Foulness SPAs or are simply part of other SPA populations that have migrated into this area. However, it is certainly clear that as the habitats within the site (the water-filled scrape features particularly) have developed,

this site has encouraged waterbird species which (apart from lapwing) were not present prior to the construction of Wall A (Posford Haskoning 2001).

Table 18: Waterbird species recorded in Area A during the spring RSPB surveys

Bird Species	May 2003	June 2003	May 2004	June 2004	Maximum
Little egret				1	1
Mute swan			1	2	2
Shelduck	8	1	8	6	8
Gadwall			1		1
Mallard	7	3	17	8	17
Oystercatcher✱◈		2	3	1	3
Hen harrier×	1				1
Avocet⊙✱×	41	3	21	22	41
Lapwing		8		1	8
Ringed plover	2				2
Redshank✱◈	5	9	10	7	10
LBB gull				1	1
Black-headed gull	1	15	4	10	15
Total	65	41	65	59	

⊙ = UK Biodiversity Action Plan Species
✱ = Overwintering or passage species cited in Foulness SPA
◈ = Overwintering or passage species cited in Foulness Ramsar
× = Species listed under Schedule 1 of the Wildlife & Countryside Act 1981

During the spring months, the area supports good number of avocet in particular (see Table 18), with occasional shelduck and redshank on passage. Further details about the breeding bird interests over this Spring period are presented in Section 8.4.5.

8.4.4 Terrestrial populations in Area A

Area A has, since the construction of Wall A, improved greatly in value for a range of non-waterbird species. During the surveys undertaken before the construction of Wall A (Posford Haskoning study 2001) a number of species were found including the following BAP species: corn bunting, skylark, grey partridge and reed bunting. Other species recorded were: meadow pipit, red-legged partridge, yellow wagtail, twite, blackbird, chaffinch, house sparrow, wood pigeon, yellowhammer, goldfinch and starling.

The results from the RSPB surveys that were carried out after the Wall's construction are shown in Tables 19 (winter) and 20 (spring). These tables show that the site again includes skylark, reed bunting and corn bunting as well as linnet (another BAP species). None of the species are though, listed in the IUCN (International Union for Conservation of Nature and Natural Resources) Red Data Book. The development of the site for these species during winter months is evidenced by comparing the results from the winter 2002/03 (on average 133 birds recorded) and winter 2003/04 (on average 1060 birds recorded) periods. During the most recent winter visits (February 2004) significant numbers of: skylarks (161 birds), linnet (222 birds), reed bunting (118

birds) and corn bunting (94 birds) have been recorded. In view of these findings, RSPB consider this site to be "*as good as anywhere in the UK*" (Chris Tyas RSPB Pers Comm.) in view of the number and diversity of birds recorded during the 03/04 winter period.

Table 19: Terrestrial bird species recorded in Area A during winter RSPB surveys

Bird Species	Dec-02	Feb-03	Dec-03	Feb-04	Maximum
Feral pigeon			205	130	205
Stock dove	9		90	284	284
Wood pigeon		2	4		4
Pied wagtail	12		4		12
Skylark⊙	32	68	131	161	161
Meadow pipit	26	43	108	36	108
Rock pipit	1				1
Stonechat			2	2	2
Carrion crow		3	4	4	4
Starling	43		135	210	210
Linnet⊙		12	95	222	222
Goldfinch				1	1
Reed bunting⊙	5		29	118	118
Corn bunting⊙	9	1	48	94	94
Total	137	129	859	1262	
⊙ = UK Biodiversity Action Plan Species					

Table 20: Terrestrial bird species recorded in Area A during spring RSPB surveys

Bird Species	May 2003	June 2003	May 2004	June 2004	Maximum
Wood pigeon	3	12		27	27
Stockdove		21	164	37	164
Grey partridge◈			2		2
Kestrel				1	1
Pheasant	1				1
Red-legged partridge	2				2
Turtle dove				2	2
Swallow			5		5
Swift				2	2
Skylark◈	36	33	48	51	51
Meadow pipit			3	3	3
Yellow wagtail	6	10	4	5	10
Winchat	1				1
Sedge warbler	2		1		2
Whitethroat	3		2	3	3
Starling	2	55	6	98	98
Carrion crow		2	0		2
Linnet◈	8	28	20	11	28
Reed bunting◈	6	1	9	9	9
Corn bunting◈	23	6	137	11	137
Total	93	168	401	260	
◈ = UK Biodiversity Action Plan Species					

In the Spring months significant numbers of corn bunting (137 birds) and skylarks (51 birds) have been recorded and in the Spring 2004 another BAP species, grey partridge, was also identified on site (Table 20). There has also been an increase (approximately a doubling) in bird numbers over the Spring months from 93 and 168 birds in 2003 to 260 or 401 birds in 2004.

8.4.5 Breeding populations in Area A and B

During the RSPB spring surveys of Area A estimates were made of the number of breeding pairs of birds within the Area A site. These estimates are presented in Table 21. The results of the Natural Resources breeding birds surveys for Area A, Area B and the strip of land 200m to the south of the proposed Wall B alignment are shown in Table 22.

Table 21 shows that in Area A there were particularly good numbers of avocet (up to 12 pairs), skylarks (up to 51 pairs), linnet (up to 11 pairs), reed bunting (up to 9 pairs) and corn bunting (up to 18 pairs) all of which are BAP species. It is apparent that the avocets in particular have benefited from the development of the freshwater lagoons and the invertebrate prey species associated with these habitats (see Section 8.5.5). As a result nesting predominantly occurs around these lagoon/scrape features.

Table 21: Estimated numbers of breeding pairs during spring RSPB surveys

	Visit 1 2003	Visit 2 2003	Visit 1 2004	Visit 2 2004	No. Pairs 2003	No. Pairs 2004
Shelduck			8	6		4
Mallard			17	6		3
Grey partridge			2			1
Red-legged partridge	1				1	
Oystercatcher✱◈		1	3	1	1	2
Avocet⊙✱◈×	2		21	22	2	12
Ringed plover	1				1	
Redshank✱◈	?	1	10	7	1	6
Skylark⊙	36	33	48	51	35	51
Yellow wagtail	5	7	4	5	6	5
Sedge warbler	2	?	1		2	1
Whitethroat	3	?	2	3	3	3
Linnet⊙	6	15	20	11	11	11
Reed bunting⊙	4	1	9	9	3	9
Corn bunting⊙	11	6	18	11	9	18
Total	71	64	163	132	75	126

⊙ = UK Biodiversity Action Plan Species
✱ = Overwintering or passage species cited in Foulness SPA
◈ = Overwintering or passage species cited in Foulness Ramsar
× = Species listed under Schedule 1 of the Wildlife & Countryside Act 1981

The results in Table 22 confirm the importance of Area A as a breeding bird site and identify a total of 85 breeding territories across this area. The table also indicates that

there are breeding bird territories across Area B. In particular, territories for corn bunting (12 territories), skylark (6 territories) and yellow wagtail (6 territories), of which the former two are BAP species, are scattered throughout the area. Other species such as pheasant, redshank, meadow pipit, mallard and reed bunting are largely confined to the field margins near the borrow dyke. Maps showing the distribution of the breeding bird territories are presented in Appendix L.

Table 22: Numbers of breeding territories during the Natural Resources surveys

	Area A (west)	Area A (east)	Area B and Borrow Dyke	200m zone south of Area B
Avocet⊙✱◈×	2	8		
Corn bunting⊙	2	9	12	5
Lapwing		2		
Linnet⊙		2		
Mallard			1	
Meadow pipit	2		4	
Pheasant		1	1	
Red legged partridge		1		
Redshank✱◈	4	6	4	2
Reed bunting⊙	2	10	6	2
Reed warbler		1		
Ringed plover		3		
Sedge warbler		2		
Skylark⊙	5	25	16	6
Whitethroat		5		
Yellow wagtail	2	1	13	4
Total	**19**	**76**	**58**	**19**

⊙ = UK Biodiversity Action Plan Species
✱ = Overwintering or passage species cited in Foulness SPA
◈ = Overwintering or passage species cited in Foulness Ramsar
× = Species listed under Schedule 1 of the Wildlife & Countryside Act 1981

8.4.6 Distribution across intertidal areas

To illustrate the value to waterbirds of the estuarine intertidal habitats as low water feeding sites, the distribution maps produced following the 1995-96 BTO low water survey of these estuaries are shown in Appendix L. These maps are reproduced from both a summary review of this survey as presented in the WeBS annual report (Cranswick et al, 1997) and from the more detailed studies that were undertaken as part of the Lappel Bank compensation site selection process (BTO, 2003). They describe the general distribution of the following species: curlew, dark-bellied brent goose, dunlin, grey plover, lapwing, oyster catcher, redshank, ringed plover and shelduck.

To also quantify the abundance of waterbirds in the mudflat areas immediately surrounding the realignment site, the raw BTO data for the relevant count sections were obtained and these are summarised in Table 23. The relevant count sections are illustrated in Figure 12 and the raw data are shown in Appendix L.

Intertidal areas surrounding realignment site

The results in Table 23 show that the foreshore immediately in front of the realignment site (i.e. count sections DR023 and DR024) support very few feeding waders (only 3 birds recorded) with only incidental occurrences of redshank and curlew. In the case of DR024 this is because there is very little intertidal mudflat present in this area and, as described above, the Brankfleet Shingle/Sand Spit which occurs in this count area is likely to be essentially barren in terms of waterbird prey species. Similarly, there is only a narrow intertidal zone within count sections DR023 and this is a physically affected by erosion/deposition cycles and as a result it supports only a low abundance of infaunal invertebrate prey species (as described in Section 8.3.3). However, it is known that the mudflat area in front of the proposed Breach 4 does have moderate numbers of prey species that may support some wader species but there is no evidence of this from these BTO surveys.

The intertidal areas of the north bank of the Crouch from Burnham-on-Crouch to the area opposite the mouth of the Roach supports greater numbers of waterbirds in particular dark bellied brent goose (357 birds), shelduck (93 birds), dunlin (279 birds) and occasional redshank, ringed plover and grey plover. The 345 dark bellied brent goose individuals in area DR003 represent 11% of the Crouch Roach SPA population of this species and 1.3% of the combined Crouch/Roach and Foulness SPA population). In total the number of all waterbirds at these two low water sections represented around 3% of the Crouch Roach Estuary SPA (based on the July 1998 citation).

In the outer sections of the Roach to the east of Wallasea Island (between Wallasea and Foulness) there were again good numbers of dark bellied brent goose (300 birds or 9.7% of the Crouch Roach SPA population of this species). There were also good numbers of dunlin (80 birds) and lapwing (86 birds) on the Wallasea side of the channel and low numbers on both banks of shelduck, curlew, grey plover, redshank (the latter two being SPA interest species of the Foulness SPA. In total the number of all waterbirds at these two low water sections represented around 2% of the Crouch Roach Estuary SPA (based on the July 1998 citation) and 0.4% of the Crouch/Roach and Foulness SPAs (the DR027 and DR041 sites includes both SPA areas).

Table 23: Peak abundance (density/ha) of waterbird species in BTO low water count sections around Wallasea Island and across whole estuary.

	Crouch north bank		Crouch south bank		Roach west bank	Roach east bank (Foulness)	Total in Crouch and Roach Estuaries
Species/Count Area	DR003	DR004	DR023	DR024	DR027	DR041	
Dark bellied brent goose✚✱	345 (20.3)	12 (0.6)				300 (12.5)	2555
Shelduck✱	67 (2)	26 (1.4)			10 (0.3)	13 (0.5)	1383
Grey plover✱	3 (0.2)				2 (0.06)	1 (0.04)	216
Dunlin✱	124 (7.3)	155 (6.1)			81 (2.4)	2 (0.08)	5923
Redshank✱	12 (0.47)	15 (0.6)	2 (0.1)		9 (0.2)	3 (0.13)	1100
Ringed plover		3 (0.1)					93
Curlew✱			1 (0.05)		4 (0.09)	1 (0.04)	275
Lapwing					86 (2.5)		1313
Oystercatcher✱					1 (0.03)		128
Cormorant		1 (<0.1)					48
Teal					4 (0.1)		986
Total no. in all survey areas	763		3		517		14020
% Crouch and Roach SPA◈	2.8		0.01		1.9		52%
% Crouch/Roach & Foulness SPA⊙	0.6%		0.02%		0.4%		10%

✚ = Overwintering species cited in Crouch and Roach SPA and Ramsar
✱ = Overwintering or passage species cited in Foulness SPA and Ramsar (included because birds feeding in the Crouch and Roach could be part of either the roosting Foulness population).
◈ = 27,021 in Crouch Roach citation of July 1998 (see Section 8.2.2)
⊙ = 134,489 (107,468 Foulness plus 27,021 in Crouch Roach citation of July 1998 see Section 8.2.2)

Intertidal areas in other parts of the estuaries

The summary review of the BTO low water surveys (Cranswick et al, 1997) shows that dark-bellied brent geese were the most abundant species and were mainly observed at Brandy Hole Creek (up river on the Crouch), Long Pole Reach (between North Fambridge and Bridgemarsh Island), Bridgemarsh Island, the confluence of the Crouch and Roach (specifically the north bank of the Crouch and the western bank of Foulness as described above) and Paglesham Reach. The study also found that while average maximum number of roosting brent geese in the Crouch and Roach during core counts is around 5,000 (see also Table 12) only a third of these (mean of 1,820 birds) were recorded at low water. This was thought to be because many geese were feeding in the fields and not on the shoreline and those geese that were recorded in intertidal were not usually observed feeding but were instead bathing or preening.

Black-tailed godwits (average of 50 birds only) were generally recorded in lower number than expected based on the core counts and were found primarily at Clementsgreen Creek (near South Woodham Ferrers) and Paglesham Reach (see Appendix L). The other species recorded across the estuary includes shelduck (widely distributed with high densities at Bridgemarsh Island at Clementsgreen Creek and

much of the Roach); dunlin (the most numerous species recorded with almost 5,000 birds, primarily to the south of Bridgemarsh Island); wigeon and teal (both along north shore of Crouch upstream of Bridgemarsh Island) and small numbers of pintail (all around Bridgemarsh Island).

By comparing the quantitative data presented in Table 23 and the maps in Appendix L it is possible to also make a semi-quantitative estimate of the waterfowl populations at low water across the different regions of the estuary (especially those upstream and downstream sections of the Wallasea Island north bank area that could be indirectly affected by the proposed realignment). The waterbirds recorded in these areas were as follows (NB abundance values are very approximate): -

(1) North bank of Foulness. Curlew (approx 30 birds), dunlin (approx 80 birds) and occasional dark-bellied brent goose, redshank and shelduck (1 or 2 birds);

(2) North bank of the Crouch, opposite Foulness. Dunlin (approx 80 birds) ringed plover and shelduck (both approx 10 birds) occasional curlew and redshank (1 or 2 birds);

(3) Lions Creek (between Wallasea and Paglesham, closed entrance to the Crouch) lapwing, redshank, shelduck and curlew (all approx 10 to 20 birds) with occasional grey plover (1 or 2 birds);

(4) Paglesham Pool (between Wallasea and Paglesham, opening into the Roach) Shelduck (approx 100-200 birds), curlew (approx 5 to 10 birds), dunlin and redshank (both approx 40 birds) and occasional grey plover (1 or 2 birds);

(6) River Roach, north and south banks to south of Wallasea Island. Shelduck, curlew (approx 200-400 birds), dark-bellied brent goose and dunlin (both approx 40 birds) and occasional oystercatcher and grey plover (1 or 2 birds);

The upstream sections of the Roach (above the confluence with Paglesham creek) also support large numbers of dunlin, redshank shelduck curlew, dark-bellied brent geese and lapwing with moderate numbers of oystercatcher and grey plover (see Appendix L).

8.5 Baseline Habitats within Proposed Realignment Site

8.5.1 Introduction

From the results of the habitats survey (EECOS 2004); the invertebrate survey (Godfrey 2004) and the results of surveys undertaken prior to the construction of Wall A (Posford Haskoning, 2001) the following sections review the following baseline habitat characteristics of the proposed realignment site

(1) The habitats and scarce plants within the realignment area;

(2) Protected Species;

(3) Terrestrial Invertebrate Species;

(4) Freshwater/Brackish Water Invertebrates and

(5) Potential Saline Lagoon Species.

8.5.2 Habitats and Plants within the Proposed Realignment Area

A Phase 1 Habitat Survey of Area A was carried out prior to construction of the new wall (Posford Haskoning, 2001). During this survey, the presence or otherwise of protected or Biodiversity Action Plan species was noted and particular, attention was paid to the potential for the area to provide habitat for reptiles, together with the conservation value of the borrow dykes and associated ditches. The survey found some 90 specified habitat types but as the site was predominantly farmland it was only the seawall and the borrow dyke behind it that were considered to be of moderate wildlife value.

The old seawall fronting Area A was found to be covered by species poor grassland, dominated by the sea couch (*Elytrigia atherica*), sea beet (*Beta vulgaris*), hoary cress (*Lepidium draba*) and false oat grass (*Arrhenatherum elatius*) seawards. The species composition shifted on the landwards side, to the common couch (*Elytrigia repens*) and creeping bent (*Agrostis stolonifera*). A number of species were identified in the grassland, including the nationally scarce roesels bush cricket (*Metrioptera roeselii*), the nationally scarce long-winged conehead (*Conocephalus discolor*) and the spider (*Agalenatea redii*). In addition, a small number of the common lizard (*Lacerta vivipara*) (protected under Section 9 of the Wildlife and Countryside Act 1981) were recorded on the seawall.

Behind the seawall the berm (strip of grassland backed by a borrow dyke) was found to have primarily the same grassland species as the seawall, with an influence from the borrow dyke due to periodic immersion. Species found included sea couch, annual sea-blite and sea aster, with sea barley (*Hordeum marimium*) found in a localised area. The borrow dyke itself was dominated by sea couch along its margins, with sea club-rush (*Scirpus maritimus*). Areas of saltmarsh were present, including the common cord-grass (*Spartina anglica*), lesser sea spurrey (*Spergularia marina*), shrubby and annual sea-blite, common and lax-flowered sea lavender, sea aster, golden samphire and perennial glasswort (*Salicornia perennis*). In areas of fresher water, the common reed (*Phragmites australis*) was dominant. Attempts were made to determine the presence of the rare Scarce Emerald Damselfly (*Lestes dryas*), but no specimens were

found during this baseline survey. At this time the land to the rear of the borrow dyke was at that time arable farmland, with little conservation value.

The recent RSPB and EECOS surveys have shown that, under existing conditions, Area A comprises between 5-20% ponded water (including the water-filled scrapes, drainage ditches and the borrow dyke behind the seawall) depending upon the seasonal and the climatic conditions with the surrounding land being either exposed mud or the growths/stubble of remnant farmed plants (Chris Tyas RSPB pers comm.). The EECOS surveys also showed that there were a number of cultivated species such as garden pea, wheat and rape with the remainder of the vegetation tending to be 'weedy' but flower rich 'tall ruderal' habitat, attracting a number of insects as well as providing seed for birds. Towards the seawall in Area A (west) the seasonal, shallow pools (i.e. the scrape excavated during the construction of Wall A) supported a range of species including: - reedmace (*Typha latifolia*), sea club rush (*Scripus maritimus*) and saltmarsh rush (*Juncus gerardii*).

During the EECOS habitat surveys several nationally scarce species were identified and these are listed in Table 24 and the survey target note locations for these species are illustrated in Figure 28. The assemblages of nationally scarce species found were considered to be important, with several being very abundant within the study site although each species is reasonably distributed along the Essex coast. No nationally rare (i.e. red data book) plants were recorded during the survey.

Table 24: Nationally scarce (and Ramsar-cited) plant species recorded in the site

Scientific Name	Common Name	Location at Wallasea
Puccinellia rupestriss	Stiff saltmarsh-grass	Lower seawall seepages
Hordeum marinum	Sea barley	Lower seawall seepages
Parapholis incurva	Curved hard-grass	Lower seawall seepages
Bupleurum tenuissimum	Slender Hares-ear	Bare ground near seepages
Trifolium squamosum	Sea clover	Throughout lower folding
Suaeda vera	Shrubby seablite	Base of outer wall face
Inula crithmoides	Golden samphire◈	Saltmarsh
Limonium humile	Lax-flowered sea lavender◈	Saltmarsh
NB - All these species are interest features for the Crouch and Roach Ramsar site ◈ = Also recorded by Posford Haskoning (2001)		

8.5.3 Protected Species

During the Posford Haskoning 2001 survey the presence of protected species such as water vole (*Arvicola terrestris*), badger (*Meles meles*), common grass snake (*Natrix natrix*), adder (*Vipera berus*), common lizard (*Lacerta vivipara*) and slow worm (*Anguis fragilis)* was investigated. No conclusive evidence was found for the presence of water vole and no evidence was found of badgers (with the area considered to be unsuitable for this species). Common lizard were through, recorded on the seawall and it was considered that the seawall is likely to support moderate populations of slow worms.

During the 2004 reptile survey (EECOS 2004) both common lizard (*Lacerta vivipara*) and adder (*Vipera berus*) were recorded. Of these species, adders were only observed on four occasions and instead the vast majority of sightings were of common lizard (126 records in total). The location of the sightings is illustrated in Figure 29 and this figure shows that common lizard were well distributed across the seawall, with a limited colonisation of the field margins and fallow areas landward of the borrow dykes. Of the adder sightings, two were on the eastern half of the seawall with the remaining two being on the grassy margins of the arable fields, inside the borrow dykes. No signs of badger or water vole activity were recorded during this survey.

In addition to these two reptile species, the site also supports hare populations. At least one or two hares are usually observed during the RSPB surveys and ABPmer site visits. This species is not protected under the Wildlife and Countryside Act but is a biodiversity action plan species.

8.5.4 Terrestrial Insect Species

The terrestrial insect survey of the site was carried out on 11 June 2004 (Godfrey, 2004) which included a sample taken by sweep net at five locations across the realignment site Area A. Table 25 presents a summary of the species found.

Table 25: Terrestrial insects recorded during sweep-netting survey

Common Name	Latin Name
Lacewing	Chrysopa carnea
Red-tipped flower beetle	Malachius bipustulatus
Ladybird	Coccinella septpunctata
Soldier fly	Chloromyia formosa
Soldier fly	Nemotelus nigrinus
Robber fly	Dioctria atricapilla
Robber fly	Dioctria rufipes
Dance fly	Platypalpus pallidiventris
Dance fly	Empis livida
Dolichopodid fly	Chrysotus gramineus
Hoverfly	Eupeodes luniger
Gall fly	Urophora quadrifasciata
Picture Winged Fly	Melieria picta
Fly	Dicraeus vagans
Fly	Rhopalopterum sp
Fly	Ceratinostoma ostiorum
Fly	Fannia hamata
Fly	Coenosia antennata
Fly	Craspedochaeta confusanea
Seedcorn maggot	Delia platura

None of the species listed in Table 25 are protected under the Wildlife and Countryside Act although *Melieria picta* and *Coenosia antennata* are considered to be notable. On the basis of the survey results overall though, the areas of the seawall, freshwater

lagoons and borrow dyke areas were considered to be of high value as terrestrial habitats for insects.

During the habitat survey (EECOS 2004) the further important insect species were found. These included two soldier flies, the nationally scarce *Stratiomys singularior* (a notable species undergoing a range expansion at present) and the Red Data Book Category 2 (vulnerable) *Stratiomys longicornis* (with coastal Essex being a stronghold for the species). Several nationally scarce mining bees were noted, all of which are generally present in suitable habitat along the Essex coast. The nationally scarce spider hunting wasp (*Priocnemis gracilis*), which is rare in Essex, was also recorded, with seawalls considered to be an important habitat for the species. The most important bee recorded was considered to be the carder bumblebee (*Bombus muscorum*). Although not nationally threatened, the species has undergone rapid decline in recent years. It was observed on large patches of sea clover and is a new area record for the species.

8.5.5 Freshwater/Brackish Water (inc. Borrow Dyke) Invertebrates

The results of the aquatic invertebrate survey show that the species composition of the invertebrate assemblages varies across the site due to changes in the salinity conditions and associated salinity tolerance of the insect species. Across the 40 sites sampled the salinity levels in the borrow dyke varied greatly from almost fully saline conditions (salinity 32) in Area A to essential freshwater conditions in Area B (see Figure 29). This is due to the intrusion of seawater in Area A (especially at the sluice near the proposed Breach 3). The scrapes/lagoons in Area A also had a variable salinity levels which is presumed to be dependant upon their connectivity with the borrow dyke and associated drainage ditch network. It should be noted however that the results in Figure 29 reflect the conditions at the time of survey and it is likely that the habitats are often more saline than indicated. This is especially true for the borrow dyke on the north bank of Area B which support distinctly brackish water saltmarsh and invertebrate species so must be subject to regular saline intrusion. The sediments of the borrow dykes behind Breach 4 for example are known to support invertebrate species that are indicative of fully marine, and organically enriched, coastal mudflat. These species include: *Tubificoides benedii*, *Capitella capitata*, *Streblospio shrubsolii*, *Pygospio elegans* and *Hediste diversicolor* (ragworm). These were recorded at Site BD1 (see Figure 17 and Appendix G) during the benthic invertebrate survey. Salinity does however decrease and turn from variable saline/brackish water to freshwater along the east bank of the island. This is confirmed by the changing invertebrate assemblages at Sites 38, 39 and 40 which were located in the borrow dyke in this area (Figure 29).

The number of species/taxa recorded at each of the sample sites is shown in Figure 30. This plot shows that site located in the Area A borrow dykes (Sites 1-10) had between 5 and 11 taxa. These habitats supported four Nationally Scarce species (*Enochrus bicolor*, *Ochthebius auriculatus*, *Agabus conspersus* and *Stratiomys*

singularior) and three saline lagoon species (*Hydrobia ventrosa*, *Idotea chelifer* and *Agabus conspersus*). The borrow dykes in Area B, which were covered by Sites 24-26, 28, 29, 32, 33 and 38-40, had between 5 and 9 taxa with two Nationally Scarce (*Ochthebius auriculatus* and *Enochrus bicolour*) and the same saline lagoon species as in Area A. These species were recorded from Sites 24 to 39 (which is subject to varying degrees of saline intrusion). At site 40, however, where the salinity was lowest, the greatest number of taxa (16) was recorded and this included a good number of scarce and notable species (*Agabus conspersus, Berosus signaticollis Cercyon sternalis, Enochrus halophilus, Ochthebius auriculatus*).

With respect to the field drain sites, these were divided into three types depending upon the degree of management/intervention to which they are subject which, in turn, appears to have affected the number of taxa and the importance of the community. The most species-poor sites were the managed drains in Area A (Sites 15-17) that had no marginal or emergent vegetation, with straight courses and little habitat variability and these supported only between 2-5 species none of which were nationally scarce. The most species-rich locations were the unmanaged weed-choked drains in Area A (Sites 18, 21 and 22) with between 16-20 taxa including seven nationally scarce species. The third type was the agricultural field drains in Area B which are surrounded by arable crops and had intermediate species richness with between 6-9 species including two nationally scarce species.

To summarise these results the rare or uncommon species were recorded during the surveys are listed below in Table 26. These include one BAP species, three red data book species and several notable species. No species listed under Schedule 5 of the Wildlife and Countryside Act, 1981 were found.

8.5.6 Saline Lagoon

In addition to surveying the sites within the proposed realignment, the saline lagoons outside the existing seawall (at and near Breach 6) were also sampled. As well as providing information about the value of this habitat, which will be affected by the creation of Breach 6 it also helps to describe the potential future species composition of the scrapes and lagoon within the site after realignment when they will be subject to regular tidal inundation.

The sites in this habitat (Sites 34-37) had between 4-14 taxa with the highest number of species occurring to the east of the site where the beach is present and thus there is a greater habitat diversity. No nationally scarce species were recorded and *Idotea chelifer* was the only saline lagoon species. These lagoons are of interest for their invertebrate fauna, which included species not found elsewhere on the site such as the gammarid shrimp *Melitta palmata* and the opossum shrimp *Praunus flexuosus*

Table 26: Rare or uncommon species recorded during aquatic invertebrate surveys.

Order/Species	Family	Common Name	Status⊙
Odonata			
Lestes dryas◈★	Lestidae	Scarce Emerald Damselfly	RDB2
Coleoptera			
Agabus conspersus	Dytiscidae	Water beetle	Notable Cat. B
Coelambus confluens	Dytiscidae	Water beetle	Notable Cat. B
Berosus affinis	Hydrophilidae	Water beetle	Notable Cat. B
Berosus signaticollis	Hydrophilidae	Water beetle	Notable Cat. B
Cercyon sternalis	Hydrophilidae	Water beetle	Notable Cat. B
Enochrus bicolor	Hydrophilidae	Water beetle	Notable Cat. B
Enochrus halophilus	Hydrophilidae	Water beetle	Notable Cat. A
Ochthebius auriculatus	Hydrophilidae	Water beetle	Notable Cat. B
Ochthebius punctatus	Hydrophilidae	Water beetle	Notable Cat. A
Diptera			
Stratiomys singularior◈	Stratiomyidae	Rare soldier fly	Notable
Dolichopus strigipes	Dolichopodidae	Long legged fly	Notable
Poecilobothrus ducalis	Dolichopodidae	Dance fly	RDB2
Thinophilus ruficornis	Dolichopodidae	Fly	Notable
Dorycera graminum	Ulididae	Picture Winged Fly	Priority BAP & RDB3
Melieria picta	Ulididae	Picture Winged Fly	Notable
Coenosia antennata	Muscidae	Fly	Notable
Lispe loewi	Muscidae	Fly	Notable

◈= Cited as nationally Scarce in Crouch Roach Ramsar
★ = Also recorded during EECOS surveys (2004) (NB the Ramsar-cited Solider fly S. longicornis also recoded by EECOS)
✚ = Also recorded during Posford Haskoning surveys (2001) (NB the Ramsar-cited Roesel's bush-cricket M. roeselii also recoded by Posford Haskoning)
⊙ - NB see glossary at start of report for definition of status terms

8.6 Impact Assessment

8.6.1 Key Issues

Within the Scoping Report the impact pathways by which the proposed realignment scheme could potentially affect nature conservation and ecological interests were identified as follows: -

(1) The direct effects on marine, terrestrial, freshwater and brackish water habitats and species at the realignment site (particularly protected species on interest features of the designated sites in the Crouch and Roach) as a result of the construction (wall construction, sediment recharge and breaching) and 'operational' (tidal inundation, coastal habitat creation and site management) phases of the proposed realignment.

(2) The indirect impacts to marine habitats and species in the estuary outside the realignment site (particularly the interest features of the nationally and internationally designated sites of the Crouch and Roach), as a result of the inundation of the site and the subsequent physical changes within the estuarine system.

(3) The potential impacts from changes in water and sediment quality within the estuary following realignment

(4) The effects on breeding and overwintering/passage bird populations during the construction and operational phases of the proposed scheme.

The effects occurring via these impact pathways are reviewed below based on a detailed understanding of the baseline conditions (as described above) and the results of the hydrodynamic modelling work. For this review consideration has been given to EN advice under Regulation 33 of the Habitats Regulations (EN 2000). Under these Regulations English Nature is required to provide advice to other relevant authorities as to the conservation objectives of European Marine Sites (such as the Essex Estuaries) and the operations that may cause deterioration to the site.

8.6.2 Impact 1 Direct effects on habitats and species

Pathway

The direct effects on habitats and species at the realignment site (particularly protected species on interest features of the designated sites) as a result of the construction and 'operational' phases of the proposed realignment.

Impact Extent and Characteristics

The direct effects of the proposed realignment on the extent of designated habitats at the realignment site were calculated using GIS mapping techniques. These changes in extent (expressed in hectares) are shown in Table 27 and include the habitats lost and altered by the scheme as well as those created for mitigation. It also includes the extent of the new habitats to be created (mudflat, saltmarsh, grassland) although these cannot be viewed as part of the ecological loss/gain budget as they represent a separate compensation requirement for port developments.

Table 27: Predicted changes in habitat extent (ha) as a result of proposed realignment.

	Area A	Area B	Total
Extent of new habitats created for compensation			
Shallow sublittoral less than -1.75 (MLW)	0.1	0.65	0.75
Mudflat -1.75 (MLW) to +1.85 (MHWN)	36.6	48.06	84.66
Saltmarsh +1.85 (MHWN) to +2.85 (MHWS)	12.05	8.69	20.74
Grassland+2.85 (MHWS) to +4m	0.45	0.62	1.07
		Total	107.2
Extent of new habitats created for mitigation			
New Wall B		3.83	3.83
Borrow Dyke B and berm (to seaward toe of wall)		5.09	5.09
Islands (entire features from toe to crest)	1.49	1.96	3.45
Total		Total	12.4
Extent of existing habitats unchanged (in extent) that will become part of the site and mitigation			
Wall A (as constructed in 2002)	4.95		4.95
Borrow Dyke A and berm (constructed 2002)	6.47		6.47
Unbreached existing defences (crest only)	2.48		2.48
		Total	13.9
Extent of internationally designated habitat directly affected by realignment *			
Landward side of Existing defences (excl. crest)	7.33		7.33
Borrow Dyke behind existing seawall	5.77		5.77
Existing Defences at all Breach Locations	2.82		2.82
Mudflat at Breach 4		1.45	1.45
Saltmarsh at Breaches 5 and 6		0.32	0.32
Saline lagoon at Breach 6		0.11	0.11
Total		Total	17.8
* = Excludes the crest of existing seawall.			

In total the breaching works will result in the direct removal and change of seawall, mudflat, saltmarsh and lagoon features across a total area of 4.7ha. Then following inundation there will a further loss of, or change to, 13.10ha of habitat within the boundaries of the Crouch and Roach cSAC, SPA, Ramsar and SSSI. The total extent of designated habitats affected is 17.8ha and the individual effects can be broken down as follows: -

(1) Loss of seawall: – All six breaches will results in the direct loss of seawall with associated plant species;

(2) Saltmarsh at all breaches: – Breaches 5 and 6 will result in the direct loss of saltmarsh habitat.

(3) Change of Mudflat at Breach 4: - There will be no loss of intertidal mudflat habitat as part of this scheme but there will be a change to the quality of mudflat at Breach 4.

(4) Change of Lagoon at Breach 6: - The lagoon habitat at Breach 6 will be lost because the channel that is cut though it will open it up to regular tidal inundation such that will become either shallow subtidal or intertidal habitat.

(3) Change to other designated terrestrial habitat: - The designated habitats (berm and seawall) on the landward side of the existing seawall will be changed by the exposure to tidal inundation.

(4) Change to other designated borrow dyke habitat: - The designated habitats (berm and seawall) on the landward side of the existing seawall will be changed by the exposure to tidal inundation.

(5) Impacts to Protected Species: - The breaching and inundation of the site will affect the two protected species (adder and common lizard) that have been recorded on site.

The impacts significance of the changes are identified below

Direct impact to seawall and grassland berm (supporting nationally scarce and Ramsar-cited plant species)

The direct losses of 1.8ha of seawall habitat from the breaching works represents a small-scale change in the context of the wider designated sites. There is approximately 1,536ha of coastal habitat in the Crouch and Roach SPA and 27,223ha (or 59% of total area) in the Essex Estuaries cSAC, the coastal borders of which extend for much of their length to include seawall and berm habitat. The extent of wall and grassland is not defined but is expected to be a substantial part of the total 13% of the cSAC (6,000ha) that is grassland, saltmarsh and salt pasture. All the breaches, except Breach 1, have been found to support nationally scarce plant species but, while this is important in a national context, these plants are locally abundant and widespread across the Essex coastal area (EECOS 2004). Also, the losses of those species that occur on the exposed seaward side will be significantly increased by the scheme (because all sides of the wall will be newly exposed to saline waters) while the losses of those occurring on the landward side are expected to be offset by the creation of mitigation habitats (see below). Therefore, the impacts from these losses are considered to be negligible.

Direct impact Atlantic Salt Meadow (cSAC interest feature).

In total 1.8ha of saltmarsh will be lost (or at least replaced by low shore and shallow sublittoral mudflat habitat) at Breaches 5 and 6. There is also a smaller patch of saltmarsh, including pioneer *Salicornia* marsh, immediately to the west of the Breach 4 but this will not be directly affected. While much of the saltmarsh on the north bank of Wallasea Island is eroding and thus is in an unfavourable condition, the area to be lost at Breaches 5 And 6 is sandwiched between the older and existing seawall and is, for

the moment, protected from erosion. It is a habitat that has been previously been created though the deposition of dredge arisings. The losses of this habitat would technically represent a failure of the relevant conservation objectives that requires no decrease in the extent of saltmarsh from an established baseline subject to natural change. However, consideration needs to be given here to the following aspects: the proposed change is very small in the context of the whole Essex Estuaries cSAC (1.8ha represents 0.03% of the total 6000ha of cSAC grassland, saltmarsh and salt pasture habitat); new intertidal mudflat will replace the lost habitat; the scheme will improve the overall ability of the estuary to adapt to coastal squeeze; there will be a significant adverse effect on the estuary if 'managed' realignment is not progressed but instead was allowed to proceed in an unmanaged way (through natural breaching of the seawall). In view of these considerations these changes are considered to be of minor adverse significance.

As the impacts are minor, no specific mitigation measures are required or have been identified (NB the large areas of new saltmarsh and mudflat habitat that will be created across other areas the site itself cannot be re-allocated as mitigation areas because they represent compensation for previous port developments). However, the changes to saltmarsh extent may well be offset at least partially by the local development of new saltmarsh patches habitat within mitigation areas (for instance on the margins of islands within the site, and in the borrow dykes). These potential changes are not however definitive and are dependent, for instance, on aspects such as the prevailing salinity regime in the borrow dykes. Therefore the impacts from breaching are still considered to be of minor adverse significance.

Qualitative Change to Mudflat Habitat (cSAC interest feature).

There will be no net loss of mudflat habitats as part of this scheme although there may be a localised reduction in habitat quality at Breach 4 (the other breaches deliberately positioned such that they don't impinge directly on mudflat habitat). At Breach 4, the excavation of the channels will reduce the tidal height of the existing mudflat and its exposure will be increased by the removal of the outer seawall works. These changes are likely to reduce the abundance of benthic invertebrate species locally. Essentially, the communities across this area, which now have a moderate abundance due to the prevailing sheltered conditions, may become comparable to the impoverished low shore communities that occur in the exposed surrounding intertidal areas (see Section 8.3.3). As there will be no net change of habitat area and the predicted qualitative changes will occur over only a small area (1.45ha) that is negligible in the context of the wider habitat resources of the SPA and cSAC, the impacts are considered to be negligible.

Coastal Lagoon (BAP Habitat)

This feature at Breach 6 is not an interest feature of the designated site and represents a relatively low quality lagoonal feature based on the invertebrate species it supports

(Godfrey 2004). Therefore loss of his feature will be of minor significance. However, these changes will still be significantly offset by the creation of large areas of new lagoonal habitat within the site itself (including in flooded borrow dykes, scrapes, drainage ditches and an area to be excavated directly adjacent to Island 7). In view of the large gains of these habitats (which are not specifically part of the compensation package) the effects are considered to be of moderate beneficial significance.

Inundation of seawall and grassland berm (supporting nationally scarce and Ramsar-cited plant species)

Following tidal inundation the scare plants on the seawall that are characteristically found in and on saltmarshes and on exposed seaward facing sides of the wall (such as shrubby seablite, golden samphire and lax-flowered sea lavender) are likely to thrive and expand their distribution over those parts of the existing seawall that will remain in place and on the walls of the new mitigation island features. These islands, extending to a height above HAT, will provide a range of conditions suitable for settlement of many of the plant species lost during breaching. These islands will be allowed to seed naturally and any such growth will be accelerated by the presence of remnant plants and seeds that are retained within the deposited seawall materials. The development and growth of these plants will be facilitated by the very low levels of disturbance that will be prevalent across these habitats.

The other five scarce species recorded on-site thrive principally on the grasslands on the landward side of seawalls. These plants are expected to flourish on the Borrow Dykes A and B mitigation habitats and may also develop on the new seawalls (Walls A and B) over the longer term. To accelerate this development, EECOS have suggested that a modest effort to collect seeds by scattering bales of cuttings from the existing seawall and placing them onto the new seawall could be pursued, equally they suggest that the value of the walls for invertebrates could be improved by seeding with a mix that includes 10-15% white and/or red clovers. It is recommended that these cost-effective measures are pursued but they are not however an essential mitigation measure because with the inclusion of the existing mitigation measures, and given the abundance of these plants locally, the overall effects of the realignment on these species is deemed to be negligible.

Inundation of borrow dyke habitats (supporting Ramsar-cited aquatic invertebrates and associated assemblages)

Following tidal inundation the aquatic conditions within the borrow dyke will become fully saline rather than brackish or fresh and this will alter the species composition of the invertebrate communities. This is likely to result in the loss of many of the notable and rare brackish/freshwater invertebrate species that are listed in Table 26 although other saline lagoon specialist species can be expected to thrive and expand their distribution as a result of the salinity change. The predicted change is evidenced by the fact that these rare species were absent from the open saline lagoon in front of

Breach 6 which only contained marine species (including one saline lagoon species). When considering impacts to insects it is not as easy (compared with other interest features of the Ramsar site, or of the SPA and cSAC, such as coastal habitats, plant species and birds) to use survey data and citation details to make value judgements about the importance of the realignment site, and the impacts of the scheme, in the context of the wider resources of these designated areas. This is because the value of the aquatic invertebrate communities goes beyond just the cited species and extends to the wider overall community (Stephen Ayliffe pers. comm.) and because, in contrast to more visible habitats, the extent of resources across the wider Ramsar area is more difficult to define and map. Therefore, to understand the value of the invertebrate communities within the realignment site and how these species might compare with the communities of other habitats within the Crouch/Roach, or the Foulness Ramsar areas, expert value-judgements were obtained. These were obtained from the specialist who carried out the baseline survey (A. Godfrey) and also from Dr Martin Drake another independent consultant specialising in brackish water invertebrates and with a lot of experience of surveying the Essex Coast.

The views of both these experts are that, although the more important species recorded during the survey are rare/uncommon in a national context, they are characteristic of Essex marshland habitats. Therefore, they believe that there is a high probability that they are locally widespread (not least because almost all the species, including most of the water beetles species, fly during their terrestrial phase) and are present in other borrow dyke habitats locally and across the wider Crouch/Roach and Foulness Ramsar sites. For example, almost all the beetles are characteristic of brackish water habitats and quite frequently occur in coastal marsh although there are natural variabilities in distributions. *E. halophilus* has been found to be particularly frequent while *O. punctatus* is somewhat less common. With respect to the fly species, once again these are relatively common across Essex coastal habitats and *S. singularior* (one of the two Ramsar-cited species recorded), for instance, is very frequent across east Anglian and Kent coast. *D. graminum*, a species that is characteristic of grassland habitats, are more frequent across the Kent and Thames Gateway though perhaps less commonly occurring across Essex marshes. Other species such as *D. strigipes*, *P. ducalis*, *T. ruficornis* and *M. picta* are again typical and frequently occurring species that are characteristic of saltmarsh habitats.

The high value in general of the borrow dyke habitats in southern Essex (including Wallasea Island) has also been shown during the EA borrow dyke invertebrate surveys (Wilson and Wilson 2003). These studies showed that Wallasea Island borrow dykes supported four specialist lagoon species as well as had other interesting species (*Berosus affinis*, *Ochthebius marinus* and *O. viridis*). It wasn't suggested however, that this area was significantly more valuable than other dykes surveyed.

In view of the importance of these habitat in a national context however, it is considered that without mitigation measures in place the proposed impact is considered to be of moderate adverse significance.

Mitigation measures are proposed in the form of the new borrow dyke habitats behind Walls A and B and due to the mobility and widespread nature of these species many are likely to also thrive in these proposed habitats. This is expected to occur irrespective of the specific salinity regime that prevails in these habitats. The effects of salinity on site are indicated by the fact that the entirely freshwater area at Site 40 (on the Wallasea Island east bank, outside the proposed realignment area) had the highest number of taxa including a relatively large number (five) of notable insect species whereas other brackish water sites especially in Area A supported good numbers of scarce invertebrates and saline lagoon species. In view of these findings it is considered to be unnecessary to include proposals for borrow dyke habitat salinity management as part of the mitigation measures. In considering the value of these mitigation habitats it is also of note that the total area of new Borrow Dykes A and B will be equivalent in size to the borrow dyke and berm area that will be inundated but that they may well have a higher quality due to the design measures proposed for Borrow Dyke B. Therefore, when considering the impacts of the scheme on these species, consideration has been be given to the locally widespread nature of these species and the fact that the mitigation habitats (especially Borrow Dyke B) are designed to provide good quality suitable aquatic habitat. With these factors in mind the overall impacts of the scheme are considered to be negligible.

Effects on protected species

Two species were recorded on site that are protected under Section 9 of the Wildlife and Countryside Act 1981 as amended. These were adder and the common/viviparous lizard. No other species (aside from birds which are considered separately) were identified during the baseline habitat surveys that were undertaken for this assessment.

These two species are largely confined to the seawall and grassland berm on the seaward side of the borrow dyke. They are not expected to be significantly affected by the Wall B construction work or the sediment recharge works that will mainly take place away from the seawall and on ground that will be cleared in advance as they will be capable of emigrating from areas of disturbance. Similarly a negligible impact is expected also from the laying of recharge pipeline along the existing seawall as reptiles will be able to readily avoid such activities. However, these species could suffer mortality/injury either during excavation of the breaches or, more importantly, by becoming marooned on sections of seawall that are isolated after breaching (NB there will be exit routes across the land bridge connecting the existing wall and the new wall (between Areas A west and East) and along the other sections of the wall which will remain connected to the new or existing seawall). Such an effect would be of moderate adverse significance given the legal protection afforded to them.

Therefore mitigation in the form of a pre-construction translocation exercise is required to remove these species from areas where they are at risk in the periods immediately

prior to breaching. These areas are the breach locations (particularly Breaches 4 and 5 where they are most common) and the isolated wall sections between Breaches 2 and 3 in Area A (east) and between Breach 4 and 6 in Area B. These reptiles would then be moved to a suitable receptor site that would be agreed in consultation with EN but would probably be other wall and berm areas along adjacent parts of the island. The new counterwalls are not expected to be a suitable receptor location. Wall B will be un-vegetated and EECOS (2004) have expressed a view that the new Wall A is not at present a suitable receptor site due to the limited colonisation by vegetation and prey. With these mitigation measures in place the overall effects on these protected species would be **negligible**.

8.6.3 Conclusion

In view of the above conclusions, the direct impacts of the proposed scheme on designated habitat and protected species (with mitigation included) are considered to be of **minor adverse significance** and no further mitigation measures are needed. While almost all effects are negligible only the small-scale saltmarsh loss is deemed to be minor and thus the whole scheme impacts are considered to be minor on this basis. It should be highlighted that the total area of habitats that are deliberately created for mitigation (islands and borrow dykes) and those habitats that are part of the design or the existing scheme (new walls, old walls) cover a total area of 36.3ha. However, the area of designated habitat that will be directly affected (not adversely in all cases) will be 17.8ha. In addition to the extent increase in these habitats, the designs of the Borrow Dyke B and Island features are expected to greatly improve the habitat diversity and quality when compared with baseline condition.

8.6.4 Impact 2 Indirect impact to estuarine habitats and species

Pathway

The indirect impacts to marine habitats and species in the estuary outside the realignment site as a result of the inundation of the site and the subsequent physical changes within the estuarine system.

Impact from hydrodynamic change in the estuary (cSAC-cited habitats and EWT sites)

Following the findings presented in Section 6 it is clear that the proposed realignment will not result in any significant changes to the flow regime and associated erosion forces within the estuary over either the short or long term. Neither will there be a detectable change in the water levels at high water or low water. It is predicted that over the long term (100s of years) the estuary may adjust to the realignment in a manner which leads to a slight widening and deepening of the outer Crouch and Roach Estuaries and the erosion of 2.5ha of intertidal habitat. This latter change represents not only a negligible area in the context of the wider intertidal resources and one that

will not be measurable in the context of the wider SPA and cSAC coastal habitat resources. These changes will also not affect the EWT sites that are located in upper sections of the Crouch Estuary (See Figure 24).

It should also be been borne in mind that, as with many other assessments of potential ecological impacts within the site, there will be much greater impacts to the interest features of the Essex Estuaries European Marine Site if the realignment is not pursued because the sustainability of the estuary will not be improved and there will be much greater risk of coastal erosion if Wallasea Island is left to breach naturally and the seawall is allowed to breach and flood the area naturally. Given these considerations the overall effects on protected habitats would be negligible.

Impact to estuarine fish populations

It is known that intertidal habitats are very important fish feeding and nursery areas, especially for demersal fish species such plaice sea bass sole and flounder (Costa, M.J., & Elliott 1991, Marshall & Elliott 1997) and that the proposed realignment scheme will increase the extent of such habitat in the estuary by 7%. However, in terms of the overall prey resource that this scheme will provide, the percentage increase is likely to be much greater than this. This is because the site is likely to support much richer invertebrate (fish-prey) communities than other intertidal habitats in surrounding which have impoverished assemblages (see Section 8.3.2). Therefore, this habitat creation scheme is likely to greatly improve the value of the estuary for demersal fish species.

This has also been shown to be the case at newly completed realignment sites where recent studies have confirmed that they can greatly benefit finfish populations by providing nursery and feeding grounds (S Colclough et al., 2004). Studies at sites in the Humber (Paull Holme Strays), Thames (marginal habitats near the Millennium Dome) and on the Blackwater (Abbotts Hall in Salcott Creek) have shown that 11 different species of fish including sea bass, herring, flounder, mullet and eels, use the new marsh as spawning, feeding and nursery grounds. The results from Abbotts Hall, which was only breached in 2002, have been particularly encouraging. Here saltmarsh and lagoon habitats have developed rapidly and this rapid development along with natural slope of the site has proved to have benefits for small fry which have been observed rising through the vegetation with the tide. The gradual slope allows for zonation of vegetation and provides a mosaic of habitats for a range of sizes and species of fish. The semi permanent pools, which are inundated on high tides, serve as feeding and refuge areas over a tidal cycle. On one occasion, 2,000 herring/sprat were caught using a seine net in one tidal pool. On the back of these findings it has become increasingly recognised that realignment, and other coastal habitat creation schemes, not only provide compensation for impacts to birds and losses of coastal habitats under the Habitats Regulations but can help to offset previous reductions in fish stock recruitment from historical losses of saltmarsh habitats. Given these potentially very positive effects, the impacts to fish populations from the proposed scheme are considered to be of moderate beneficial significance.

8.6.5 Impact 3 Changes in water and sediment quality conditions

Pathway

The potential impacts from changes in water and sediment quality within the estuary following realignment

Impacts from water-sediment quality changes

The results of the hydrodynamic modelling work, and the water quality assessment (Section 7), indicate that there will be no significant adverse effects on estuarine water quality. Therefore any effects on the habitats and species of the estuary will be negligible.

8.6.6 Impact 4 Disturbance to waterbirds and breeding populations.

Pathway

The effects of disturbance on waterbird populations (especially breeding birds in Area A) during construction and operational phases of the proposed scheme.

Impacts on bird populations

The main potential impacts to birds can either occur through disturbance to bird populations especially overwintering SPA interest species) during the construction work and after realignment or through the impacts to breeding birds (protected under the Wildlife and Countryside Act 1981 as amended). These potential impacts are reviewed below.

Disturbance to overwintering and passage birds (SPA and Ramsar-cited species)

The construction of Wall B and the recharge works in front on Walls A and B will be undertaken throughout 2005 and including the autumn early winter period when overwintering and passage species will be present in the estuary. Also the breaching preparatory works and the breaching work itself will be carried out in the autumn of 2006. Therefore, there is the potential for these works to cause disturbance to roosting and/or feeding waterbirds that are part of the SPA or Ramsar-cited populations. However, as the foreshore area fronting the north bank of Wallasea Island (almost exclusively in front of Area A) has been shown to be of very low value as a feeding area for waterbird species, the construction works will have a negligible effect on low water feeding activities.

The island has though, been shown to support moderate numbers (up to 700 birds) of roosting birds at high water with some feeding dark-belied brent geese in the fields.

The extent of any disturbance to such populations is expected to be minimal because the majority of the works will be confined to discrete areas of the island and during any given period of the construction phase there will remain large expanses of the area that will be largely undisturbed. This is particularly true on this site as it covers a large area in total and there is no evidence of roosting site fidelity (i.e. an established single site at which birds regularly roost on each tide). Therefore there is no specific site that will be affected and also it is clear that birds already vary their roosting sites and will be able to continue to do so to avoid construction disturbance.
Up to around 15% of the Crouch-Roach SPA dark-bellied brent geese populations (i.e. around 3000 birds) were recorded on Wallasea Island in mid-winter. However, these were not recorded in the proposed realignment area and as with the roosting populations they will not be affected during the construction work because of the localised nature of the effects and the large expanses on Wallasea Island that will remain available for feeding/roosting. Overall therefore the effects of the scheme on these waterbird species is consider to be negligible

After the realignment there is expected (based on previous similar schemes) to be a temporary increase in visitor numbers due to the improved views and the novelty of the scheme. On past evidence though, this is expected to be followed by a decline later and ultimately the site is expected to return to its current status where there is a low level of activity on site. Therefore, there are expected to be very low levels of disturbance to waterbirds using the new coastal habitats and the borrow dyke mitigation habitats. The main source of disturbance will be from walkers using the new footpath along the top of Walls A and B. It is known that birds are more disturbed by walkers, tourists and dog-walkers than they are by other activities such as construction vehicle movements (Smit and Visser 1993). However, it is also known that they are less disturbed by the kind of predictable directional pedestrian movements that will take place on this site (i.e. primarily confined to the footpath) than by more random movements that occur along open coastlines. It has been shown that those birds which feed close to the west and east walls of the Tollesbury realignment site are occasionally subject to low levels of disturbance by people walking on these wall and that at these times they move to another locations within the 21ha site (Brown 2003). This shows that they were not so disturbed that they left the site altogether. A similar situation is expected at the Wallasea site although, because it is five times larger than Tollesbury, not only will the incidents of such disturbance and relocation be lower (i.e. birds will, more often, be feeding away from the walls) but there will be much more opportunity for relocation to other areas of the site.

In addition to walkers, other activities such as wildfowling or boating are expected to continue but again these are expected to be at the low levels which occur at present. Overall therefore, it is considered that disturbance levels will continue to be low and that it is the location (i.e. new footpath alignment) rather than degree of disturbance that is expected to change. On this basis the impacts of the scheme are considered to be negligible.

Breeding birds (protected under Wildlife and Countryside Act 1981)

It is an offence, under Schedule 1 of the Wildlife and Countryside Act 1981, to disturb a birds nest and this could occur during the construction phases of this scheme. Therefore, the itinerary for the realignment work has been specifically designed to avoid affecting the breeding populations in Area A and no work will be undertaken in this area over the Spring and early Summer months. Therefore, the only breeding birds populations that could be affected are those that are located in Area B along the route of the proposed Wall B.

This area has been shown to support breeding territories of corn bunting, skylark and yellow wagtail (of which the former two are BAP species), which are scattered throughout the area, including the site of the proposed Wall B construction and Borrow dyke B excavation works. Other species have also been recorded in the coastal margins but there will only be limited works carried out in these areas. Without mitigation measures, this work will have moderate significant adverse effects given the high level of protection afforded to breeding bird species. As it is not possible to undertaken this work at other times of the year it is proposed that these impacts will require mitigation. Therefore, the areas in which the work is proposed will be cleared of vegetation prior to the spring of 2005. This is expected to deter birds from utilising these areas as nesting sites so that the works can proceed. Advice will be sought and provided by EN and RSPB (as part of the Project management Team) throughout the construction phase to ensure that these measures are as effective as possible.

The inundation of areas A and B will take place in the late summer/autumn months (therefore outside the breeding season) and will not affect nesting birds. The losses of the undesignated habitat particularly across Area A will clearly reduce the value of the site for breeding waterbirds in he future, but the mitigation works are designed to help offset such impacts and in this context it is of note that nesting avocets have recently been recorded at Abbotts Hall and Paull Holme Strays realignment site (Helen Deavin and Chris Tyas RSPB pers, comm.). Therefore, there is expected to be a high possibility of the island habitats and the proposed Borrow Dyke B mitigation areas providing good quality replacement habitat for this and other species.

With these mitigation habitats and land preparatory measures in place, and given the absence of any work in Area A during the breeding season, the overall effects of the scheme on breeding birds is deemed to be of **minor adverse significance** and does not require further mitigation works.

8.7 A note on findings from previous realignment schemes

This impact assessment does not take into account the benefits of the scheme in terms of the new mudflat and saltmarsh habitats created and the waterbird populations that are likely to use the site in future. This is because these gains are separate requirments for the port development compensation measures. However other

aspects such as the benefits to fish populations (which are not a compensatory target) can be taken into account (as above). In view of this, the findings from three previous realignment developments are summarised below. These also give some indications about the potential success of not only the scheme but also the associated mitigation habitats: -

(1) Abbotts Hall Salcott Creek (Breached October 2002, Size 85ha): - After just two years a mosaic of habitats has developed including semi-permanent pools (inundated only at high water) that serve as feeding sites and refuges for a range of different fish species (EA 2003). In total 11 species of fish (including bass, sprat, herring, gobies, and flounder) and 1697 individuals were recorded over 3 visits in June-August 03 (Colclough et al., 2004). The site also supports good numbers of birds with 51 different species having been recorded in the first counts made during the 2003/04 winter (Chris Tyas RSPB pers. com.). Of these many are waterbird species including up to 1000 lapwing and around 300-400 golden plover. Also three avocet nests were recorded on islands during Spring 2004 (Helen Deavin RSPB pers comm.).

(2) Tollesbury, Blackwater (Breached 1995, Size 21ha): - This site has a relatively low elevation except for a narrow fringe at the top of the site and as such that it was mainly colonised by marine benthic invertebrates (Brown et al., 2003). Six years after inundation, 19 different marine benthic species have been recorded across all areas of the site. Some 6ha of the site has been colonised by *Salicornia* (Garbutt et al 2002). It is now used as feeding and/or roosting site by good numbers of waterbird species and during the 1999-2000 winter period (Brown L, 2003) the following (with maximum abundances in brackets) were recorded: redshank (190), dunlin (950), golden plover (950), black-tailed godwit (65), grey plover (80) and knot (450). Most commonly these birds were recorded just after or before high water when other intertidal habitat in the estuary were still immersed. Thus the site, by having a reduced immersion time compared with surrounding areas, extends the time over which these birds can feed.

(3) Paull Home Strays, Humber (Breached September 2003, Size 80ha): - Since breaching the site has been visited by a large number of birds and a range of different species including curlew, redshank, golden plover (in nationally important number) and knot (which were not previously recorded in this part of the Humber). Over one third of the Humber populations of black-tailed godwit has been recorded roosting and ebbing on site. Water voles have been recorded using the new lagoonal habitats. As at Abbotts Hall (see above) avocets have also recently been recorded on site (Chris Tyas RSPB Pers Comm.). Siltation here has been an order of magnitude higher than expected from December 2003 to March 2003 (IECS 2004).

Further details, photographs and maps describing the former two of these realignment sites, from an ABPmer database, are included in Appendix G.

9. Commercial and Recreational Fisheries

9.1 Baseline

In England and Wales, the 12 Sea Fisheries Committees are the main organisations concerned with the management of inshore fisheries. For the Crouch and Roach estuaries, the relevant Sea Fisheries Committee is the Kent and Essex Sea Fisheries Committee (KESFC). The committees have jurisdiction between high water and 6 nautical miles offshore, with the aim of protecting habitats and fish stocks, with the KESFC extending from Harwich in the north to Dungeness in the south. The KESFC also holds the River Roach Oyster Fishery Order (1992). The Environment Agency also has jurisdiction over fishing activities 6 miles from the freshwater baseline, with a duty to maintain, improve and develop salmon, trout, freshwater and eel fisheries.

Although commercial fishing within the Roach and Crouch is limited (Crouch Harbour Authority, 1996), Pawson et al (2002) provide a summary of the coastal fisheries of England and Wales, including that within the KESFC district. The report found that the estuaries in the region provide a rich feeding ground for finfish and shellfish, together with shelter for the small fishing boats that are active for most of the year. Burnham-on-Crouch is identified as the most important landing place along the Crouch and Roach, supporting 6 full-time and 6 part-time vessels. Sprats and whiteweed (a hydroid) are taken from within the estuary and nearshore waters, with demersal fish caught further offshore. Drift netting for herring is undertaken in the autumn and winter, with drift and set nets used in warmer months for mullet, bass, rays and sole. Trawlers catch shrimps in both the Crouch and Roach during the summer, occasionally landing smelts. Green shore crabs are taken as 'peeler crabs' during the moulting period for bait.

Rogers (1997) identified areas closed to fishing for numerous reasons, including historic wrecks, nursery areas etc. None of these areas falls within the rivers Crouch or Roach.

The main fisheries interest in the Crouch, and to a greater degree the Roach, is shellfish cultivation, particularly in relation to oyster layings. The cultivation of oysters was severely affected by the severe winter of 1962/63 and the subsequent slow recovery, the latter attributed to the effects of TBT (Crouch Harbour Authority, 1996). There has, however, been an increase in oyster in the estuaries, in both native and pacific oysters, together with some cockle and mussel fishing.

In 1999, 6.6km^2 of the Roach and Lower Crouch were designated as shellfish waters and there are several areas designated as Shellfish Harvesting Areas and several

beds for number of oyster, mussel and clam species are present and commercially exploited. In the Essex SMP (Mouchel, 1997), a shellfishery at Paglesham Pool in the Roach was identified as containing oysters, with a new oyster area having developed on the north shore of the Crouch opposite the Roach. Pawson et al (2002) identified some 4 vessels being partially involved in working the private oyster beds for both pacific and native oyster, the latter also harvested offshore.

Kent and Essex Sea Fisheries Committee (KESFC) were contacted to request information on the location of shellfish beds in the Crouch and Roach. The locations given represent the indicative areas where shellfish are currently harvested, as given in Figure 22. From the information provided, it is apparent that some harvesting of *O. edulis* occurs from approximately Brankfleet Spit seawards along the Crouch to the mouth, with further harvesting areas for *M. edulis* and *O. edulis* up-estuary from Lions Creek. South of Wallasea in the Roach, fishing for *O. edulis* occurs in the area of Quay reach, with areas for *O. edulis* and *M. edulis* in Paglesham Pool, Paglesham Reach, Barlinghall Creek and Yorkesfleet Creek. Area B therefore fronts onto an area currently used as a shellfishery (*O. edulis* and an area for *O. edulis* and *M. edulis*).

An important distinction for shellfisheries in the Roach is the River Roach Oyster Fishery Order (1992). The Order confers the right for the fishery within the Roach (as shown on Figure 22) for 20 years to the KESFC. The rights include maintaining the marks delineating the extent of the Order, taking samples for disease control and the power to grant leases.

9.2 Impact Assessment

9.2.1 Key Issues

The pathways by which the proposed realignment scheme could affect commercial and recreational fisheries were identified within the Scoping Report as follows: -

(1) Impacts from changes in water quality conditions and particularly, increases in the turbidity of the water column, that could lead to the settlement of sediment onto shellfish beds or impede shellfish filter feeding mechanisms.

(2) Alteration to estuarine ecology/habitats (particularly, the composition of the seabed from sedimentation and/or erosion) from hydrological changes in the system and the addition of new intertidal habitat.

Drawing upon the findings from the hydrodynamic and sediment transport modelling work, as well as the findings from previous case examples, the potential effects on shellfisheries or finfish species are reviewed below.

9.2.2 Impact 1: Water Quality Changes

As detailed in Section 7, the results of the hydrodynamic modelling and water quality assessment work indicate that there will be no significant adverse effects on estuarine water quality and, particularly, no elevated turbidity levels. Therefore any effects on shellfishing or other fisheries interests in the estuary will be negligible.

9.2.3 Impact 2: An alteration to the existing habitat

The results of the physical modelling work have shown that the scheme will not have a significant effect on the adjacent estuarine system and although some flow increases are predicted to occur after the realignment these changes are predicted to be transient and small-scale. There is no indication that the integrity and sediment composition of the bed substrata will be altered or that the water quality conditions will be adversely affected and therefore, the effects on shellfisheries interests (mussel and oyster beds) are considered to be negligible. It should be reaffirmed in this context that if the realignment is not pursued in a managed way, as proposed, then significant adverse effects in the estuary are predicted to occur (see Sections 8.6.4 and 11.2). Such significant changes would be more likely to affect existing shellfish beds.

It is known that the oyster fishermen working in Salcott Creek have not noticed any effects on their fishery from the Abbotts Hall scheme which although smaller than Wallasea at 85ha is relatively large because it added an extra 5% by volume of water to the creek (compared with 2.5% of the Crouch and Roach from Wallasea). Also extensive hydrodynamic monitoring work on this site has shown that there are 12-15% increased tidal velocities on the ebb of on Springs (compared with 3-17% in the Crouch from Wallasea). This monitoring has also shown that there are no measurable impacts on current speeds on the flooding tide and negligible impacts on Neap tides (Mark Dixon DEFRA pers. com.). Based on the scale of the changes that are predicated to occur in the estuary the effects on shellfisheries interests are considered to be negligible.

With respect to finfish species (e.g. Bass) which are important for recreational angling particularly as described in Section 8.6.4 the creation of new intertidal habitat is likely to greatly enhance the fish populations in the estuary. Therefore, it is concluded that the proposed scheme will have an impact on recreational fishing that is of moderate beneficial significance

10. Marine Heritage

10.1 Baseline

To describe the baseline marine heritage of the site an initial search of the Essex County Council (ECC) database was undertaken during the Scoping Report to identify features of potential archaeological interest in the vicinity of Wallasea Island. These features were as follows: -

(1) Oyster pits and a wooden wreck to the east of Gardenness Point, dated 1540-1900.

(2) West of Overland Point, at least 3 wrecks (including a wooden boat) dated 1540-1900.

(3) Roman coins found at Red Hill.

(4) The 'Wallasea Gate', a causeway between Wallasea Island and Canewdon Parish (1777).

(5) Red Hill (Roman/Saxon sea salt production site), possibly ploughed out.

Further information about the maritime heritage is presented in the Roach and Crouch Flood Management Strategy (Halcrow/EA 2003). This identified no scheduled monuments in the area noted that some of the seawalls in the general area are perceived to be of interest, with some dating to medieval periods. Within the SMP three historical conservation areas were identified including Burnham-on Crouch seafront and Rochford and Paglesham Eastend (Mouchel, 1997).

To obtain a better understanding of the specific interests at the realignment site than is possible from the publicly available information, the Essex County Council Field Archaeology Unit (ECCFAU) was commissioned to undertake an assessment of the archaeological and built heritage constraints at the site (see Section 5.2). ECCFAU had previosuly carried out a similar study and site visit to assess Area A, prior to construction of Wall A. From information presented in both these assessments further details about the archaeological interests at Wallasea are summarised below.

Wallasea Island forms part of a group of low lying marsh islands, collectively termed the 'Foulness Archipelago'. Previous studies indicate that during the Neolithic period (c 4000-2000BC) the coastline was significantly different from that found today (Murphy and Brown, 1993), and was likely to be mainly tidal flats, with occasional sand beach ridges and estuaries. Hence, it is considered unlikely that buried land surfaces will be present at Wallasea.

By the later Bronze Age (c1000-700BC), the Essex coast was probably approaching its current form, with Wallasea being one of a number of marshland islands, possibly used as pasture. However, it is considered to be unlikely that remains from this period are present.

There is some evidence of late Iron Age or Roman (c100BC-400AD) industrial activity of the island, in the form of 'red hills', typically found at what was then the high tide line. Such features are mounds of burnt material left after extracting salt from seawater by evaporation. Such features are found adjacent to Paglesham Pool, to the east and on southern fringes of Wallasea, outside the proposed realignment site. There is no evidence to suggest Saxon activity (c400-1066AD) within the proposed site, at which time it was likely to have been marshland that was used for grazing.

Evidence suggests that Wallasea was embanked in the 13th or 14th centuries and was composed of a number of small areas of marsh enclosed by individual embankments. The proposed site is crossed by 3 such boundaries. By the Tudor period (1484-1603AD), documentation identifies permanent settlements on the island, with some 10 farmsteads by 1777. By 1875, this had increased to 13, including Lower Barns, located to the edge of Area B. No such features are now present to the east of Grapnells Farm.

The seawalls have been subject to regular breaching and erosion. During gales in 1897, 75% of the island was flooded, with several episodes of breaching and flooding occurring in the 20th century. The most significant of these was the 'Great Tide' in 1953, which overtopped and breached the walls, leaving the majority of the island underwater. Such an event is considered likely to have damaged or destroyed any earlier remains on the island.

There are a number of potential sites of archaeological interest, lying outside of the existing seawall, that are post medieval. These include oyster pits and wrecks; a series of oyster pits; pits dug into the marsh to enable repairs to be made to sections of the now abandoned outer seawall; loadings or quays along the north shore and the remains of three Thames barges along the north shore.

The information available demonstrates that there has been human activity on Wallasea since at least the Roman period; hence, the potential exists for remains to be found. However, given the combination of the re-drainage, levelling and flooding that occurred in the 20th century, it is likely that any such remains will have been damaged or destroyed. Any remains are likely to be fragmented and therefore of only minor importance.

The sea defences were started in the medieval period. However considerable repair, alteration and maintenance has occurred subsequently, damaging or destroying the potential early remains. Again, such remains are likely to be of only minor importance.

Of the sites known to exist, the wrecks have been observed to be submerged and in very poor condition.

10.2 Impact Assessment

10.2.1 Key Issues

National responsibility for maritime archaeology lies with English Heritage and, following the publication in 2002 of the National Heritage Act, this responsibility extends into the coastal zone and out to the 12 mile limit. Essex County Council takes local responsibility for archaeology interests, including collation of relevant data on monuments, evidence (such as historical artefacts) or other data sources. Both parties provided advice and discussed the assessment requirments as part of this proposal and Essex County Council's Field Archaeology Unit carried out their archaeological assessment of the site (ECCFAU 2004) on the basis of this advice. As impacts to features of archaeological interest are most likely to occur at locations where there will be invasive works (e.g. removal of seawalls at the breach locations, and channel deepening/creation work within the site), ABPmer forwarded details about these areas to the ECCFAU for their assessment work.

The ECCFAU concluded on the basis of this information as well as the baseline site characteristics (as review above) and their assessment work (see Appendix J), that the archaeological potential of the proposed realignment site is low and that those remains, which may be present, are of minor significance. The impacts significance of is therefore considered to be negligible.

11. Coastal Defences

11.1 Baseline

In the Crouch and Roach clay embankments are the most common coastal defence structures although some areas (including the north bank of Wallasea Island) are protected by reinforced concrete, blockwork or stone revetments. The defences are extensive, protecting numerous islands, Rochford and the length of the River Crouch. The majority of the defences are maintained by the Environment Agency except for small sections that are maintained by the Ministry of Defence (MOD).

The coastal defences in the Crouch and Roach have been the subject of a series of strategic studies and reviews including the Essex SMP (Mouchel, 1997), the Essex Seawall Management Strategy (Halcrow/EA 1998) and, most recently, the Roach and Crouch Flood Management Strategy (Halcrow/EA 2003). The SMP identified a number of large sections of the coast where a short-term policy of hold the line was recommended, while in the longer term an economically and environmentally viable solution was required. The Flood Management Strategy then presents a detailed

review of the physical conditions in the Roach and Crouch and identifies the coastal protection requirements for tidal limits of this system.

For the Flood Management Strategy, the Roach and Crouch were divided into 27 Flood Management Units (FMUs) of which FMUs 17, 18A, 18B and 19 are located on Wallasea Island (see Figure 32). FMU 17 covers the southern part of Wallasea, FMU 19 covers the commercially important area to the north west of Wallasea and the proposed realignment site falls within FMUs 18B and 18A (see Figure 32). The Strategy recommended abandonment of 18B (because Wall A is already in place here) and managed realignment of 18A while maintaining the defences in FMU 17 and 19 in the short term. Therefore, the current scheme is directly in line with this policy.

11.2 Impact Assessment

During the Scoping Study no specific issues of concern emerged in respect of coastal defences and this subject was not considered to be a major issue. This is because it was recognised that one of the main objectives of the proposal is to improve the coastal protection afforded to Wallasea Island and that the proposed realignment scheme is in accordance with the Flood Management Strategy recommendations (Halcrow/EA 2003).

The new seawall will be much more robust than the existing walls in terms of their structural integrity and the crest height of the wall. They have been (in the case of Wall A) and will be (in the case of Wall B) constructed in line with Environment Agency guidance, with side slopes of at least 1:3, a crest width of at least 3m and a minimum height of +4.8m ODN (the design height of Wall B will be +5.3m whereas the existing defences are at a height of +4.7mODN). Added to the elevated wall height, the expanse of saltmarsh and mudflat in front will greatly reduce the wave heights and tidal current speeds to which the new defences are exposed and therefore the quality and duration of the costal protection levels will be greatly enhanced at this site.

The hydrodynamic modelling work (ABPmer 2004b) has also shown that the proposed scheme will not result in net increases in water levels in the estuary at high water (although a transient 2cm increase was observed on peak ebb and flood peak relative to the corresponding tidal times under baseline conditions). Therefore, there will not be an adverse effect on the coastal defences in other areas of the estuary.

The modelling work indicates that over the longer term (period of 100s rather than 10s of years) the estuary will widen and deepen slightly across an area extending from the realignment site eastwards to the estuary mouth. Similar trends are predicted for the outer Roach. However, even over this period of time the expected losses of intertidal area are low (approximately 2ha in the Crouch and 0.5 hectares in the Roach).

Such changes are a consequence of the large habitat gains (an extra 108ha) provided by the proposed scheme and, when considering these losses, it should be borne in

mind that erosion is currently progressing in the estuary at the present anyway and the realignment will help to mitigate for these losses. Also, after realignment, the estuary will have a more 'sustainable shape' (i.e. it will have a greater capacity to accommodate sea level rise and limit the impacts associated with coastal squeeze). These 2.5ha losses are also negligible when compared with the much larger losses in the Crouch that would occur if no managed realignment scheme was pursued and instead the Wallasea island defences were left to breach in an unmanaged way (with widespread flooding of the island and much larger volumes of water then passing through the estuary).

Overall, the new defences are therefore assessed as being of moderate beneficial significance.

12. Navigation and Marine Recreation

12.1 Baseline

A wide range of statutory and non-statutory organisations have an active interest in leisure and recreation in the rivers Crouch and Roach. Crouch Harbour Authority is the statutory authority for the estuaries (Figure 33), which was established by the Crouch Harbour Act 1974. By virtue of the 1974 Act, the Authority controls most activities in the harbour, with several types of activity requiring a licence (e.g. dredging) and others regulated through local byelaws. The main port in the Crouch is the Baltic Terminal at Wallasea, with Stambridge Mills on the River Roach being the main area of commercial activity (Mouchel, 1997). However, commercial shipping has reduced in recent years, with recreational craft being the main use of the estuary.

The harbour is regarded as one of the leading sailing and power boating centres in the UK (Crouch Harbour Authority, 1996), with Burnham-on-Crouch being a key centre. In addition to sailing, the harbour is also used for the following activities (some of which occur up-estuary from Wallasea): water skiing, personal watercraft, sailing, angling, wildfowling, canoeing, bird watching, walking and windsurfing.

The Harbour Authority delineate areas for marinas and mooring (Figure 34), water-skiing (and other personal water craft) and a speed limit zone (Figure 35). Of these, Essex Marina is located to the western end of the north bank of Wallasea, with the large Burnham Yacht Harbour just across the water. Moorings extend along the Crouch to approximately the area in front of Breach 3 of the realignment site.

A number of RYA clubs are located along the Crouch, including the Bridgemarsh Island Cruising Club (yachting and motor boating), Burnham on Crouch Sailing Club (dinghy racing, yacht racing and Rigid Hulled Inflatables (RIBs)), Corinthian Otters (dinghy racing), Crouch Area Yachting Federation, Crouch Yacht Club (yacht racing, yacht cruising, RIBs and motor boating), Royal Burnham Yacht Club (dinghy racing,

yacht racing, yacht cruising, RIBs and motor boating) and the Royal Corinthian Yacht Club at Burnham on Crouch (youth racing, dinghy racing, yacht racing, yacht cruising and RIBs). The clubs hold race events, training and encourage pleasure sailing on the Crouch and Roach, with the Burnham Week Regatta, usually held in August, having been held for some 100 years.

Charter angling boats operate in the Crouch, including one based at the Essex Marina on Wallasea. Fish landed by anglers include bass, whiting, tope, dab, pouting and codling, with the bass fishery being active during the summer. One of the main advantages given for fishing in the Crouch is the shelter provided, enabling fishing when windy. Anglers fish from chartered vessels, private vessels and directly from the shore, including from the frontage at Wallasea Island, including rod fishing for bass during the summer months.

Canoeing is popular on the Crouch and Roach, particularly in the upper reaches during the winter. Club activities include the Southend Canoe Club 'Battlesbridge Canoe Race', run from North Fambridge Beach during July. Several clubs from surrounding areas also organise day canoeing trips to the Crouch. The Crouch also attracts birdwatchers, particularly in the creeks and marshland areas. Several footpaths cross the area, including the north and part of the east bank of Wallasea Island, with footpaths following the majority of the banks of the Roach and Crouch (including the 'Roach Valley Way'). The existing seawall fronting Wallasea is a public footpath.

Wildfowling occurs around the Crouch and Roach, primarily on privately owned land, including areas such as Bridgemarsh Island and Wallasea. For wildfowling on Wallasea, the Rochford and District Wildfowling Club currently has the wildfowling rights seaward of the project boundaries under agreement with Wallasea Farms Ltd. The Club also leases the foreshore of the Crouch from the Crown and have been managing some adjacent areas of saltmarsh for a number of years.

12.2 Impact Assessment

12.2.1 Key Issues

The key issues as respect of recreational and navigation impacts (as identified during the consultation process and the scoping report are as follows: -

(1) The implications for sailing or commercial shipping transit of change in hydrodynamic conditions in the estuary.;

(2) Use of the existing public footpath (which runs along the existing seawall) and diversion for the construction period;

(3) Effect on other recreational activities (including particularly wildfowling) from construction and subsequent 'operation' of the site.

12.2.2 Impact 1: Sailing, power boating or commercial shipping in estuary

In view of the limited scale of the proposed changes to water flow and the lack of any significant effects on the morphology of the estuaries, the scheme is not expected to have any effects on the navigability of the estuary. The flow changes are transient, occur only during periods of maximum flows and are not expected to be detectable (maximum increase 0.2 knot compared against baseline flow speeds of 1.2-2 knot) in situ. These changes also occur downstream of all major marinas and moorings (i.e. to the east of Breach 3).

It is possible that some smaller recreational vessels transiting the estuary in areas immediately in front of the breaches at times of peak flow may experience altered directional flow conditions (from water emerging from breaches). However, the flows though the breach channel within this site range from 0.2 to 0.5 m/s (or 0.4 to 1 knot) which is equivalent to the flow speeds already experienced in the channel under these tidal conditions and these flow streams are predicted to disperse rapidly in the estuary. It is possible that signage may be installed at the discretion of the Harbour Master advising of flow direction changes adjacent to the breaches to advise recreational estuary users. Overall however, the impacts of this scheme on the sailing and navigation interests in the Crouch are expected to be **negligible**.

12.2.3 Impact 2: Use of the existing public footpath on seawall

The footpath on Wallasea Island runs along the crest of the existing seawall and skirts the island from the road in the west, along the north seawall and continuing around the eastern bank to the point (Figure 36). The section of the route that runs along the north bank will clearly be altered by the breaches in the seawall although a new path will be put in place along Walls A and B. This change will need a footpath diversion order consent (see Section 3.2.2). There will be no interruption during the construction period because the public footpaths can remain open in their existing location during the wall construction and sediment recharge work. There will though be a requirement for a temporary ramp over the pipeline for the dredging operation. The permanent diversion to the new wall will then take place before breaching.

The crest of Walls A and B will be 3m wide and will be a permanent feature opposed to the existing seawall which is around 2m and in the near future is likely to be subject to natural breaching at weak points in the wall. Therefore, this change represents a positive management measure that will ensure continued and safer access in the future. The quality of the footpath will also be markedly improved in terms of the views afforded from it. This is because there will be views of the new and developing coastal habitats while the views of the estuary will still be possible from the existing seawall which will remain accessible at selected points. Land access will also be maintained from eastern end of Wall B to Branklet Spit not least because the RNLI have expressed concerns that they may need to land casualties at this beach area and then

will need to have overland access to this point. Overall therefore the scheme will have a minor beneficial significant impact.

12.2.4 Impact 3: Changes to wildfowling and other recreational activities

As wildfowling will continue and a footpath will remain in place (and indeed will be improved) the proposed realignment will increase rather than decrease the amenity value of the north bank of Wallasea Island. In addition the following recreational activities could be enhanced following realignment:

(1) Bird Watching: - As noted above, the creation of a wide range of new coastal habitats across Areas A and B (and of mitigation habitats to compensate for impacts to birds currently using Area A) is expected to result in an influx of waterbirds to the area. The improved ornithological interest of this area can then be expected to increase the number of bird watchers on site. These visitors will be able to view the area from the new footpath along Walls A and B. There are no proposals for bird hides to be constructed on site to discourage the visitors from staying too long and thus potentially causing disturbance to the waterbird populations and also to avoid the visual jarring, and the potentially significant adverse impact that structural buildings would have in an otherwise open and natural looking landscape (see next section).

(2) Use of shingle 'beach' feature at Wallasea Ness: - The shingle habitat at the northeast corner of Wallasea Island (i.e. to the east of Breach 6) is used occasionally by locals who access the site by boat. This area will not be directly affected by the breaching works (the breaches were deliberately placed to avoid such effects) and the numerical modelling studies have indicated that this area will not be indirectly affected by the changes in the hydrodynamic conditions within the estuary and therefore this feature will remain in place.

(3) Vessel Navigation within site: - During the first round Crouch and Roach Management Plan, Essex County Council received several requests for the creation of inland creeks in the Wallasea project, that could be explored by dinghy (Carol Starkey ECC Crouch and Roach Officer). Such navigable creeks are not going to be included in the scheme but the site will be navigable by small shallow draughted vessel at high water. As the ground is typically +1-1.2mODN and high water Spring and Neap the tide will be about +2.9m and +2.4m respectively, there will be 1-2m depth of water over the site for around 2 hours centred on high water during a Spring tide. For most of the time therefore, there will be no vessel access because of the limited water depths and flows on the ebbing and flooding tides although the site will still provide a feature that can be viewed from vessel located outside the breaches (especially at the large Breach 4) in the main estuary.

(4) Sport Fishing: - Rod angling for species such a bass currently takes place to a limited extent along the foreshore during the late summer especially and this will be allowed to continue in future. These activities will be greatly enhanced in the short-term because the new scheme design will provide additional angling vantage points along the new seawalls (as well as those safely accessible and new habitats for demersal fish species (e.g. developing saltmarsh, breach channels, intertidal pools and ditches etc,). Also as the realignment scheme is likely to provide nursery habitats for demersal species the scheme is also likely to enhance the fish populations of the estuary generally.

Therefore, the proposed scheme will have no significant impacts on existing recreational activities and is instead likely to provide a number of new amenity opportunities. These beneficial recreational changes, and particularly the potential increased value for birdwatchers and walkers, will contribute to the Thames Gateway Management Area (Shaun Scrutton RDC pers. comm.). This is because within the Thames Gateway Management Area the Rochford District is a proposed as a 'Green Grid' area (Green Grid is a long-term project to develop a network of open spaces and green links throughout Thames Gateway South Essex). Therefore the environmental and recreational improvements provided by this proposal will help to meet the objectives of this project. Overall therefore the scheme will be of moderate beneficial significance.

13. Landscape and Visual Impact

13.1 Baseline

The lower Crouch and Roach estuaries are largely undeveloped, with the main exceptions being the farming and military areas at Foulness and Havengore and the Baltic Terminal to the north western end of Wallasea. A complex pattern of creeks and channels at points in the estuaries (several of which dry or nearly dry at low water) contribute to its remoteness. The banks of the estuaries have a considerable area of productive agricultural land, including Grade 1 areas.

Wallasea itself is completely enclosed by flood defences, typically clay embankments with block revetment. From the seawalls, the elevation above the Island (which lies at approximately 1-1.2mODN) affords views across the estuary and the island. The land is primarily arable farming (approximately 820ha), with some 50ha of industrial and residential land, limited farm tracks and a few cottages located towards the west of the Island. The road that serves the cottages also runs past the timber yard, hotel and Essex Yacht Marina. The closest built up area to the proposed site is Burnham-on-Crouch across the water to the north. The island has limited fringing saltmarsh and

mudflat. Hence, the area is primarily rural in character, and given its reclaimed origins, the land is extremely flat and low lying.

A number of aerial photographs, covering the Crouch and Roach, have been made available by the EA and these photographs, as well as those that were taken on site, provide more focused information on the existing appearance of the site, particularly at the proposed breach locations (Figures 6-10). The images clearly show the agricultural nature of the site, with the clear structure of the existing seawall and the isolated patches of saltmarsh. Similarly, the photographs at the proposed breach locations highlight the rural nature of the site, the wide-open spaces and general natural appearance. In several of the photos, the more urban areas on the north bank of the Crouch are also visible.

13.2 Impact Assessment

No substantial issues relating to landscape or visual impact were raised during consultation because it was recognised that the scheme will not involve any elevated structures that will be visually imposing and that the overall scheme will create new attractive and low lying coastal landscapes. This was reflected in the responses received during the consultation process many of which had favourable comments which anticipated improvements to the aspect and appearance of the area, with a more natural maritime view.

The change in visual appearance will be from one of primarily arable agricultural land or rough grassland to estuarine foreshore. As such, the proposed realignment scheme at Wallasea is consistent with the existing landscape and geographic location. However, to assist in the appreciation of proposed change, a GIS-based 3D visual model has been produced. The model has integrated aerial photographs, model outputs and bathymetric data (from LiDAR images) to create a high-quality representation of the site. The model has generated images of the existing visual appearance (Figure 36) and the visual change that will occur as a result of the scheme during different stages of tidal inundation (Figures 37 and 38). The images help to show that the scheme will integrate with the current landscape and the impact is therefore considered insignificant. Also available with this report are a series of 'fly though' visualisations which show the site under changing tidal conditions from various view points around the island.

14. A note on socio-economic effects

During the consultation process, a number of individuals expressed concern about the economic consequences of the loss of existing arable land from within the proposed realignment site. Whilst losses of arable land will be incurred (only now on Area B as farming has already ceased in Area A) the proposed realignment work will improve the currently poor defences along the north bank of Wallasea Island and, in so doing, will

protect the remaining valuable farmlands and farm infrastructure on the island. Therefore, the scheme, in its own right, has economic benefits and hence the landowner is firmly supportive of this proposal.

There are also less visible secondary benefits. For instance, without improved defences Wallasea Island would be at risk of significant flooding from natural breaches in the seawall and this in turn would have significant effects in terms of sediment erosion, channel morphology and shellfish mortality in the estuary. Also in the longer term, economic gains will be achieved though enhancing the sustainability of the Crouch estuary and improving the ability of its coastal defences to cope with future impacts from sea level rise and coastal squeeze.

There will also be modest economic and social benefits from the future usage of the site (as summarised in Section 12). There will be an improvement to recreational activities such as: walking, wildfowling, bird watching and angling that occur on site while water-based activities that occur in the Crouch will not be significantly affected and in many cases will be enhanced by the scheme (by providing visual amenity and/or island mooring points for shallow draughted dinghies). The site, as a visual amenity, also forms part of the backdrop of the estuary through providing a rural outlook, benefiting people on the opposite banks of the Crouch and Roach and those using the estuaries for recreation or business. Hence a positive social effect can be anticipated from this perspective.

Therefore, it can be concluded that the proposal represents a **moderate beneficial effect** in economic and social terms.

15. In-combination/cumulative effects

Under the EIA Regulations there is a need to assess the potential cumulative effects of the proposal with other proposals that are in the planning domain. Also, the Habitats Regulations require that the effects of a proposal on internationally designated sites is considered in-combination with the effects of other extant plans or projects.

In this instance a number of different potentially relevant projects were identified in the Scoping Report based on recent planning applications received by RDC. From this list, and information supplied in consultation from EN (Stephen Ayliffe pers. comm.), the extant marine-related projects in the Crouch were: -

(1) Maintenance dredging operations within the Crouch and Roach estuaries;

(2) The beneficial disposal of dredge arisings at Westwick Marina (North Fambridge);

(3) Replenishment of an existing beach with a layer of sharp sand (300mm totalling approx 200 tonnes) and repairs to stone steps and handrail fitted. Located at The Beach, The Quay, Burnham-On-Crouch.

As part of the EIA consultation process, the RDC planning department was also asked whether there were any other projects which could have cumulative or in-combination effects but none were identified that were in the planning domain (Shaun Scrutton RDC pers. comm.).

There is no expectation that the proposed realignment scheme will have cumulative or in-combination effects any of the above proposals. This is because it has been shown that the realignment will not significantly affect the patterns of sediment accretion and erosion within the estuary in the short-term and that any long term changes (over 100s of years) will be negligible and will occur to the east of the site (i.e. not in the area of Burnham, Westwick or the marinas). Therefore, it is not expected that the hydrodynamic conditions and sediment accretion/erosion rates will show a discernable detrimental change in areas where either maintenance dredging or beneficial sediment disposal is carried out. Equally, it cannot be concluded that there will necessarily be any benefits to these project as a results of this scheme. For instance, there is no indication that there will be reduced sediment deposition or maintenance dredging requirements because a proportion of the estuarine sediment will in future enter and remain within the realignment site.

In addition to the above projects, it is known that an underground power cable is to be placed along an alignment that will take it below Area A. The location of Breach 3 was selected to deliberately avoid the proposed route of this cable and ensure that no invasive excavation works could affect a cable along this proposed alignment. Therefore, this proposal will not be affected by the realignment. Overall therefore, any potential cumulative or in-combination effects are considered to be negligible.

16. Additional Mitigation and Monitoring

16.1 Mitigation

The mitigation measures that were a pre-determined and integral part of the scheme design were reviewed in Section 2.2.5, these measures and the overall timing of the scheme (which has been developed to mitigate for impacts to breeding birds in Area A) were considered as part of the impact assessment. The residual impacts of the scheme with these measures in place were identified in Sections 6 to 13. In addition, the following mitigation measure were also identified during the Impact Assessment process

(1) Reptile Translocation: - To avoid deliberate impacts to the protected species (common lizard and adder) there is a need to remove them from the breach

points and areas of the existing wall between Breaches 2 and 3 and between 4 and 6 before breaching (see Section 8.6.2).

(2) Area B ground preparation: - To avoid deliberate impacts to breeding birds in Area B, the areas in which construction and excavating work needs to be undertaken (during the spring and early summer months) will be cleared of vegetation to discourage bird nesting.

It is also recommended that, if possible, plant cuttings from the breach areas and other parts of the existing seawall are distributed across Wall B and Borrow Dyke B to accelerate the natural re-seeding of these new seawall habitats by the local plant species. Also use of a seeding mix that includes 10-15% white and/or red clover is recommended to accelerate the site's development as a wildlife site for plants and invertebrate species.

16.2 Management and Monitoring

16.2.1 Management

In terms of future management of the site, Wallasea Farms Ltd. will be responsible for the maintenance of the new seawall and DEFRA will be responsible for all aspects relating to the management and monitoring of the site over the five years after inundation. Further details of the responsibilities in each case are set out in Section 2.4.1

For the management of the realignment site, DEFRA's core objective will be to let nature take its course and to interfere as little as possible with the development of the site. It is proposed that there will be no intervention at all for the first 12 months after breaching. If after this period problems are identified which require resolution then methods to address these issues will be agreed with the WPMT and pursued accordingly. It is not possible at this stage though, to predict the problems that may occur and the measures required to address them but they could include limited excavation or filling works to modify flows in certain areas. However, for any works that could be needed, priority consideration will be given to Health and Safety constraints (e.g. the need to ensure safe access and egress to staff working on site).

In response to a concern that has been raised by EN (Stephen Ayliffe e-mail dated 3.8.04) the issue of maintaining good water drainage in the saltmarsh recharge area has been specifically considered. The saltmarsh that develops in the recharge area will need to be free draining if it is to develop effectively and, while some limited ponding may be of value and may, for instance, provide refugia for fish fry, intervention may be needed if there is significant ponding. In this event it is proposed that the clay bund could be modified to create shallow weir points and thus facilitate drainage. Another approach could involve digging narrow shallow channels (the size of which will

be dictated by natural process) and then letting the flow of flooding and ebbing tidal water form a more defined creek system in the recharge area.

For the seawall maintenance work Wallasea Farms will undertake some plant cutting to maintain a clear footpath. Wherever possible, they will endeavour to minimise intervention and only the top of the sea wall will be mown annually (to maintain the footpath) while other areas will be rotationally cut to limit disturbance to plant and insect communities. The value of minimal intervention has been proven by the results of the aquatic invertebrate surveys which showed that the drainage ditches which were untouched had a much higher invertebrate interest (see Section 8.5.5) than those that were managed.

16.2.2 Monitoring

For this scheme there are two types of monitoring that will need to be undertaken as follows: -

(1) Site Success Monitoring: - To determine whether the created habitats attain an ecological value that is sufficient to compensate for the habitats losses and waterbird impacts at Lappel bank and Fagbury Flats.

(2) Impact Verification Monitoring: - To confirm the findings of the assessments and demonstrate that the physical and ecological changes within the estuary are within the limits predicted within this ES.

The Site Success Monitoring Programme has already been agreed by the WPMT and has taken into account the joint DEFRA/EA guidance on monitoring managed realignment schemes (DEFRA/EA, 2004). Details of this programme are set out in Section 2.4.2. For the impact verification monitoring, the following measures are recommended based on the findings of this assessment and the hydrodynamic modelling work.

(1) Current monitoring within the breaches: - To be undertaken to confirm the flow regime through the breaches occurs as predicted. This could involve deploying an in-situ flow-speed and flow-direction profiler to describe the hydrodynamic conditions in some or all of the breaches during spring tidal conditions.

(2) Current monitoring within the estuary: - To be undertaken to confirm that the flow regime within the estuary, as predicted, is not significantly altered following realignment. This could involve deploying an in-situ flow-speed and flow -direction profiler in the central channel (but outside the main navigable areas and clearly marked) to describe the hydrodynamic conditions before during and after realignment over a Neap and Spring tidal cycle.

(3) Benthic Intertidal Sampling on the Wallasea North Bank: - To confirm that the scheme does not have a qualitative (ecological) effect on mudflats in front of Area A, the benthic invertebrate sampling for the Site Success Monitoring should be extended to include sites on the adjacent foreshore and a control location to the west of the realignment site. In view of the limited ecological value of this foreshore, this sampling needs only to be sufficient to identify significant effects and to provide a context for the assessment of changes within the site.

(4) Monitoring Saltmarsh and mudflat habitat extent outside the site: - The aerial photos/EA data/satellite techniques that are to be used to map vegetation changes within the site for the Site Success monitoring programme should be extended to include intertidal areas in front of the site. This will provide continuing contextual information on the status of these habitats especially on the status of the already eroding saltmarsh.

(5) Fixed point photography to check for visual foreshore changes: - To describe the foreshore in front of Area A and at Wallasea Ness and confirm that there are no significant changes to this habitat, fixed-point photographs should be taken on an annual basis from safely accessible areas of the existing seawall. These can be used to ground-truth the results of aerial photograph surveys of habitat extent (see above) and can be easily integrated with other monitoring programmes. As with saltmarsh monitoring the results should be reviewed in recognition of the fact that saltmarsh on the north bank is eroding rapidly already.

It is recommended that both of the above monitoring programmes are integrated into a single programme in order to maximise both cost efficiency and the standardisation of survey methods. For both monitoring elements it is of note that the studies undertaken for this impact assessment will form the baseline against which future monitoring results can be reviewed. Therefore, the methods used in this assessment should be replicated wherever possible and appropriate. Also, survey methods should adhere to DEFRA guidance on standardising monitoring protocols (DEFRA/EA 2004).

17. Conclusions and Recommendations

The proposal for managed realignment at Wallasea has benefited greatly from having been pursued in an iterative manner over a period of several years. This process has involved several stages including: an extensive site selection process; advance consultations with the public and interested parties and the careful development of the scheme design. The proposal has also benefited from having the involvement, advice and input of key statutory authorities and NGO stakeholders throughout this process. It was also important that EA's extensive and detailed Flood Management Strategy (Halcrow/EA 2003) recommend realignment on the north bank of the island. This means that the proposal fits precisely within the established strategic framework for the

coastal protection and sustainable development of the Crouch and Roach estuaries. All these measures were valuable components for this proposal given its size and importance and the fact that it will represent the largest realignment scheme ever undertaken in Europe.

As a consequence of the above process as well as the detailed scoping and impact assessment work that are reviewed in this ES, it is considered that the potential impacts of the scheme have been either avoided or foreseen and mitigated. It must be recognised though, that the scheme cannot be pursued without having any effects on wider hydrodynamic system of the Crouch. This is because changes within the estuary must occur in order for the extra volume of water that inundates the new site at each high water (and extra 2.5% at on Spring tide) to get into and out of the estuary on each tide. It has been shown, through numerical modelling, that these changes will take the form of small-scale and short-term alterations to water flows and water levels as well as long-term losses (2.5ha) of intertidal downstream (to the east of the site). These are the unavoidable "costs" incurred for the gains that the scheme as a whole provides in terms of enhanced coastal protection, increased estuary sustainability, higher ecological interest and improved recreational value. However, the modelling work undertaken for this scheme (ABPmer 2004b) and the work undertaken for the preceding Flood Management Strategy have indicated that these costs and their impacts on the ecological and socio-economic interests of the estuary will be insignificant.

These changes must also be seen in the context of the do-nothing option. If this were pursued then natural breaching of the existing wall will occur in an unmanaged way and this will lead to widespread flooding of most of Wallasea Island (which has a relatively low ground elevation throughout). These would then result in uncontrolled significant adverse effects on the estuary and also detrimental effects on the value (economic and recreational) of the island itself. Equally, the active improvement of the exiting defences, along their present alignment, would not be sustainable in the long terms as there would be increased stress on the defences and continued loss of intertidal habitats.

Therefore, overall the scheme with the relevant mitigation and monitoring measures in place is deemed to have a range of either negligible or minor (both adverse and beneficial) effects in the short term but with moderate beneficial effects (in terms of coastal protection and estuary sustainability) in the long term. The ecological gains provided by the creation of new mudflat and saltmarsh habitat within the realignment site have not been considered here because these are relevant solely to the port compensation requirments for which this proposal is being pursued.

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Figures

(Separately available in the “Figures” folder)

Wallasea Farms Ltd

Wallasea Island North Bank Realignment: Environmental Statement (Appendices to main report)

Date: November 2004

Project Ref: R/3439/3

Report No: R.1114

ABP mer
marine environmental research

Appendix A

Review of Alternative Options Considered

Appendix A. Review of Alternative Options Considered

(Information for this appendix is separately available in the “Appendices” folder)

Appendix B

Appropriate Assessment Signalling Document.

Appendix B Appropriate Assessment Signalling Document

Introduction

If needed, this document is designed to contain the information necessary for Competent Authorities to undertake an Appropriate Assessment (AA) of the effects of the proposed Wallasea Island realignment on the Essex Estuaries European Marine Site and the Crouch and Roach Ramsar areas. With the aim of assisting the Competent Authority, this Appendix has been prepared to provide a reference to the relevant sections of the ES that provide the required information for the AA. Further information on the requirements of an Appropriate Assessment are given in Section 3.1.2 of the main report.

Need for an Appropriate Assessment

The scheme is located adjacent to and partially within the Essex Estuaries candidate Special Area of Conservation (cSAC), the Roach and Crouch Special Protection Area (SPA) and the Roach and Crouch Ramsar areas. Therefore RDC as the lead Competent Authority in this case needs to take account of the Habitats Regulations, taking appropriate advice from English Nature. Regulation 48 (1) states that

"A competent authority, before deciding to undertake, or give any consent, permission, or other authorisation for a plan or project which:

(a) is likely to have significant effect on a European site in Great Britain (either alone or in combination with other plans or projects); and

(b) is not directly connected or necessary to the management of the site

shall make an appropriate assessment of the implications for the site in view of that site's conservation objectives".

While the scope and content of an Appropriate Assessment can vary on a case-by-case basis the following information is likely to be sufficient: -

Information on the Need for the Proposed Development:

A comprehensive description of the project's rationale is presented in Section 2.1 of the Environmental Statement .

Scheme Description and alternatives

A detailed description of the scheme as provided in Section 2.2-2.4 and a demonstration that no alternatives exist that could have lower environmental impacts is provided in Section 2.5 and Appendix A.

Indication of consultation with English Nature and/or the general public

Detailed and extensive consultation has been carried out at intervals during the proposal, involving meetings, discussions and written correspondence. Table 4 of the ES and Appendices C to E provide further detail of the consultations carried out.

An understanding of the site's designated features conservation objectives

The Essex Estuaries European Marine Site is formed from a number of constituent designated sites, with the Essex Estuaries cSAC, Crouch and Roach Estuaries SPA and Foulness SPA being considered here. The sites have been designated for a number of reasons, and Table B1 summarises the features of the sites; the presence or absence of these features in the Crouch and Roach estuaries (as identified in the Regulation 33 document, English Nature 2000) and the conservation objectives for these features. Sections 8.2.2 to 8.2.4 of the ES also reviews the interest features for these sites as well as the Crouch and Roach and Foulness Ramsar Sites.

Baseline description of relevant interest features

Broadly this is addressed in Sections 8.3 to 8.5 of the ES although this can be divided into the following categories. Saltmarsh/Atlantic saltmeadow Section 8.3.4; Intertidal mudflats and shallow coastal waters Section 8.3.2; overwintering and passage waterbirds Sections 8.4.2, 8.4.3, 8.4.6; breeding birds Section 8.4.5.

Impacts to relevant SPA and cSAC interest features

Broadly this is addressed in Section 8.6 of the ES although this can be divided into the following categories: Saltmarsh/Atlantic saltmeadow Sections 8.6.2 to 8.6.4; Intertidal mudflats and shallow coastal waters Sections 8.6.2 to 8.6.5; overwintering and passage waterbirds Section 8.6.6; breeding birds Section 8.6.6.

Impacts to relevant Ramsar interest features

The impacts to Ramsar interests are reviewed in Section 8.6.2.

Mitigation measures

These are reviewed both in Section 2.2.5 and 16.1

In-combination effects with other plans or projects

The other extant project that are relevant to this project and the in-combination effects with these proposals are considered in Section 15.

Integrity of the European Marine Site

In an Appropriate Assessment it is necessary to determine whether the project or plan, in this case the proposed realignment at Wallasea, would adversely affect the integrity of the European Marine Site in the light of the site's conservation objectives. Planning Policy Guidance Note 9 on Nature Conservation (PPG9), (DETR, 1994) defines the integrity of a site as the coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species for which it was classified.

In this case there will be minor loss (1.8ha) of saltmarsh (a cSAC interest feature) at Breaches 5 and 6 although this will be replaced by intertidal mudflat habitat (another cSAC interest feature). There is also predicted to be long-term loss of intertidal habitat over a prolonged and indefinable length of time. These impacts are considered to be minor and negligible respectively given the scale and character of the changes and, in the latter instance, because of the long duration of the predicted effect. Also they should be seen in the context of the do-nothing option (i.e. leaving defences to breach naturally) which could well lead to significant adverse effects on these habitats within the boundaries of the EMS.

All other impacts whether direct or indirect, permanent or temporary to cSAC, SPA and Ramsar interest features are considered to be negligible or minor once mitigation measures are taken into account (as described in the report text). These mitigation measures are particularly important to replace Ramsar-cited invertebrate and plant species that will be lost during the breaching and following the tidal inundation of the site. These features, while important in national context, are more frequent locally (Section 8.6.2) and as such the effect is considered to be negligible with mitigation.

Given these findings, it is considered to be unlikely that these impacts will affect the integrity of the European Marine Site or the Ramsar areas under review based on the PPG9 definition above. Formal advice will though be need to be obtained from EN on this issue.

Table B1: Conservation Objectives for the Essex Estuaries European Marine Site

Site	Feature	Sub-Feature	Present in the		Conservation Objective
			Roach	Crouch	
Crouch and Roach Estuaries SPA	Internationally important assemblage of waterfowl (wildfowl and waders) (all species)	Intertidal mudflats and sandflats	✓	✓	Subject to natural change, maintain the habitats for the feature in favourable condition, in particular the saltmarsh, intertidal mudflats & sandflats and the boulder & cobble shores.
		Boulder and cobble shores	✓	✓	
		Saltmarsh	✓	✓	
		Shallow coastal waters	✓	✓	
	Internationally important populations of regularly occurring migratory species (dark-bellied brent geese *Branta bernicla bernicla*)	Intertidal mudflats and sandflats	✓	✓	Subject to natural change, maintain the habitats for the feature in favourable condition, in particular the saltmarsh, intertidal mudflats & sandflats and the boulder & cobble shores.
		Boulder and cobble shores	✓	✓	
		Saltmarsh	✓	✓	
Foulness SPA	Internationally important breeding populations of regularly occurring Annex I species: sandwich tern (*Sterna sandvicensis*), common tern (*Sterna hirundo*), little tern (*Sterna albifrons*) and avocet (*Recurvirostra avosetta*).	Shell, sand and gravel shores	✓	✓	Subject to natural change, maintain the habitats for the internationally important population of the regularly occurring Annex I bird species
		Intertidal mudflat and sandflats	✓	✓	
		Saltmarsh	✓	✓	
		Shallow coastal waters	✓	✓	
	Internationally important wintering population of the Annex I species hen harrier *(Circus cyaneus*). Feeding area occurs outside of the SPA.	None given			None given
	Internationally important assemblage of waterfowl (wildfowl and waders)	Intertidal mudflats and sandflats	✓	✓	Subject to natural change, maintain the habitats for the feature in favourable condition, in particular the saltmarsh, intertidal mudflats & sandflats and the boulder & cobble shores.
		Boulder and cobble shores	✓	✓	
		Saltmarsh	✓	✓	
		Shallow coastal waters	✓	✓	
	Internationally important populations of regularly occurring migratory species	Intertidal mudflats and sandflats	✓	✓	Subject to natural change, maintain the habitats for the feature in favourable condition, in particular the saltmarsh, intertidal mudflats & sandflats and the boulder & cobble shores.
		Boulder and cobble shores	✓	✓	
		Saltmarsh	✓	✓	
	Nationally important breeding population of a regularly occurring migratory species, ringed plover (*Charadrium hiaticula*)	None given	✓	✓	None given

Site	Feature	Sub-Feature	Present in the		Conservation Objective
			Roach	Crouch	
Essex Estuaries cSAC	Pioneer Saltmarsh	Glasswort (*Salicornia* agg.)/annual sea blite (*Suaeda maritima*) community	None marked	✓ Bridgemarsh Island	Subject to natural change, maintain *Salicornia* and other annuals colonising mud and sand in favourable condition, in particular the glasswort/annual sea-blite community and sea aster community
		Sea aster (*Aster tripolium* var. *discoides*) community	None marked	None marked	
	Cordgrass swards	Small cordgrass (*Spartina maritima*) community	None marked	None marked	Subject to natural change, maintain the *Spartina* swards in favourable condition, in particular the smallcord grass and smooth cordgrass communities
		Smooth cordgrass (*Spartina alterniflora*) community			
	Atlantic saltmeadows	Low/mid marsh communities	✓ at intervals	✓ at intervals	Subject to natural change, maintain the Atlantic salt meadows (*Glauco-Puccinellietalia*) in favourable condition, in particular low/mid marsh communities, upper marsh communities, upper marsh transitional communities and drift-line community.
		Upper marsh communities			
		Upper marsh transitional communities			
		Drift line community			
	Mediterranean saltmarsh scrubs	Shrubby sea-blite (*Suaeda vera*) community	None marked	None marked	Subject to natural change, maintain the Mediterranean and thermo-Atlantic halophilous scrubs (*Arthrocnemetalia fruticosae*) in favourable condition, in particular the shrubby sea-blite community and rock sea lavender/sea heath community
		Rock sea lavender (*Limonium binervosum*)/sea heath (*Frankenia laevis*) community			
	Estuaries	Saltmarsh communities	✓ at intervals	✓ at intervals	Subject to natural change, maintain the estuaries in favourable condition, in particular the saltmarsh communities, intertidal mudflat & sandflat communities, rock communities, subtidal mud communities, subtidal muddy sand communities and subtidal mixed sediment communities.
		Intertidal mudflat and sandflat communities	✓ extensive	✓ extensive	
		Rock communities	None marked	✓ NE Bridgemarsh, N bank of Crouch to Creeksea	
		Subtidal mud communities	✓ at intervals	✓ at intervals	
		Subtidal muddy sand communities	None marked	✓ mouth of the Crouch	

Site	Feature	Sub-Feature	Present in the		Conservation Objective
			Roach	Crouch	
		Subtidal mixed sediment communities	None marked	✓ mouth of the Crouch	
	Intertidal mudflats and sandflats	Mud communities	✓ extensive	✓ extensive	Subject to natural change, maintain the mudflats and sandflats not covered by seawater at low tide in favourable condition, in particular the mud communities, muddy sand communities and sand & gravel communities.
		Muddy sand communities	None marked	None marked	
		Sand and gravel communities	None marked	None marked	

Appendix C

List of the individuals and organisation contacted during the DEFRA advance consultation.

Appendix C. List of the individuals and organisation contacted during the DEFRA advance consultation.

For the DEFRA consultation, the owners and occupiers of land and property within the proposed site (i.e. Wallasea Farms) as well as adjacent landowners (e.g. caravan site, timber port, marina etc.) and all other householders on Wallasea were contacted and invited to express their views. In addition the following parties were also contacted: -

(1) Local MPs (via letter from DEFRA Minister).

(2) Anglian Water Services Ltd

(3) BNFL

(4) British Association for Shooting & Conservation

(5) British Gas

(6) British Telecom

(7) BTO

(8) Buglife

(9) Burnham on Crouch Town Council

(10) Burnham Yacht Harbour

(11) Canewdon Parish Council

(12) JN Cardwell

(13) John Carr

(14) CEFAS (via EWD, Defra)

(15) Chelmsford Borough Council

(16) Paul and Jacquie Clark

(17) The CL&BA

(18) RG Charnock

(19) Countryside Agency

(20) CPRE Essex

(21) Crouch Harbour Authority

(22) Crouch and Roach Oystermen and commercial fishermen

(23) Crown Estate Commissioners

(24) FN Curtis

(25) WM Daley

(26) N Wellum, DEFRA Fisheries Inspector (via EWD, Defra)

(27) DfT
(28) James Dorrell
(29) DTI (via EWD)
(30) EDF Energy
(31) English Nature Local Team
(32) English Heritage
(33) Environment Agency
(34) Environmental Futures Ltd
(35) Essex Amphibian and Reptile Group
(36) Essex County Council
(37) Essex Local Flood Defence Committee
(38) Essex Wildlife Trust
(39) Dr Mark Fisher
(40) Mr D Gale
(41) GO East
(42) Dennis Haggerty
(43) Richard Harman
(44) Harwich Haven Authority
(45) Hydrographic Office
(46) Gary Kempen
(47) Kent & Essex Sea Fisheries
(48) Roger Lankester
(49) Maldon District Council
(50) SJ Meddle
(51) Mrs Morse
(52) National Farmers Union
(53) National Grid
(54) National Trust
(55) Mr and Mrs Newby
(56) John Parsons
(57) David Perry

(58) Local police
(59) Ramblers Association
(60) Regional Flood Defence Committee
(61) Mr MI Rider
(62) RNLI
(63) Roach Area Fairways
(64) Rochford 100 Wildfowlers Club
(65) Rochford District Council
(66) Royal Burnham Yacht Club
(67) Royal Corinthian Yacht Club
(68) Royal Yachting Association
(69) Local RSPB Group
(70) Jeremy Squier
(71) Sustrans
(72) Mr B Thomas
(73) Mr and Mrs Wallaker
(74) Gillian Warner
(75) Dennis Watling
(76) Mr C Wayland
(77) The Wildlife Trusts
(78) WWF

Appendix D

Outline of views expressed during the DEFRA public consultation process

Appendix D1: Views expressed during the DEFRA public consultation process (1st September 2003 to 5th January 2004)

Meeting/ Letter	Name	Concerns/Views	Section in ES Where Addressed
Public Exhibition	N/A	Thirty attendees wished for their comments to be noted, of which 58% were in favour, 30% against and 12% neutral. Those in favour were for aspects of restoring the coast for the benefits of both wildlife and people, and better flood defence. Those against were opposed to loss of food producing land (four coastal landowners), increase in flood risk and causing a loss of navigation through siltation of the main estuary. The biggest concern and most queries were on public access, including requesting assurance of footpath continuity on the wall crest, desire for a discreet bird hide and a low level path across the site to view the area in future. Many commented on the loss of the Burnham/Wallasea ferry. Much discussion and comment was made about the seaward impacts to navigation/potential siltation (especially by local yacht users, boat yard owners or those who made a living on the river) to the estuary with concern about mud being "sucked" out of the site and into the river or onto Burnham frontage. At present the majority on local people believe that the eroding Bridgemarsh Island 3km to the West of the site to be the cause of all the rivers siltation problems. Similar comments were made about increasing tidal speeds in the estuary causing increases in erosion/siltation or a navigation hazard, with a lot of related discussion on breach sizes and location. Ron Pipe raised the issue of an existing sand/stone bar that is building on an east/west line on the east of the mouth of the Roach. Other comments were received on potential lorry movements through Canewdon, an increase in flood risk to Burnham and the existing seawall being in good condition. In general, the site was viewed from a landward perspective in a mainly favourable/neutral perception but with navigation concerns on erosion/siltation/current speed increasing from a seaward perspective.	All ES but mainly Sections 6, 11, 12

Meeting/ Letter	Name	Concerns/Views	Section in ES Where Addressed
Public Exhibition	County Councillors Ray Howard, Tracy Chapman and the member for Rochford South, Roy Pearson.	All gave their support for the project.	✓
Public Exhibition	Wildfowling clubs	The local wildfowling clubs were very interested in the project and expressed concern both in terms of maintaining their existing arrangements with WFL and extending them/managing the new wetland. A map of their adjacent land ownership and wildfowling positions was provided.	12.2.4
Public Exhibition	Essex Amphibian and Reptile Group	Many concerns on pre-monitoring, pre-construction management and mitigation for, in particular, adders, newts, lizards and water vole.	8.5.3 and 8.6.2
Meeting with Wildfowlers	Rochford 100 Wildfowlers Club	Approximately 25 members attended a meeting held at their request to answer specific concerns regarding the impacts on their sport and the role of the RSPB. Requested that they be considered to assist in any future site management, but a clear understanding that wildfowling would not be permitted on the site itself. Offers were made to control poaching, clear up man made high tide litter, keep out jet-skis/power boats, monitoring etc.	12.2.4
Meeting with Harbour Authority	Crouch Harbour Authority	The CHA is composed of interests as varied as the navigation, wildlife, yachting, wildfowling and landowner representatives. The scheme case was put in a series of four brief talks by Robert Bache (the landowners view), John Hesp (engineering), Karen Thomas from the EA (Roach and Crouch Flood Management Strategy), and Mark Dixon from DEFRA (Project Manager). The questions raised were an objection to the EA Strategy as regards compensation to landowners, a suggestion that the site be freshwater only with no breaching, a request for detail on the strength of the proposed counter wall, a suggestion that breaches be lined with rock/old revetment.	2.1, 6, 11 and 12
Letter	Pam Thompson, Clerk to Bircham Dyson Bell	Were previously in contact regarding the Weymarks proposal and the possibility that their client, the RNLI, would be affected.	✓

Meeting/ Letter	Name	Concerns/Views	Section in ES Where Addressed
Letter	Dennis Haggerty	100% in favour of the development.	
Letter	Nigel Brigham, Sustrans	In favour of the project. The area is one where they would like to see better cycle facilities, with links to Southend, Rochford and Burnham-on-Sea. A cycle route/footpath along the new defences would link from Grapnells or the Marina to a ferry crossing to the Quay on Foulness.	12.2.3
Letter	Roy Rawlinson, Rochford 100 Wildfowling club	Support the proposal but would like wildfowling rights	12.2.4
Letter	Dr. Connor O'Gorman, BASC	Request for information on the long term management of the site and suggests that local wildfowling clubs with local knowledge and management skills could be approached as potential managers. If Defra acquires the land, wants to know how the sporting rights will be managed and whether local clubs will be offered the opportunity to buy or lease the rights.	2.4.1 and 12.2.4
Letter	Mr D Gale	Wildfowling rights	2.4.1 and 12.2.4
Letter	Peter Murphy, English Heritage	Referred to guidance documents and the process required. A desk based assessment of the archaeology will be required - states that standard practice is for this to be commissioned from a commercial archaeological unit. Requires reassurance that the scheme will be designed to avoid damage to Listed Buildings.	10
Letter	John Brien, Harwich Haven Authority	Recharge works	2.2.3
Letter	Richard Bessey, Roach Area Fairways	It is important that the existing profile of the estuaries are not altered as commercial trade could be affected, which is important to Crouch Harbour Authority any may result in management of the estuary being cut. The existing footpath between Grapness to the ancient ferry landing opposite Foulness Quay must be maintained. The remaining seawall and public access to Branklet Spit and the adjacent shingle beach must be maintained. Mud eroded from the exposed marsh may cause other areas to silt up and a thorough hydrological study is required. Finally, is any claim being made against those who profited from	6 and 12

Meeting/ Letter	Name	Concerns/Views	Section in ES Where Addressed
		the port development.	
Letter	Gary Kempen	Has navigation and siltation concerns, but is a supporter.	6
Letter	Dennis Watling	For wildfowling rights	12.2.4
Letter	Paul MacBride, Chelmsford Borough Council	The proposal appears to be in accordance with the EA's Flood Management Strategy for the Crouch and Roach and would enable a more sustainable approach to flood defence to be taken. It would also assist in the creation of a new habitat for birds and other wildlife.	✓
Letter	Matt Shardlow, Buglife	Initial comments were disappointment that no analysis of the existing wildlife value of the site has been made and would be pleased to have copies of any surveys undertaken, EIA once produced. Expressed considerable concern that ecological value of sites was not taken into consideration when determining what site would be chosen for realignment, with considerable discussion between Buglife, EN and DEFRA. Wish to ensure that the potential importance of invertebrate fauna is investigated through a thorough survey. The borrow dykes and seawalls are critically important habitats for invertebrates in Essex and if not sustainable should be recreated elsewhere.	8
Letter	Dr Mark Fisher	Support for wilderness area	✓
Letter	F.N. Curtis	Agrees with the aims of the scheme but concerned about the cost and the unnatural method proposed. Does not understand the need to import mud and to breakdown existing defences. Could the area not be allowed to develop into brackish water reedbeds? States that there are problems with silting and erosion in the river and that to import more mud is 'incredible'.	2.2.3
Letter	Clea Rawinsky, Burnham Yacht Harbour	Has dredgings to dispose of	-
Letter	Gareth Gunning, CPRE Essex	CPRE supports the proposal	✓
Letter	John Barnard, Ramblers Association	Requested input on the reason for project, site access and where the funding will come from.	2.1

Meeting/ Letter	Name	Concerns/Views	Section in ES Where Addressed
Letter	Jeff Delve, BTO member and Wallasea site surveyor	Carried out the BTO survey work for breeding skylark and winter farmland birds. Requested further information on the links between the new seawall built around Area B and the current scheme. Noted that an area of wet pools formed between the walls, which was subsequently levelled – seemed a shame as avocets looked interested and it was attracting waders. Requested input on how the habitat is expected to develop and if greater public access will be allowed. Of note are the corn buntings that use the current set aside, particularly in the eastern area. Queried if the shingle ridge at Wallasea Ness would be affected.	8 and 6.2.3
Letter	Richard Harman	Support for the realignment as a flood defence	✓
Letter	Martyn Smith, RNLI	Unlikely that the scheme will affect lifeboat operations.	✓
Letter	Mrs K Cumberland, clerk to Canewdon Parish Council	The Parish Council is in favour of the proposal and wish to be kept informed. Recognise that the site is at risk from flooding, with the proposal helping with sea defence.	✓
Letter	Shaun Scrutton, Rochford District Council	The Council supports the proposal, but wish to ensure that the entrance to the Crouch from the Roach is protected from silting to ensure safe passage for vessels.	6
Letter	Jeremy Squier	Against managed retreat in general and on Wallasea in principle. The plan for Wallasea to 2054 seems to be to allow the remaining walls to deteriorate and the whole Island to be flooded. Does not agree that the scheme would not let any more water into the river system. The mud that will be used will come from Harwich and will not make saltings but a beach for boaters to land on. Believes that the scheme is proposed to satisfy the Birds Directive, release the Government from the fine, to save the cost of flood defence and to allow the development of the rest of Harwich Harbour.	2, 6, 8 and 11
Letter	Stuart Jennings, Maldon District Council	The Council is pleased to see the proposal instead of the Weymarks scheme and raises no objection to the proposal. The Wallasea proposal appears to be consistent with the Crouch and Roach Flood Management Strategy. The Council needs to understand the effects on the north side of the River Crouch.	✓

Meeting/ Letter	Name	Concerns/Views	Section in ES Where Addressed
Letter	Karen Thomas, Environment Agency	Support the scheme in conjunction with the Flood Management Strategy for the Crouch	✓
Letter	John Parsons	Full support for the scheme. Has lived in the area for 3+ years and is concerned about the commercial development of farmland at the expense of wildlife. Strongly believes in the need for such work, especially as regards birds.	✓
Letter	Jill Warner	Full support for the scheme. Is a keen bird watcher and looks forward to another area of natural beauty being preserved.	✓
Letter	David Perry MBE	Full support for the idea. In particular, has noticed that the existing footpath needs attention and that a new footpath along the new seawall would be beneficial.	12.2.3
Letter	Mrs Morse	Very concerned about the loss of saltmarsh to development and therefore gives full support to the proposal.	✓
Letter	Paul and Jacquie Clark	Local residents concerned about the loss of green belt land and natural habitats. Often walk in the area and recognise the value of the area to wildlife. Therefore give full support to the proposal.	✓
Letter	Lindsay Murray, CEFAS	Supports the proposal but would like all uses of the area to be acknowledged and involved.	✓
Letter	Mr & Mrs Wallaker	Feel that the site is an ideal place to create wetland for internationally important birds. Full support.	✓
Letter	John Carr	Generally in favour, but did raise some concerns. Is the area likely to encourage visiting geese that could feed on the farmers fields, is the new seawall going to be continued to form the additional wall needed, where will the mud required come from and will it cause disturbance elsewhere, what will the effect be on water flow in the area especially Roach, will the level of high tide be affecter, are high tide levels gradually increasing and will there be any public access to the area. These questions were answered in part at the time.	6
Letter	Mr and Mrs Newby	Consider the project to be an excellent scheme for the environment and give full support.	✓
Letter	James Dorrell	Pleased to hear about the proposal having walked in the area on several occasions. However disagrees	12.2.4

Meeting/ Letter	Name	Concerns/Views	Section in ES Where Addressed
		with the purchase of land close to the road on the south of the Island, now barred from public entry, by the Rochford Wild Fowlers Association. To the other side of the road is a wildlife sanctuary for breeding wildfowl, which are shot. Hopes something can be done to prevent the proposals from making a new target for shooting.	
Letter	W.M.J. Daley	Support the proposal, especially for the improved sea defences, new habitat for wildlife and an improved footpath, but would like more advertising.	✓
Letter	Chris Edwards, RYA	The main concern relates to ensuring no detrimental impact to the ability to navigate in the estuary system. The area has a thriving yacht and dinghy racing tradition which uses all the navigable waters – would not wish to see any works that reduce or impair the internationally recognised facilities.	12.2.2 and 6
Letter	Dennis Watling	Attended the presentation at Rochford 100 Wildfowlers Club on 12 November and was very impressed. Concerned that the sport of wildfowling could be affected by the scheme and seeks assurances that this will not happen.	12.2.4
Letter	Mr. B. Thomas	Provided information on Wallasea Farms Ltd as to their behaviour with a neighbouring farm and permitting horse riders to ride over conservation margins.	-
Letter	Howard Green, EDF energy	Concerned about 3 underground power cable crossing Wallasea and that flooding the area may prevent access. Of particular relevance is that the cables on land are not protected sufficiently to endure permanent or semi-permanent flooding. However, the company is currently looking at replacing the cables, with the main concern relating to the possibility that the area north of the seawall could be flooded before the plant is replaced.	15
Letter	S.J. Meddle	Concern at loss of wildfowling	12.2.4
Letter	R.G. Charnock	Concern at loss of wildfowling. Notes that the proposal overlaps one of the clubs conservation areas on the Crouch and extends along one of the favoured shooting stretches.	12.2.4
Letter	Mrs J.N. Cardwell	Feels that the lost saltmarsh should be replaced and is in favour of the proposal.	✓

Meeting/ Letter	Name	Concerns/Views	Section in ES Where Addressed
Letter	Phil Sturgess, Essex Wildlife Trust	EWT support in principle such projects. Ideally the compensation should be as close as possible to that lost. Note that Wallasea is a new option from R947 and that it is not clear why some options in that report have not been considered. BTO report 210 details the bird usage of the sites lost and should be used in the EIA. It must be considered that the proposed site is outside of the affected SPA and whether the birds affected will benefit. The BTO report recommends compensation ratios up to 3:1 for habitat created to that lost. As a landowner, EWT has concerns regarding potential impacts to nature reserves at Lion Creek, Lower Raypits, Blue House Farm & Woodham Fenn. The footpath needs to be replaced.	6
Letter	Dr Stephen Crooks, Environmental Futures Ltd	Although creating replacement intertidal is difficult, believes that the scheme presents a good opportunity to enhance the area and offset losses from elsewhere. Points that should be considered include alteration to the tidal prism, potential erosion and enlargement of the outer estuary channel, adequate monitoring and action to take if the scheme does not develop as requried. States that due to the properties of arable land, habitats that form differ from local intertidal. Successful colonisation can be encouraged by a creek network or by alterating the topography.	6
Letter	David McNeill, Burnham on Crouch Town Council	The Council give full support to the proposal.	✓
Letter	Michael Parker, BNFL	The Wallasea scheme poses far fewer implications for BNFL than the Weymarks and no opposition is expressed to Wallasea.	✓
Letter	Helen Deavin, RSPB	Supports the project subject to a favourable EIA and AA as required. Highlight the need for habitat and bird targets to be set based on those lost at Lappel and Fagbury Flats. The RSPB feel that permitting wildfowling on the site would be unwise as it may increase the risk of the site failing to meet its objectives.	12.2.4
Letter	Ray Cranfield, Essex Amphibian and Reptile Group	The Wallasea scheme is preferable to Weymarks, since the latter has populations of several reptiles. The agricultural nature of Wallasea makes it less likely that such species are found there, however the	8.6.2

Meeting/ Letter	Name	Concerns/Views	Section in ES Where Addressed
		seawall, ditches and other water bodies at Wallasea will require surveying before works are carried out. Recommends that the creation of a freshwater lake be looked at together with hibernation areas for herpetofauna. Specific concerns for reptiles and great crested newts. Should reptiles be found, the scheme should aim to incorporate them in the design. Any mitigation scheme should need at least 5 years monitoring for reptiles.	
Letter	Mr. C Wayland, wildfowler	Support but concerns on wildfowling rights	12.2.4
Letter	Neil Jacobson, Crown Estate	Raised some land ownership issues. Stated that the River Crouch along the northern boundary is not Crown so agreement needs to be with the owners. The foreshore of the Roach to the east is Crown and will therefore need consent, but there are previous consents that may complicate the issue.	3
Letter	Roger Lankester	Pleased to see the Wallasea proposal to come from the Weymarks public meetings but wants a more 'sociologically' aware approach taken. This could include sustainable development facilities for recreational sailing - see project Greensail.	12
Letter	Graham Wynne, RSPB	The RSPB supports and welcomes the decision to create new wetland at Wallasea. Believes that the site, subject to the necessary consents, can provide the necessary number and variety of wildfowl.	✓
Letter	Graham Mee, Southend RSPB	Wholeheartedly supports the proposal but feels that some hides would improve it further.	✓
Letter	FJ Beardsworth	Has been actively involved in wildfowling on Wallasea for several years and hopes to be able to continue.	12.2.4
Letter	Mr M.I. Rider, wildfowler	Support but concerns on wildfowling rights	12.2.4

Appendix E

Consultation responses received during EIA.

Appendix E Consultation responses received during EIA

(Information for this appendix is separately available in the “Appendices” folder)

Appendix F

Non-Technical Summary from the Wallasea Proposal Hydrodynamic Modelling report (ABPmer 2004b)

Appendix F Non-Technical Summary from the Wallasea Proposal Hydrodynamic Modelling report (ABPmer 2004b)

(Information for this appendix is separately available in the “Appendices” folder)

Appendix G

Survey data including: water quality, sediment PSA/contamination and intertidal benthos.

Appendix G Survey data including: water quality, sediment PSA/contamination and intertidal benthos.

(Information for part of this appendix is separately available in the "Appendices" folder)
This Appendix Contains: -

(1) Environment Agency Water Quality Results

(2) Intertidal Sediment Contamination data

(3) PSA analysis sheets for the sediment taken at benthic sampling site B1 to B7

(4) Species abundance matrices for the invertebrate communities at sampling site B1 to B7

(5) Summary information, maps and photographs for three previous realignment scheme

[NB A selection of photographs taken during the assessment process are included on the electronic copy of the ES which is separately available.]

ENVIRONMENT AGENCY WATER QUALITY RESULTS

The EA monitors water quality conditions at several sites in the Crouch including the Essex Yacht Marina (upstream from the proposed realignment site), North Fambridge (upstream from the proposed realignment site), Ropers Farm (in Paglesham Reach) East End Paglesham and Monkton Quay (Foulness). The data collected in 2001 from these sites is summarised in Table G1 and reviewed in the main report.

Table G1: Environment Agency Water Quality Data Collected for Crouch and Roach (1 January to 31 December 2001)

Determinand		Essex Yacht Marina	North Fambridge	Ropers Farm	Monkton Quay	East End Paglesham
Dissolved Oxygen (%)	Min	82.1		76#^	89.6	89
	Max	119		146.4	165.5	156
	Mean	95.1		102.69	104.36	106.9
pH	Min	7.89	7.8	7.8	7.7	7.7
	Max	8.35	8.25	8.2	8.2	8.2
	Mean	8.01	7.97	8.03	7.93	7.95
Turbidity	Min	3.3	3.4	9.3	20.5	19.2
	Max	49	82.6	260	55.8	61.7
	Mean	19.2	21.4	40.55	39.3	36.3
Suspended solids (mg/l)	Min		4.5		8.8	7.7
	Max		74		1274	495
	Mean		24.35		284.88	110.59
Temperature	Min	4.6	5	3.1	4.5	4.5
	Max	20.5	21	22.3	22.5	22.6
	Mean	14.3	14.4	15.1	15.4	15.14
Salinity	Min	25.62		32.56	26.53	25.43
	Max	32.44		32.56	33.39	31
	Mean	29.62		32.56	30.18	18.14
BOD (mg/l)	Min	<1		<1	<1	<1
	Max	4		5.4	5.2	6.3
	Mean	1.1		2.16	2.14	1.8
Ammonia (N) (mg/l)	Min	0.012	0.021'	0.088'	0.008	0.007
	Max	0.201'	0.228'	0.489'	0.203'	0.451'
	Mean	0.085'	0.116'	0.225'	0.091'	0.178'
N Oxidised (mg/l)	Min	0.029	0.16	0.079	0.069	0.026
	Max	1.85	2.7	3.161	1.02	2.04
	Mean	0.559	1.11	0.8	0.349	0.584
Orthophosphate (mg/l)	Min	<0.025	0.071	0.097	0.023	0.038
	Max	0.155	0.323	0.555	0.136	0.397
	Mean	0.09	0.207	0.217	0.074	0.146
Lead ug/l	Min	<0.07	<0.07	0.14	0.04	0.024
	Max	0.424	0.32	0.386	0.37	0.738

Determinand		Essex Yacht Marina	North Fambridge	Ropers Farm	Monkton Quay	East End Paglesham
	Mean	0.188	0.133	0.202	0.15	0.21
Mercury (ug/l)	Min	<0.01	<0.01	<0.01	<0.01	<0.01
	Max	0.016	0.03	0.04	0.14	0.04
	Mean	0.008	0.0096	0.02	0.019	0.0085
Cadmium (ug/l)	Min	<0.04	<0.04	<0.04	<0.04	<0.04
	Max	0.042	0.051	0.07	0.044	0.046
	Mean	0.031	0.039	0.03	0.024	0.024
Zinc (ug/l)	Min	2.39	1.81	2.67	1.75	1.71
	Max	5.11	9.55	5.6	10.4’	10.1’
	Mean	4.01	4.38	4.02	3.54	4.08
Chromium (ug/l)	Min	0.033	0.015	0.048	0.016	0.017
	Max	0.063	0.51	0.35	0.407	0.35
	Mean	0.048	0.106	0.097	0.123	0.057
Nickel (ug/l)	Min	1.21	1.69	1.72	0.98	1.18
	Max	1.92	3.35	2.4	1.48	2.19
	Mean	1.42	2.17	2.08	1.29	1.63
Copper (ug/l)	Min	1.67		1.64	1.21	1.29
	Max	3.18		2.59	1.93	7*
	Mean	2.46		2.03	1.67	2.24
Coliforms (no/100ml)	Min	<10		<10	<10	<10
	Max	81		892#^	760#^	924#^
	Mean	30.3		317#	85.9	170.45

* - exceeds water quality standards for List II substances under the Dangerous Substances Directive
# - exceeds guideline water quality standard under the Shellfish Waters Directive
^ - exceeds guideline water quality standard under the Bathing Waters Directive
‘ – exceeds saltwater EQS

INTERTIDAL SEDIMENT CONTAMINATION

Sediment Quality Standards

The levels of contamination within sediments that are to either be dredged or deposited in the UK are evaluated by DEFRA's Marine Consents and Environment Unit (MCEU) under the FEPA licensing system. and are usually analysed by CEFAS. When making judgements about sediment quality levels, no absolute levels of acceptability are set but, instead, a pragmatic 'weight of evidence' approach is used to determine the acceptability for disposal because there are no absolute British sediment quality standards. This 'weight of evidence' approach which takes into account existing background levels of contamination, local geology and natural variability. This approach allows variations between regions, resulting from the local geology, to be taken into account.

Although British sediment quality standards are not available, an analysis of sediment contamination level can be informed by reference to established Dutch and Canadian standards. The Dutch apply a tiered system to classify the level of contamination of dredged materials for disposal, with quality levels based on pre-determined limits for the different contaminants. The three levels are defined as follows:

(1) Target Value (TV) - Indicates the level below which the risk to the environment is considered to be negligible, at the present stage of knowledge.

(2) Reference Value (RV) - Indicates the maximum allowable level of contaminants.

(3) Intervention Value (IV) - An indicative value, indicating that remediation may be urgent, owing to increased risk to public health and the environment.

The Standard Levels are shown in Table G2 and in each case an exceedence of reference values by one or two parameters to a maximum of 50% is allowed, as long as no exceedences are recorded for the other parameters. This system is precautionary, offering a clear and consistent methodology for the consideration of contaminants in marine sediment. It does not however allow for assessment of sediments on a case-by-case basis taking into account natural geological variability (as applied in the UK by DEFRA).

An additional set of guidelines, which can be used for the comparison of concentrations of heavy metals and other contaminants, are the Canadian Interim Sediment Quality Guidelines (ISQGs). These were developed by the Canadian Council of Ministers of the Environment as broadly protective tools to support the functioning of healthy aquatic ecosystems (CCME, 2001) and can be used as a first approximation in assessing whether organism are at risk from sediment concentrations of toxic substances (Grimwood and Dixon, 1997).

Table G2. Dutch Quality Standards for dredged material disposal at sea

Determinand	Dutch Standard (Marine Disposal)			Canadian Standards	
	Target Value (TV)	Reference Value (RV)	Intervention Value (IT)	ISQG (TEL)	PEL
Heavy Metals mg/kg dry weight					
Arsenic	29	55	55	7.2	41.6
Cadmium	0.8	7.5	12	0.7	4.2
Chromium	100	380	380	52.3	160
Copper	35	90	190	18.7	108
Lead	85	530	530	30.2	112
Mercury	0.3	1.6	10	0.13	0.7
Nickel	35	45	210	-	-
Zinc	140	720	720	124	271
PAH mg/kg dry weight					
(Total 10 PAK)*	1	10	40	-	-
PCBs µg/kg dry weight					
Total 7 PCBs	-	200	1000	21.5	189

Note: * Naphthalene, Benzo (a) anthracene, Benzo (ghi) perylene, Benzo (a) pyrene, Phenanthrene, Indeno (123-cd) pyrene, Anthracene, Benzo (b/k) fluoranthene, Chrysene, Fluoranthene

Data from IADC/CEDA, 1997 and CCME, 1999

The Canadian approach (ISQGs) involves the derivation of Threshold Effects Levels (TEL's) and Probable Effect Levels (PEL's) from an extensive database containing direct measurements of the toxicity of contaminated sediments to a range of aquatic organisms exposed in laboratory tests and under field conditions. Effects may be observed in some sensitive species exposed to the TEL, whereas the PEL is likely to cause adverse effects in a wider range of organisms. The three ranges of chemical concentrations (below TEL, between TEL and PEL, and above PEL) indicate those that are rarely, occasionally and frequently associated with adverse biological effects.

Table G3. Canadian ISQGs for heavy metals in terms of adverse biological effect

Metal	ISQG (TEL)	PEL	Incidence of Adverse Biological Effects		
	mg/kg dry weight		%<= ISQG	ISQG<%<PEL	%=>PEL
Arsenic	7.24	41.6	3	13	47
Cadmium	0.7	4.2	6	20	71
Chromium	52.3	160	4	15	53
Copper	18.7	108	9	22	56
Lead	30.2	112	6	26	58
Mercury	0.13	0.7	8	24	37
Nickel*	-	-	-	-	-
Zinc	124	271	4	27	65
PCBs	21.5	189	4	40	50

Note: * There is currently no ISQG for Nickel

Sediment Contamination at Wallasea

The chemical quality of sediments collected around the intertidal section of Wallasea Island was assessed by Scientific Analysis Laboratories (SAL). Chemical contamination levels for heavy metal, Polycyclic Aromatic Hydrocarbon (PAH) and Polychlorinated biphenyl (PCB) in relation to the Dutch and Canadian Guidelines are shown in Table G4 as dry weight concentrations in Tables G4. Table G5 shows the incidence of adverse biological effects based on the ISQGs and PEL concentration ranges.).

Table G4. Chemical quality of sediments on Wallasea Island

Determinands		Units	Sample						
			B1	B2	B3	B4	B5	B6	B7
Heavy metals	Arsenic	mg/kg	6	6	5	11	7	6	10
	Cadmium	mg/kg	<1	<1	<1	<1	<1	<1	<1
	Chromium	mg/kg	12	12	8	11	10	11	21
	Copper	mg/kg	12	10	6	7	7	9	19
	Lead	mg/kg	20	18	15	8	15	16	33
	Mercury	mg/kg	<1	<1	<1	<1	<1	<1	<1
	Nickel	mg/kg	12	11	7	13	9	10	20
	Zinc	mg/kg	53	48	33	34	38	44	85
PAHs	Naphthalene	mg/kg	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	0.03
	Acenaphthylene	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	Acenaphthene	mg/kg	<0.01	0.02	0.02	<0.01	<0.01	<0.01	0.03
	Fluorene	mg/kg	<0.01	0.01	0.01	<0.01	<0.01	<0.01	0.02
	Phenanthrene	mg/kg	0.02	0.04	0.05	0.01	0.02	0.01	0.11
	Anthracene	mg/kg	<0.01	0.01	0.01	<0.01	<0.01	<0.01	0.03
	Fluoranthene	mg/kg	0.02	0.04	0.10	0.02	0.02	0.02	0.12
	Pyrene	mg/kg	0.02	0.02	0.10	0.01	0.02	0.02	0.10
	Benzo (a) anthracene	mg/kg	0.01	0.02	0.06	<0.01	0.01	0.01	0.05
	Chrysene	mg/kg	0.01	0.02	0.05	<0.01	<0.01	0.01	0.04
	Benzo (b/k) fluoranthene	mg/kg	0.02	0.02	0.10	<0.01	0.01	0.02	0.06
	Benzo (a) pyrene	mg/kg	0.01	<0.01	0.06	<0.01	<0.01	<0.01	0.03
	Indeno (123-cd) pyrene	mg/kg	<0.01	<0.01	0.04	<0.01	<0.01	<0.01	<0.01
	Dibenzo (ah) anthracene	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	Benzo (ghi) perylene	mg/kg	<0.01	<0.01	0.06	<0.01	<0.01	<0.01	<0.01
PCBs	Total PCBs	µg/kg	<0.05	0.14	<0.05	0.27	0.07	<0.05	<0.05
TPHs	Total TPHs	mg/kg	5	<1	<1	<1	<1	<1	10
TBT	Tributyltin	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Table G5. Summary of sediment contamination in Wallasea Island samples

	As	Cd	Cr	Cu	Pb	Hg	Ni	Zn	PAHs	PCBs
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	µg/kg
Average	7.29	<1	12.14	10.00	17.86	<1	11.71	47.86	0.2	0.16
Range	2.1 - 11	<1	8 - 21	6 - 19	8 - 33	<1	7 - 20	33 - 85	0.03 - 0.53	<0.05 - 0.27
No. above Dutch TV	0	0	0	0	0	0	0	0	0	-
No. above Dutch RV	0	0	0	0	0	0	0	0	0	0
No. Above Canadian 1SQG/TEL	2	0	0	1	1	0	-	0	-	0
No. Above Canadian PEL	0	0	0	0	0	0	-	0	-	0

INTERTIDAL PSA

Data sheets showing the results of the PSA analyses for samples taken at Site B1 to B7 are included.

INTERTIDAL BENTHOS

The species abundance matrices for the intertidal benthic surveys are shown as Table G6 to G8.

REALIGNMENT SCHEME CASE EXAMPLES

Summary information, maps and photographs, from an ABPmer database, for two previous realignment schemes are included.

References

CCME, 1999. Canadian sediment quality guidelines for the protection of aquatic life: Summary tables. In: Canadian environmental quality guidelines, 1999, Canadian Council of Ministers for the Environment, Winnipeg.

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Grimwood, M. and Dixon, E., 1997. Assessment of risks posed by List II metals to 'Sensitive Marine Areas ' (SMAs) and adequacy of existing environmental quality standards (EQS's) for SMA protection. WRc Report CO 4278/10435-0 to English Nature.

IADC/CEDA, 1997. Environmental aspects of dredging - conventions, codes and conditions: marine disposal, 71pp.

Appendix H

Aquatic and Terrestrial invertebrate survey report (Godfrey 2004)

Appendix H Freshwater/Brackish Water Aquatic Invertebrate and Terrestrial invertebrate survey report

(Information for this appendix is separately available in the “Appendices” folder)

Appendix I

Extended Phase 1 habitat survey of Wallasea Proposed Realignment site (EECOS 2004)

Appendix I Extended Phase 1 habitat survey of Wallasea Proposed Realignment site (EECOS 2004)

(Information for this appendix is separately available in the “Appendices” folder)

Appendix J

Archaeological Assessment Desk Study Report

Appendix J Archaeological Assessment Desk Study Report

(Information for this appendix is separately available in the “Appendices” folder)

Appendix K

Citations for nationally and internationally designated sites in the vicinity of Wallasea Island.

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(Information for this appendix is separately available in the “Appendices” folder)

Appendix L

Birds data and maps from WeBS, BTO, RSPB and Natural Resources surveys

Appendix L Birds data and maps from WeBS, BTO and Natural Resources surveys.

(Information for this appendix is separately available in the "Appendices" folder)

This Appendix contains the following:

(1) WeBS unpublished core counts for the Outer and Middle Crouch and Roach Estuaries

(2) Estuary-wide low water counts from published WeBS accounts and BTO Studies undertaken for DEFRA as part of realignment site selection process

(3) Estuary-wide and Wallasea area low water counts from unpublished WeBS counts

(4) Report and survey maps from Natural Resources' Wallasea Island Surveys (2003-2004)

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