

Theme five:

Coastal environmental management
and enhancement

Compensatory Habitats: Defining Needs and Demonstrating Success

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Abstract

The Stour and Orwell estuaries on England's east coast are designated as sites of importance for nature conservation under the EC Birds Directive (79/409/EEC). However, over recent years, a number of significant port development projects - focussed on major ports at Felixstowe and Harwich - have been either undertaken or granted consent within the estuary system (the 'Harwich Haven').

This paper discusses the approach adopted to defining the mitigation measures and compensatory habitats required in order to progress, and to demonstrating the efficacy of such measures in maintaining the overall coherence of Natura 2000 sites, in relation to the predicted impacts of a proposal to construct a major container terminal at Bathside Bay.

Through the example provided by the Harwich Haven Authority and the Port of Felixstowe, this paper examines a successful approach to:

- Enabling dredging and port development in an environment designated for its nature conservation importance.
- Ensuring the delivery of appropriate mitigation and compensation based on good data and consultation.
- Monitoring the performance of mitigation measures and compensatory habitat.
- The acceptance of some (measured) risk in developing management strategies within a dynamic environment.

Background

Over recent years a number of major developments have been proposed in the Stour and Orwell estuarine system (see Figure 1). Projects that have been completed include ❶ the deepening of the approach channel to the Harwich Haven (the water area at the confluence of the Stour and Orwell estuaries) and ❷ the extension of deep water facilities at the northern end of the Port of Felixstowe (Trinity III Terminal (Phase 2) Extension). More recently, two further schemes have gained consents which are yet to be implemented. In December 2005, consent was achieved for ❸ the development of a new container terminal at Bathside Bay, Harwich; while in February 2006 consent was achieved for ❹ the reconfiguration of the southern end of the Port of Felixstowe (north of Landguard Point) to increase container handling capacity.

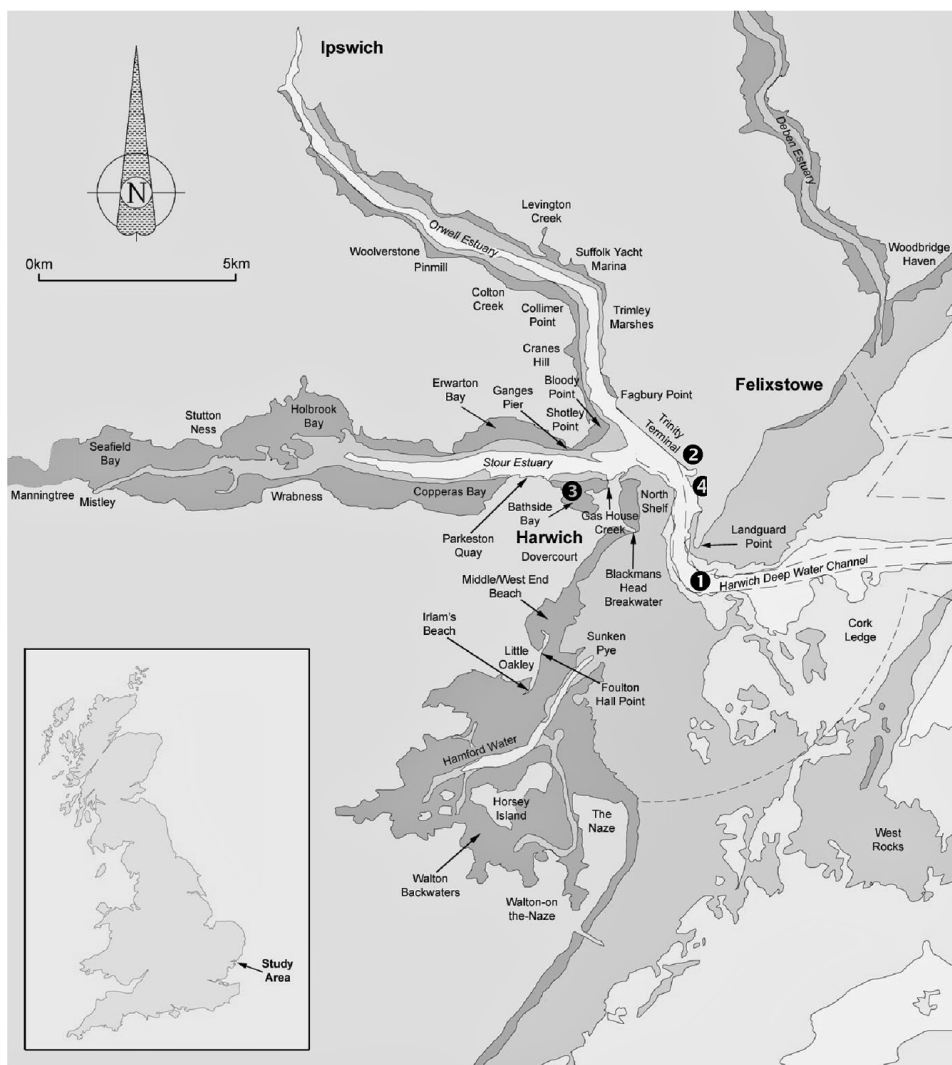


Figure 1 Location plan of the Stour and Orwell estuarine system

Detailed and wide-ranging environmental impact studies were required for all four of the development proposals. These studies identified a variety of potential impacts on the hydraulic and sediment regime - and consequently on the designated habitats and species - of the Stour and Orwell estuarine system. In addition, a number of the schemes also have a direct impact on estuarine habitats due to reclamation works. Therefore, in view of the international nature conservation importance of the system, it was necessary to investigate a variety of techniques to adequately mitigate and compensate for these predicted impacts and to establish a framework through which the mitigation and compensation could be delivered, monitored and enforced.

Through the example provided by the Bathside Bay Container Terminal (BBCT), this paper examines a successful approach to the definition of sufficient and appropriate mitigation and

compensatory measures in light of the predicted impacts of the scheme on the Stour & Orwell Estuaries Special Protection Area (SPA) (the relevant grey areas on Figure 1). Where appropriate, and to provide further insight into the application of the EC Habitats Directive (92/43/EEC), reference is also made to the approach adopted to mitigation and compensation for some of the other schemes in the estuarine system (mentioned above).



Overview of the predicted effects of BBCT

Brief description of the proposals

In 2001, Hutchison Ports UK Ltd (HPUK) announced their plans to construct a deep-water container terminal at Bathside Bay, located between Harwich International Port to the west and the town of Harwich to the east. The proposals involved the reclamation of approximately 65ha of intertidal area at Bathside Bay and the dredging of a further 4ha of intertidal immediately adjacent to the proposed container terminal to create a small boats harbour (between the terminal and Harwich). In order to provide the required sea access to the terminal by deep-water container vessels, capital dredging of approximately 3.5Mm³ of material will also be required.

Following an extensive environmental impact assessment process (extending over four years) and a major public inquiry, the BBCT scheme received all consents in late 2005.

Summary of key predicted impacts on the European site

The proposed BBCT is predicted to have a variety of effects on the functioning of, and the habitats within, the Stour and Orwell estuarine system. These impacts can be divided into two categories. Firstly, the proposals will have a direct effect on estuarine habitats due to the loss of habitat within the footprint of the reclamation for the proposed terminal and due to the dredging that is required to create the small boats harbour. Secondly, it was predicted that the proposed scheme will have effects on the hydraulic and sediment regime of the estuarine system, resulting in indirect effects on intertidal habitats throughout the system. The nature of these indirect effects can be categorised as follows:

- Effects on tidal range due to changes in tidal propagation;
- Effects on the rate of intertidal erosion throughout the estuarine system due to deposition of sediment within dredged channels and subsequent removal from the system by maintenance dredging and offshore disposal; and,
- Localised erosion of intertidal areas due to localised changes in wave energy (e.g. as a result of reflection of waves from quay faces across intertidal areas).

The above predicted effects were quantified as part of the environmental studies. Table 1 provides a summary of the direct and indirect predicted effects of the BBCT scheme on the Stour and Orwell estuarine system.

The magnitudes of the effects quoted in Table 1 are those predicted to arise without the implementation of mitigation measures. The approach to the definition of sufficient and appropriate mitigation (and compensatory) measures for the predicted impacts associated with BBCT is discussed below.

Definition of mitigation and compensation associated with BBCT

The environmental studies concluded that it is possible to mitigate some of the predicted impacts associated with the scheme, namely the predicted increase in the background rate of erosion of intertidal areas throughout the estuary system and the localised erosion in the lower Stour estuary (in the eastern part of Erwarton Bay) (refer to Table 1). However, the studies further concluded that some of the impacts of the scheme could not be mitigated. These impacts are the direct loss of 69ha of intertidal habitat (comprising a mixture of mudflat (66.2ha) and saltmarsh (2.8ha)) as a result of the reclamation and dredging and the decreased exposure of intertidal habitat (approximately 3ha) as a result of the predicted effect on tidal propagation.

Table 1 Summary of the predicted direct and indirect impacts of the BBCT

Intertidal reclamation/dredging (ha)	Effect on exposure of intertidal area due to changes to tidal range (ha)*	Effect on estuary-wide intertidal erosion (ha/yr)**	General zone of localised erosion
69 (includes loss of 4ha due to dredging)	-2.7	-2.6 to -2.8	Lower Stour estuary

* A negative figure indicates decreased exposure of intertidal habitat, quantified at low water on spring tides ** and an ongoing loss of intertidal and, hence, an increase in the erosion rate.

Development of appropriate mitigation: the sediment replacement programme

It was proposed that mitigation for the predicted increase in the background erosion rate of intertidal areas within the estuary system and the localised erosion in the lower Stour estuary could be provided through an existing 'sediment replacement programme'. This programme was a requirement of the consents received by the Harwich Haven Authority (HHA) for the deepening of the approach channel to the Haven from a depth of 12.5m below Chart Datum (CD) to 14.5m below CD (the channel deepening was completed in 2000).

The mechanism for these predicted impacts on the habitats of the estuarine system is based on the principle that more sediment depositing in the enlarged operational areas of the ports (encompassing the approaches), and subsequently being placed offshore through maintenance dredging, would further deplete the eroding system by reducing the supply of sediment to the estuaries. The basic principle of the sediment replacement programme, therefore, is to return a proportion of the extra sediment depositing in the Haven berths and Harbour approaches to the wider estuarine system, via targeted and monitored water column recharge and subtidal placement, such that natural processes are then able to redistribute the material; leading to retention of some of the returned sediment.

At present, the licenses for the sediment replacement programme allow for the placement of up to 250,000 dry tonnes of sediment within the estuary system and Harwich Haven area. Of this total, 140,000 dry tonnes are licensed for placement at six locations within the Stour and Orwell estuaries via water column recharge and a further 110,000 dry tonnes are licensed for subtidal placement at the North Shelf (see Figure 2). Currently, the sediment replacement programme results in the placement of approximately 10% of the sediment accumulating in Harwich Harbour within the estuary system. In addition, sediment disturbance during maintenance dredging and agitation by vessels also represents a significant release of sediment into the Harbour.

The BBCT development is predicted to cause an increase in the estuary-wide background rate of intertidal erosion of approximately 24,500 dry tonnes per year. Therefore, in order to achieve sufficient mitigation, it was proposed that the amount of sediment returned to the system via the sediment replacement programme be increased from 250,000 dry tonnes/year to 500,000 dry tonnes/year. Although this increase appears large in relation to the predicted effect associated with BBCT, the return of such quantities is necessary because the natural system is inefficient at retaining material on the intertidals. That is, only a small percentage of the material entering the estuary system on the flood tide will deposit on the intertidals, with the majority moving back and forth in the subtidal channels before being exported from the system.

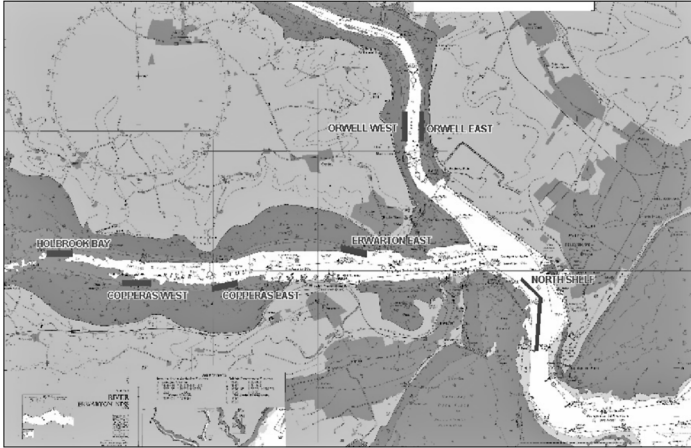


Figure 2 Sites licensed for the placement of maintenance dredged material

In addition to the proposed mitigation for the system-wide impact discussed above, it was proposed that the localised impact in the lower Stour estuary could be mitigated by the sediment replacement programme targeting Erwarton Bay (see Figure 1) for local recharge. That is, up to 25,000 dry tonnes/year would need to be recharged at this location.

Development of appropriate compensation measures

As mentioned above, it is not possible to provide mitigation within the estuary system for the direct loss of intertidal area due to the reclamation and dredging associated with BBCT and the decreased exposure of intertidal area due to the predicted effect on tidal range. In addition, it was concluded that these predicted impacts would have an adverse effect on the integrity of the Stour & Orwell Estuaries SPA. As a consequence, it was necessary to develop compensatory measures in accordance with the requirements of the EC Habitats Directive; implemented in the UK through the Conservation (Natural Habitats & c.) Regulations 1994.

Based on these Regulations, the Department for Transport determined that a significant effect on the SPA was likely to occur and, in line with Regulation 48, an 'appropriate assessment' needed to be undertaken. This concluded that an adverse effect was expected to arise and, in line with Regulation 49(1), the absence of less ecologically damaging alternative solutions and imperative

reasons of overriding public interest for BBCT had be demonstrated. Regulation 53 then required compensatory measures to be implemented in order to ensure the coherence of *Natura 2000* (the suite of European designated sites, including SPAs, Special Areas of Protection (SACs) and Ramsar sites).

The preferred approach to creating compensatory habitat

Due to the nature of the habitat that would be impacted as a consequence of BBCT, and the magnitude of this loss, the environmental studies concluded that the most appropriate approach to compensating for this impact was through the creation of new intertidal habitat. Furthermore, the best method to create intertidal habitat at the scale required to provide sufficient compensation for BBCT was considered to be the managed realignment of coastal flood defences.

Following a scoping and site selection exercise, HPUK identified a suitable site (with an area of approximately 138ha) for undertaking managed realignment on the northern shore of the Walton Backwaters near the village of Little Oakley, Essex (see Figure 1). The Walton Backwaters are designated as the Hamford Water SPA and Ramsar site and the proposed managed realignment site is immediately adjacent to this designated site.

Defining the characteristics of compensatory measures

In broad terms, European guidance on managing *Natura 2000* sites suggests that, in order to ensure the coherence of the network, compensatory measures should:

- address in comparable proportions the habitats and species negatively effected;
- concern the same biogeographical region; and
- provide functions comparable to those which justified the selection of the original site.

However, distance between the original site and the compensatory measures is not considered to be an obstacle.

This section discusses the key criteria taken into account in defining and developing sufficient and appropriate compensation for BBCT. That is, the criteria that informed site selection and the design of the proposals for compensatory habitat at Little Oakley. As a starting point, it is important to define a 'high level' objective which embodies the overall purpose of the compensation. In this instance, the high level objective was to ensure the overall coherence of *Natura 2000* through the provision of compensatory habitat of (eventually) SPA quality. To this end, a need existed to create the range of habitats necessary to support an equivalent assemblage of feeding and roosting waterfowl to that present within Bathside Bay.

Geographic location

In selecting a potential site for the creation of compensatory habitat, one of the most important considerations is the geographic location of the site in relation to the location of the loss or damage. It is preferable for the compensatory habitat to be located as close as possible to the site to be compensated for, given that the habitat is intended to provide at least an equivalent function to that which is impacted by development.

Little Oakley is located less than 5km to the south of Bathside Bay, is also at the mouth of an estuary, is relatively undisturbed and was considered to have the physical characteristics to enable it to be developed into compensatory habitat.

Type of habitat

Typically, there is a requirement to replace the habitat (and thereby the species) which are impacted by development with a similar habitat type. However, the overall objective is to compensate for ecological structure and function and, therefore, replacing habitat on a 'like for like' basis may not be required as long as the compensatory habitat is able to fulfil the same ecological function(s) as the habitat which is lost or damaged. The replacement of ecological functioning requires consideration of a range of other attributes of the compensatory habitat, such as area, timing and quality (discussed below).

With respect to habitat type, the aim of the Little Oakley managed realignment site was to create a mixture of habitats, where the proportion of different habitats created need not be the same as that present at Bathside Bay (as long as the designated features were replaced). For example, it was considered desirable that the realignment site should have a greater saltmarsh to mudflat ratio than that which exists at Bathside Bay, as this would be more typical of a healthy, natural system and would improve the overall ecological functionality of the site. It was also considered desirable to incorporate areas of sand and shingle into the site and to allow limited areas of the site to retain water at low tide to create shallow water habitat.

Area of habitat

The area of compensatory habitat to be created is a particularly important consideration and a number of other criteria (e.g. geographic location and habitat quality) influence the decision as to the area that is appropriate. As a consequence of the range of criteria that influence the decision on required habitat area, the decision is made on a case-by-case basis by the applicant, their representatives and (ultimately) by the relevant Regulators; there is no formula. However, it can be assumed that a habitat lost to habitat created ratio of at least 1:1 will be appropriate and, in most cases, there is likely to be a requirement for the area of habitat created to be greater than that lost. This reflects that fact that there is likely to be some degree of risk that a newly created habitat will not adequately achieve the functionality of the original site due to factors such as, for example, geographical separation from the original site and confidence in the ability to produce a habitat of sufficient quality to maintain ecological functioning.

The proposed managed realignment site at Little Oakley has an area of 138ha. When allowing for land which does not represent compensatory habitat within the site (e.g. for the construction of new seawalls and drainage dykes) the site will provide a ratio of around 1:1.5 of habitat loss in the Stour and Orwell estuarine system compared to gain at the managed realignment site.

As mentioned above, one of the key considerations in determining the required area of compensatory habitat is risk or uncertainty in the ecological quality of the newly created habitat. In this respect, experience from elsewhere informed the nature of the multiplier to be adopted. Of particular relevance given its proximity to Little Oakley, was experience gained from monitoring the Trimley Marshes managed realignment site in the Orwell estuary. This site was created as compensation for the deepening of the approach channel to the Harwich Haven. An extensive monitoring programme was established to assess the success of the site in terms of its ecological functioning. This monitoring revealed colonisation of the site by a range of saltmarsh and benthic macrofaunal species, as well as usage of the site by a range of waterbird species in the short term (less than 5 years), which has led to its rapid inclusion within the Stour & Orwell

Estuaries SPA. The confidence gained from the success of Trimley Marshes, along relevant monitoring commitments, provided the Regulators with a degree of certainty over the ability of the Little Oakley managed realignment site to replicate the ecological function of Bathside Bay over a short time period.

Timing of habitat creation

Although no requirement exists in the Habitats Directive to have the compensatory habitat in place and functioning at the same time as the development is constructed, it is ultimately desirable to have created a functioning compensatory habitat by the time that there is an adverse effect on the impacted European site.

In the case of Little Oakley, it was determined that it was not reasonable to expect the construction of the managed realignment to commence prior to initiation of the construction works at Bathside Bay. A number of scenarios were developed to assess the likely timing of the creation of a functioning compensatory habitat in relation to the adverse effect on the Stour and Orwell estuaries arising. Critically, it was determined that an adverse effect on the SPA will not occur until 15 months into the construction programme for BBCT (i.e. until the reclamation phase commenced). This will allow HPUK to 'create' the managed realignment site and develop BBCT simultaneously and, thereby, minimise the time between the loss of bay and the habitat creation; where, at worst, this was predicted to be one winter which, with severe weather mitigation, was determined to be acceptable by the Regulators.

Sustainability

It is recognised that over time any compensatory habitat will evolve. The biological communities supported within the site (e.g. benthic macrofauna, saltmarsh and waterbird usage), for example, will develop. In addition, the relative areas of different habitats types (e.g. intertidal mudflat and saltmarsh) may change, for example, due to the accumulation of fine sediment, resulting in changes to the topography of the site. It is important, therefore, to consider the nature of the likely evolution of the site in order to provide confidence that the compensatory habitat will be capable of continuing to fulfil the ecological function(s) for which it was intended, over the long term, without the need for significant management to maintain its nature conservation interest.

Table 2 presents the conclusions of the environmental studies concerned with the prediction of the mixture and relative areas of different habitat types within the realignment site at Little Oakley in the long term (i.e. at an equilibrium state). These predictions are based on the initial topography of the site and modelling the predicted accumulation of fine material within the site over time. It should be noted that areas of the site devoted to the 'non-marine' elements of the scheme, such as seawalls, borrow dykes, ponds, footpaths, etc., have been excluded from Table 2 but form part of the overall 138ha site (see Figure 3).

The desire for the Little Oakley managed realignment site to be sustainable in perpetuity contrasts with the objective for compensatory measures elsewhere in the Stour and Orwell estuaries. That is, compensatory habitat was required in relation to the extension of the Trinity III Terminal at the Port of Felixstowe (completed in late 2004). This compensation took the form of a series of intertidal clay and gravel bunds, backfilled with muds from maintenance dredging, on the foreshore at Shotley and Trimley in the lower Orwell estuary (see Figure 4). The aim of these schemes was to improve the ecological quality of these foreshores, which had experienced

significant erosion. In this case, the regulatory bodies did not wish the schemes to be fixed in perpetuity, but rather that the bunds should be designed to evolve (erode) gradually over time. The rationale behind this desire was that the structures should not constrain future options for flood defence management of the lower estuary and should not, therefore, be permanent.

Table 2 Predicted areas of realignment habitat at an 'equilibrium' state

Habitat	Level (m OD)	Approximate area (ha)	Objective for compensation (ha)
Intertidal mudflat (including intertidal creek)	From 0.0 to +1.5	70 to 80	Minimum of 69
Intertidal mudflat/saltmarsh transition	From +1.5 to +2.0	5 to 15	
Saltmarsh	From +2.0 to +2.4	15 to 25	10 to 20
Sand and shingle	Above +2.4	5	up to 5
Wave breaks	Above +2.4	2	N/A



Figure 3 Artists impression of managed realignment at Little Oakley



Figure 4 Habitat enhancement on the Shotley foreshore

Ability to designate

The ultimate aspiration is for the compensatory habitat to become designated, either in its own right or as an extension to an already designated site. For the managed realignment at Little Oakley, the aim is to incorporate the site within the Hamford Water SPA within 15 years of its creation. That is, within this timescale, the compensatory habitat should be of 'SPA quality'; this aspiration is clearly interlinked with the other criteria for the compensatory habitat discussed above, such as habitat type and sustainability.

Potential for impact on other designated sites

It is important that compensatory habitat should not have an adverse effect on the integrity of a European site; if this were to be the case, then such effects would require further compensatory

measures. In this case, it was considered that the Little Oakley managed realignment scheme had the potential to have a significant effect on the Hamford Water SPA; requiring appropriate assessment. Therefore, the environmental studies undertaken examined the potential for the scheme to impact both on the designated status of the SPA and the biodiversity of the area more generally. In particular, the studies focussed on the potential for effect on the brackish/freshwater habitats present in the site and the functioning of two beaches on either side of the location of the proposed breach in the seawall. These beaches protect extensive areas of saltmarsh that are within the Hamford Water SPA and which make a significant contribution to its nature conservation interest.

It was concluded that, with appropriate monitoring and management, the managed realignment would not significantly affect the beaches and, therefore, would not have an adverse effect on the Hamford Water SPA. Moreover, the design of the realignment included for the replacement of important terrestrial, brackish and freshwater habitats that were to become 'intertidal'.

Monitoring success and the management of risk

Mitigation

Monitoring the mitigation for the predicted impacts of BBCT on the Stour and Orwell estuary system is to be incorporated within an ongoing commitment by the HHA to monitor the success of sediment replacement. The existing monitoring programme is wide-ranging and includes bathymetric surveys, topographic surveys of saltmarsh, mapping of benthic communities, waterbird counts throughout the estuary system and monitoring of fish communities. In addition, targeted monitoring of Erwardon Bay will be undertaken in relation to the predicted local impact.

Compensation

A detailed programme of monitoring for the proposed compensatory habitat was developed. This programme has two components, namely monitoring the managed realignment site itself and monitoring of the effects of the scheme on the wider Hamford Water SPA. For the realignment site, the programme includes monitoring habitat extent, usage by feeding and roosting waterbirds, benthic invertebrate colonisation, particle size distribution and the development of saltmarsh communities. For the SPA, monitoring focuses on potential effects on coastal processes and, specifically, on the crest level, position and extent of the beaches outside the realignment site.

An important feature of the monitoring programme is the development of habitat and species-based targets for the realignment site. For example, based on the measured level of usage of Bathside Bay by feeding and roosting waterbirds, targets for the managed realignment site were developed. These targets relate to the desired usage of the site by a particular assemblage of waterbirds (and key species) and also numerical targets for those waterbird populations for which Bathside Bay is of particular importance (i.e. 1,500 feeding and 2,200 roosting waterbirds).

The development of an appropriate monitoring programme, together with an enforceable commitment to remediation measures should monitoring reveal a cause for concern with respect to impact on the Stour & Orwell Estuaries SPA, the Hamford Water SPA or the ecological functioning of the realignment site, provides the Regulators with confidence that appropriate compensation can be delivered and that risk of failure has been minimised and can be managed.