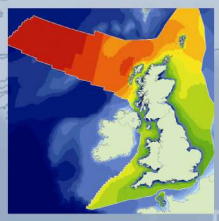
Case Study on the Welwick Managed Realignment Scheme (England)

White Paper

Creating sustainable solutions for the marine environment


Case Study on the Welwick Managed Realignment Scheme (England)

Basic Statistics

Location	Coordinates (long; lat)	Area (ha)	First Tidal Inundation Date	Years Embanked	Previous Land Use	Tidal Range
Outer Humber Estuary, East Riding of Yorkshire	53.64717188369820; 0.00954951150096	54	June 2006	~35	Arable	6m (spring)

Plate 1. The managed realignment at Welwick - Google Earth derived aerial view

Design and Management

Welwick was undertaken for the same purpose as another realignment on the Humber, Chowder Ness, which is presented as a separate case study. Both schemes were designed and implemented by the same organisations (Associated British Ports (ABP) and ABPmer), and to very similar timescales and principles. To inform the final design of these sites, numerical modelling was undertaken based on LiDAR elevation data. This was designed to ensure the correct balance of habitats would be achieved. As mudflat creation was the main objective of the schemes, and as the sites were largely too high for this to occur, the land was re-profiled to increase the extent of lower areas where mudflat could develop (i.e. below Mean High Water Neap (MHWN)) (see Plates 2 and 3 for an illustration of the design steps undertaken). Prior to these works, the land at Welwick had an approximate elevation of 2.8mODN, some 0.4m below the level of the Mean High Water Spring (MHWS) tides. The reprofiling included the creation of a gentle slope from the fronting, existing, mudflats to the rear of the sites.

New flood defences were created at the rear of the 54ha Welwick site to a minimum height of 6.1m Ordnance Datum Newlyn (ODN); designed to withstand a 1 in 50 year design event. A strip of saltmarsh was expected to develop in front of the new defences. The 70,000m^3 of material needed for these defences was obtained from within the site from a combination of reprofiling and creation of temporary borrow pits. The new embankment was seeded and left to stabilise for one year.

The existing seawall was removed over a length of 1,400m, and the approximately 20,000m^3 of material gained was used to fill the temporary borrow pits. The wholesale removal, rather than the creation of solitary breaches, was chosen for a number of reasons:

- It improves connectivity with the wider estuary;
- It more closely recreates the type of environments that existed prior to the land claim;
- It enables the whole cross sectional area of estuary including the realignment site, to respond to estuary wide changes; and
- It increases energy levels within the site, thereby improving the likelihood that mudflat habitat will be maintained.

The old defence was removed in a series of stages: (1) removing the rear of the embankment, (2) the rock gabions, and (3) the overall lowering of the embankment. Following this, breaches were created in the existing saltmarsh in front of site. These were required as the fronting marsh is designated, and could thus not be removed completely to increase wave energy even further. As the typical elevation of this marsh was 3.2mODN, which coincides with the MHWS level, these breaches were necessary to allow the site to flood and drain sufficiently. The location of the breaches was chosen to minimise marsh losses (approximately 0.4ha). Their width had been assessed by calculating the discharge and considering the critical threshold for erosion of sediment. The suggested breach size was considered large enough for the velocities to be below the critical threshold for erosion.

Plate 2: Rear embankment construction and re-profiling at Welwick in 2005

(Aerial images taken for ABP)

Plate 3: Welwick shortly after seawall removal (i.e. first inundation) in December 2006

As Welwick was considered relatively small-scale in relation to the estuary as a whole any predicted changes to the hydrodynamics and sediment dynamics were expected be extremely localised and relatively small in magnitude (ABPmer, 2003).

Promoters and Objectives

Associated British Ports (ABP) constructed a new Roll-on Roll-off terminal at Immingham Outer Harbour (opened in July 2006), which resulted in the direct loss of 22ha of intertidal mudflat area and potentially up to 5ha of indirect losses in a proposed Special Protection Area (pSPA) and a proposed Special Area of Conservation (pSAC). In consultation with regulatory bodies and local nature conservation interest groups, the two managed realignment schemes at Welwick and Chowder Ness were identified as contributing to a potentially acceptable compensation package for the impacts of the Immingham development. The objective of Welwick was to create between 15 and 38 ha of intertidal mudflat, between 12ha and 28ha of saltmarsh and between 4 ha and 10ha of grassland.

Funding

Funded by ABP.

Planning Requirements and Consultation

1. The scheme required planning consent under the Town & Country Planning Act 1990.
2. A formal Environmental Statement was required to accompany the planning application, as the scheme was classed as an infrastructure project comprising coastal works capable of altering the coast (under section 10m of Schedule 2 of the Town & Country Planning (EIA) Regulations 1999). East Riding of Yorkshire Council provided a scoping opinion on the scope of the environmental assessment
3. Under the Water Resources Act 1991 and the Land Drainage Byelaws, the prior written consent of the Environment Agency was required (for any proposed works affecting tidal flood defences). The agreement of the Winestead Level Drainage Board was also required for any changes affecting land drainage.
4. As the 'old' flood defences were the responsibility of the Crown Estate, they needed to provide approval for the new flood defences.
5. The consent of the harbour master under the Humber Conservancy Acts 1852 to 1951 was required in relation to the effects of the scheme on navigation in the estuary.
6. An appropriate assessment was undertaken under the Conservation (Natural Habitats &c.) Regulations 1994 (the Habitats Regulations), as the competent authority (ABP) considered that the scheme was likely to have a significant effect on the existing and possible European nature conservation sites.

Monitoring

A ten-year monitoring programme is being undertaken to describe both changes to sites fronting the realignment (in relation to bathymetry, saltmarsh evolution, invertebrates and waterfowl), and to

the realignment site itself (in relation to topography, saltmarsh composition, changes to intertidal invertebrates and bird and wildfowl usage).

Findings and Lessons

(Taken by: ABPmer, August 2010)

Plate 4. Panoramic view from easterly corner of site

Accretion

In order for the site to support both mudflat invertebrates and saltmarsh plants, it was important that fine marine sediments were imported into the site, as these provide the ideal environment for intertidal flora and fauna. Furthermore such sediment import would ensure that the site would continue to increase in elevation (i.e. accrete) as sea levels rise. Observations from previous managed realignments has shown that sites can accrete relatively rapidly immediately after a breach, but that elevation increases then tend to level off. At Welwick, site elevation monitoring has so far followed a similar trajectory. To date, overall, the site has increased in elevation with the most notable changes occurring in the initial year following the realignment.

Invertebrates

The monitoring has shown that invertebrates have colonised this new sediment. In 2009, between 667 and 7,286 organisms were found per m² (belonging to between 5 and 13 species). The abundance, diversity and biomass of species in the mudflat have been increasing since the realignment has been implemented, although these are still typically lower compared to fronting, pre-existing, mudflat sites. This is unsurprising given that the community has still not had much time to establish and develop.

Birds

Shorebirds are making good use of the site; overall, numbers observed exceed original predictions. For example, a total of 31 different waterbird species were recorded using the realignment site between September 2008 and March 2009. The site has developed as a major roosting site for wading birds at high water, including red knot, dunlin, curlew and bar-tailed godwit. Birds such as black-tailed godwit and curlew have been using the site with increasing frequency.

Saltmarsh and Grassland

With regards to the development of other habitats, there was a requirement to also create saltmarsh and grassland on site. By 2009, a proportion of the site had developed into saltmarsh, with the typical pioneer plants such as glasswort colonising within one year (see Plate 3). Other plants such as common saltmarsh grass, annual sea blite and common cord-grass have been slowly increasing in number. Thus, recognisable saltmarsh plant communities assembled relatively rapidly at Welwick; which was not unsurprising given the proximity of existing saltmarshes (and thus seed sources). With regards to grassland, this was mostly established on the new flood banks, and it appears to be developing the desired species composition. Breeding farmland birds have been found within this habitat. A total of 25 different species were observed during the latest survey undertaken in May 2009, including reed bunting, skylark and yellow wagtail.

(Taken by: ABPmer)

Plates 5 & 6. Marsh development in the eastern corner – 1 year on and 3 years on

Contacts

Natalie Frost - ABPmer (Environmental Advisors) – nfrost{at}abpmer.co.uk

References

ABPmer, 2003. Environmental Statement for a Managed Realignment Scheme at Welwick. ABP Marine Environmental Research Ltd, Report No. R.980, 152p.

Pontee, N.I., Hull, S.C., and Moore, J.R., 2006. Banked realignment: a case study from the Humber Estuary, UK. *Proceedings of the Institution of Civil Engineers – Engineering Sustainability* 159 (ES3), 99-108.