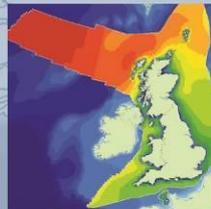
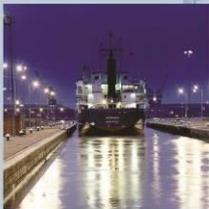


The cost of undertaking managed realignment schemes in the UK

Briefing Note
May 2015

Creating sustainable solutions for the marine environment



Introduction

This briefing note reviews the costs that have been incurred for undertaking managed realignment in the UK. It has been prepared using the coastal adaptation database that is held and maintained by ABP Marine Environmental Research Ltd. (ABPmer). This database collates the lessons that have been learned from completed coastal adaptation projects and this review uses all the data about UK project costs that is available to ABPmer at the time of production (May 2015). It is hoped that this note and the database will be useful for coastal managers wishing to implement such schemes in the future.

Background

To date, 64 different managed realignment schemes have been implemented in the UK over the last 25 years.

These schemes are predominantly designed to be flood protection measures and are undertaken at locations where it will improve the sustainability of the existing coastal defences. However, they also have a key function as coastal habitat creation initiatives and, indeed, the majority of completed projects in the UK (especially those of a large scale) have been undertaken with habitat creation as one primary motivation (often as compensation for losses of habitat elsewhere along the coast).

A Definition of a Managed realignment

Managed realignment projects involve realigning the position of existing sea walls (in a landward direction) and allowing tidal water to inundate the former hinterland. This is land that was at risk of flooding without intervention and is often land that was historically claimed from the sea.

The tidal inundation of this land can be brought about by either removing the old vulnerable sea wall or by placing breaches within it which, in each case, bring about the free exchange of tidal waters. It can also be achieved by introducing structures (i.e. sluices, culverts) that control the throughput of tidal water (specifically referred to here as Regulated Tidal Exchange (RTE))

Many aspects of the implementation of managed realignments are relatively well reviewed and understood, but there has been very limited reporting or investigation of the financial implications of such schemes. Such insights would provide implementers of future schemes with valuable first order insights into the likely costs of their project, and also aid in validating cost estimates. Furthermore, such data is an important input variable for high-level cost benefit exercises.



ABPmer has collected a wealth of data on intertidal habitat creation schemes across Europe, and elsewhere. This data is presented on the Online Marine Registry (OMReg, <http://www.omreg.net/>) together with data on other coastal restoration/creation measures. Cost data is available mostly for UK schemes, due to ABPmer frequently having direct involvement, or contacts in these national schemes, and also because ABPmer has funded and supervised student research projects (notably Rowlands, 2011) on this subject.

With regard to costs of these habitat creation schemes, ABPmer holds cost data on 45 of the 64 UK managed realignment and RTE schemes. These data are reviewed below along with a brief summary and discussion section.

Managed Realignment

The cost of managed realignment is influenced by a number of factors, including

- the extent of site manipulation/engineering works required to achieve the underlying objectives;
- the location and desirability of the land; and
- the efforts involved in gaining planning consent.

A review of the implementation costs for completed UK schemes has shown that unit costs (i.e. per-hectare) can vary very widely, depending very much on the location, engineering effort, and objective of a given scheme (*inter alia*). The lowest per-hectare costs have been reported for the Lantern Marsh scheme on Orford Ness (Suffolk) with just under £800/ha, whereas the most costly scheme to date has been the Trimley scheme on the Orwell (Suffolk) at almost £123,000/ha. Such variability is to be expected given the distinct challenges and constraints faced at the individual schemes. Table 1 lists the unit costs for all the UK managed realignment schemes for which ABPmer hold cost data. For location, and other, information, please refer to the OMReg database.

Over the past 25 years, unit costs of managed realignment schemes, excluding RTEs, have averaged at just over £35,000/ha (2014 prices, n=29¹, excluding an outlier²). Since 2000, there has been a slight upward trend in average costs, with post-1999 schemes averaging just over £40,000/ha (n=23; again excluding the outlier).

In general, there has been a clear shift over the course of two decades from initial small-scale and relatively inexpensive trial projects to high-cost, larger, projects that were designed to meet specific targets for habitat creation and flood alleviation. A contributory factor in this increase has been rapidly rising land values and greater costs being incurred for associated licensing, assessment, engineering and mitigation requirements.

The length and scale of the new defence alignment is a critical consideration; where substantial new defences needed to be constructed these accounted for a large percentage (on average 44%) of the total cost (Abbott, 2009). Therefore, it is unsurprising that seven of the eight most expensive realignment schemes required extensive new defence construction. This includes the Medmerry scheme, which involved the construction of almost 7km of new defences (see Image 1).



(Image Credit: J. Akerman)

Image 1. Aerial image of Medmerry taken in January 2014

¹ As of May 2015, at least 42 managed realignment schemes have been implemented in the UK (excl. RTEs).

² This outlier is the 0.4ha urban managed realignment at Barking Creek in London, which cost £370,052 (2014 prices), leading to a unit/per-hectare cost of £925,130.

Surprisingly, economies of scale are often not realised, and the bigger schemes have frequently incurred high unit costs. With the exception of Freiston (the Wash, Lincolnshire) and Alkborough (Humber, North Lincolnshire), all other schemes which are bigger than 50ha have incurred above-average unit costs, as can be seen in Table 1, with Paull Holme Strays (Humber, East Riding of Yorkshire) having the highest unit costs of the bigger schemes, costing some £115,000/ha. This is further illustrated in the graph shown.

Compensatory scheme costs have typically been much higher than schemes implemented for other reasons, at just over £72,000/ha on average (n=8). Examples include the port development compensatory schemes at Welwick (Humber, East Riding of Yorkshire) and Trimley Marsh. Reasons for this higher cost include:

- the generally higher land costs encountered (driven by location and also competition for land);
- frequently more involved assessment, design and stakeholder engagement requirements; and
- generally greater site preparation/embankment necessities.

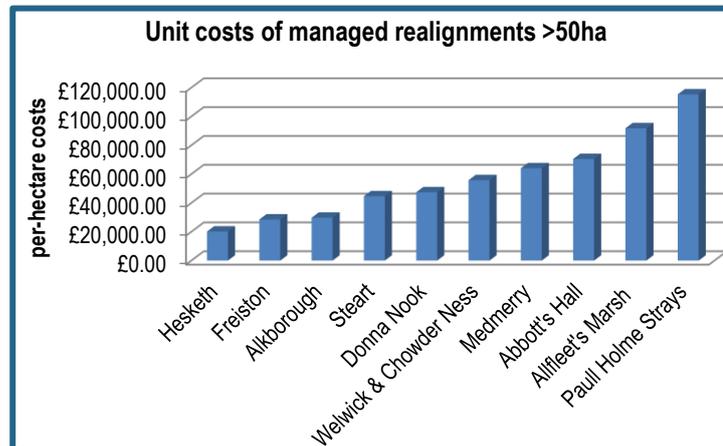


Table 1. Per-unit costs of UK managed realignment schemes (for which ABPmer hold cost data), arranged by year of implementation

Scheme	Year	Size	Unit Cost**	Scheme	Year	Size	Unit Cost**
Northey Island	1991	0.8	£51,713	Nigg Bay	2003	25	£5,537
Orplands	1995	38	£5,334	Paull Holme Strays	2003	90*	£115,360
Tollesbury	1995	21	£24,128	Man Sands	2004	3	£8,997
Montrose Basin	1997	0.3	£2,643	Thorness Bay	2004	7	£14,364
Thornham Point	1997	6.9	£11,492	Alkborough	2006	440*	£29,754
Lantern Marsh	1999	29	£786	Allfleet's Marsh	2006	130*	£91,821
Annerly Kiln	2000	3.8	£1,992	Alnmouth 1 + 2	2006	28	£2,338
Havergate Island	2000	8.1	£13,907	Welwick***	2006	54	£55,805
Pillmouth	2000	12.9	£1,281	Chowder Ness***	2006	15	£55,805
Trimley Marsh	2000	16.5	£122,884	Barking Creek	2006	0.4	£925,130
Watertown Farm	2000	1.5	£2,003	Hesketh	2008	180	confidential
Abbott's Hall	2002	85	£70,505	Devereux Farm	2010	15	£19,320
Brancaster West Marsh	2002	7.5	£114,150	Medmerry	2013	450*	£64,089
Brandy Hole	2002	12	£10,702	Stearth	2014	470*	£44,681
Freiston	2002	81*	£28,538	Donna Nook	2015	137	£47,445

* Includes (mostly) terrestrial/freshwater wetland area outside of managed realignment area (which would have however been included in total costs): 15ha saline lagoon at Freiston, 70ha of freshwater/terrestrial land at Alkborough, 15ha of borrow dyke and terrestrial area at Allfleet's Marsh, ca. 150ha of terrestrial/freshwater area at Medmerry, ca. 70ha of terrestrial/freshwater area at Stearth (nb: the intertidal area at Stearth has been created using both the managed realignment and the RTE technique, its costs were included with managed realignment schemes, as the majority of the newly created intertidal area is in the realignment section).

** per hectare, 2014 prices.

*** Welwick and Chowder Ness were implemented by the same organisation; one overall total figure for both schemes was supplied.

Regulated Tidal Exchange

The costs of RTE projects can vary widely depending on the degree of engineering intervention. Some sites have simply involved the removal of outfall flap gates to facilitate water exchange through existing pipes, whereas at others, complex water exchange structures have been inserted (see Image 2 for a collage of RTE water exchange structures, from the simple/inexpensive to the complex). Landward defence construction is frequently not required for such projects, as water exchange can often be controlled by closing a sluice gate (many examples, including Horsey Island (Hamford Water), all self-regulating tide (SRT) gate schemes³). However, defences are frequently constructed or upgraded to delineate a wetland area and/or provide flood protection for the hinterland.

³ UK SRT schemes: Black Hole Marsh (Axe, Devon), Goosemoor (Clyst, Devon), Lymington (Lymington Estuary, Hampshire), South Efford Marsh (Avon, Devon).



Image 2. Collage of regulated tidal exchange water exchange structure images

On average, the RTE schemes implemented to date have cost just under £33,000 per hectare (n=174). After 2000, costs only increased slightly; post-1999 schemes have averaged just under £35,000/ha (2014 prices, n=13). Costs have varied from just under £12,000/ha for the 2004 Walborough scheme (Axe Estuary, North Somerset) to £143,000/ha for the 2009 Warkworth scheme (Coquet Estuary, Northumberland). It is noteworthy, however, that to date the UK schemes have involved relatively limited engineering efforts, and have also been relatively small, with the average scheme size being just under 9ha (n=22). Highly engineered schemes are likely to be significantly more expensive. For example, the 10ha Lippenbroek scheme in Belgium (on the Zeeschelde), which involved significant new defence build and a substantial new inlet sluice, cost around £101,000/ha.

In the UK, the costs for water exchange structures has varied widely; for example, at Ryan's Field (Hayle Estuary, Cornwall), the sluice modifications cost just £713 (in 1995), whereas the Goosemoor SRT gate, which was imported from the US, cost some £25,000 (in 2002). Table 2 lists the unit costs for all the UK RTE schemes for which ABPmer hold cost data.

Table 2. Per-unit costs of UK regulated tidal exchange schemes (for which ABPmer hold cost data), arranged by year of implementation

Scheme	Year	Size	Unit Cost*	Scheme	Year	Size	Unit Cost*
Horse Island	1995	1.2	£2,533	Vange Marsh	2006	1	£57,758
Ryan's Field	1995	6.23	£4,446	Treraven Marsh	2007	14	£18,698
Saltram	1995	4.2	£14,879	Black Hole Marsh	2009	6	£19,880
Black Devon Wetlands	2000	7	£19,310	Warkworth	2009	0.4	£143,136
Glasson	2002	6.4	£30,009	Skinflats	2009	11	£19,605
Goosemoor	2004	6	£24,304	Goswick/Beal	2010	4.5	£24,472
Walborough	2004	4.5	£11,996	Clapper Marshes	2011	10	£28,784
Lepe/Darkwater	2005	5	£31,825	South Efford Marsh	2011	17	£21,741

* per hectare, 2014 prices.

⁴ As of May 2015, at least 22 RTE schemes have been implemented in the UK.

Summary and Discussion

When it was first implemented, managed realignment was often envisioned as a low cost way of providing flood defence (Burd, 1995). However, the data held by ABPmer illustrate that managed realignment and RTE can be fairly, and increasingly, costly and complex to achieve. This is very much dependent on the location and scale of the works, the extent of any engineering and ongoing intervention requirements, as well as the associated assessment and implementation elements. Costs can be well over £100,000/ha for managed realignment and RTE schemes, particularly where significant engineering is required (which it typically is for habitat compensation schemes). However, lower cost schemes are still implemented, though rarely along more developed/urbanised estuaries.

When creating intertidal habitat in England, the Environment Agency generally works to a guideline cost of £50,000. This research has shown that, whilst this figure is close to, and in fact slightly above, the average unit cost for actually implemented schemes to date, it may not be a valid figure to use in more urbanised locations and those where new landward defences are required.

Often, managed realignment can lead to long-term cost savings in flood risk management terms, particularly where a given embankment is in a poor state of repair. For example, prior to the Medmerry scheme being undertaken, the fronting shingle ridge required annual re-profiling at £200,000 to £300,000/year, achieving a much lower standard of defence than what is now provided. However, in the short term managed realignment can clearly often be a more costly option when compared to maintenance and upgrade of existing defences. Frequently, the numerous other long-term benefits of managed realignment, which can be expressed as ecosystem services, help to make, or support clear investment cases for managed realignment. ABPmer are in the process of preparing a separate briefing note/white paper on the ecosystem services associated with intertidal habitat creation.

References

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Adapting Shorelines Database (OMReg) www.omreg.net

We would like to express our gratitude to the numerous project implementers who have contributed, and continue to help with, the population of the OMReg database. ABPmer continues to collate information about coastal adaptation and marine habitat creation schemes within our database. We welcome any contributions or comments from other organisations and interested parties whether about project costs or any other relevant subject.

**To learn more about coastal adaptation or to share information on existing schemes
contact Colin Scott or Susanne Armstrong on 023 80 711840**