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Cost estimation for habitat creation – summary of evidence

Report –SC080039/R14

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We cannot do this alone. We work closely with a wide range of partners including government, business, local authorities, other agencies, civil society groups and the communities we serve.

This report is the result of research commissioned by the Environment Agency's Evidence Directorate and funded by the joint Flood and Coastal Erosion Risk Management Research and Development Programme.

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Evidence at the Environment Agency

Evidence underpins the work of the Environment Agency. It provides an up-to-date understanding of the world about us, helps us to develop tools and techniques to monitor and manage our environment as efficiently and effectively as possible. It also helps us to understand how the environment is changing and to identify what the future pressures may be.

The work of the Environment Agency's Evidence Directorate is a key ingredient in the partnership between research, guidance and operations that enables the Environment Agency to protect and restore our environment.

This report was produced by the Scientific and Evidence Services team within Evidence. The team focuses on four main areas of activity:

- **Setting the agenda**, by providing the evidence for decisions;
- **Maintaining scientific credibility**, by ensuring that our programmes and projects are fit for purpose and executed according to international standards;
- **Carrying out research**, either by contracting it out to research organisations and consultancies or by doing it ourselves;
- **Delivering information, advice, tools and techniques**, by making appropriate products available.

Miranda Kavanagh
Director of Evidence

Executive summary

A number of research projects and case studies have reviewed the costs associated with habitat creation in the UK in relation to flood risk management measures. As out-turn costs for this aspect are poorly recorded, the aim of this summary of evidence on habitat costs is to provide information on these costs, case studies and guidance to support appraisers carrying out works where habitat creation may be required.

Habitat creation	
Key cost components	<p>Key cost components for habitat creation aspects will include:</p> <ul style="list-style-type: none"> • initial planning, assessment and design costs • land acquisition costs (in some cases) • capital costs • aftercare and maintenance, and monitoring costs
Key asset types	<p>Restoration and habitat creation costs for various habitat types are covered including:</p> <ul style="list-style-type: none"> • watercourse rehabilitation • inland water bodies and lagoons • floodplain grassland • bogs, marshes, fens • grazing marsh • woodland • reedbed habitat • mudflats • saltmarsh • coastal vegetated shingle and sand dunes
Data reviewed in specific guidance	<p>A number of reports, guidance and studies have been reviewed to provide up-to-date information on the costs of various habitat restoration and creation procedures. These include:</p> <ul style="list-style-type: none"> • English Nature report on habitat creation • Defra/Environment Agency reviews on managed realignment and coastal restoration • UKBAP cost estimates for BAP habitat types • Environment Agency report on third party flood risk assets • Scottish Government reports on river basin management plan impact assessments <p>Costs associated with bioengineering and bank protection have also been provided by manufacturers/suppliers of these solutions.</p>

Other relevant data	Local or proxy records such as data from Environment Agency SAMPs and local authority information Ongoing research projects	
Relative cost importance	Enabling costs	Variable costs associated with project coordination, management and administration, site survey, investigation and assessment, design, consent and licence application costs, and stakeholder consultation and liaison.
	Capital costs	Variable costs depending on scale and type of restoration/creation.
	Maintenance costs	Generally low costs associated with inspection, general maintenance and monitoring.
	Other cost considerations	Land purchase costs can be high (if relevant). Loss of productive agricultural land (in some cases).
Cost estimation methodology	Initial concept/national appraisal	Some case studies and example projects are provided to demonstrate cost elements required. Indicative costs provided for management, restoration and creation for a range of habitat types.
	Strategic, regional, or conceptual design	Some case studies and example projects are provided to demonstrate cost elements required. Indicative costs provided for management, restoration and creation for a range of habitat types.
	Preliminary feasibility/design	No specific cost information provided. Guidance on data availability and procedures provided. Site-specific assessment and specialist advice required.
Design life information	Generally not applicable.	
Quality of data	Case studies and examples are provided to support those undertaking similar schemes and to indicate the magnitude of the likely costs.	
Additional guidance	Checklist of factors likely to influence capital and maintenance costs, and key factors to consider for detailed costs estimation List of R&D and general design guidance	

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1 Flood mitigation measures – habitat creation aspects

This chapter includes guidance and costs associated with habitat creation and restoration that are applicable to flood and coastal erosion management. As there a number of linkages with other flood risk mitigation measures, in particular channel management and managed realignment, it is recommend that these evidence summaries are also reviewed.

This evidence summary discusses the following two topics:

- **Restoration** – restoring a site to the topographic shape, hydrologic function and plant communities that existed in historical times before disturbance by man. This practice can be expensive and generally requires detailed knowledge and regular management.
- **Habitat creation** – designing and managing plant communities for use as habitat by birds, mammals, fish, reptiles, or insects. Habitat creation involves providing one or all of cover, food or water to a targeted species and requires detailed planning and development funding. Where general habitat for wildlife is a goal, the preservation of existing sites is preferable to the development of new habitat.

1.1 Habitat creation costs – introduction

Habitat replacement or creation costs are undertaken when one or more of the following apply:

- there is a commitment to replace habitats lost as part of a wider scheme
- where a scheme promotes environmental aspects
- there is a commitment to provide habitat improvements as part of wider policy requirements

Habitat aspects may involve the restoration or re-establishment of existing habitat or the creation of entirely new habitat where previously none existed.

1.2 Key cost requirements

At a high level it may be appropriate to transfer indicative costs from case study reviews or as part of previous research. For more detailed analysis it may preferable to assess cost elements individually and to consider which elements need to change to fit a particular situation.

A number of standard cost parameters are required for habitat creation, although the preliminary planning aspects may be incorporated into wider project administration costs where habitat creation is part of a larger project. The following may be required:

- initial planning, assessment and design costs

- land acquisition costs
- capital costs
- aftercare and maintenance, and monitoring costs

A considerable amount of work has been undertaken with regard to the monetary benefits associated with habitat creation/environmental benefits and the inclusion of this in economic appraisal studies. The most relevant and recent guidance on this aspect is provided in the Eftec report (Eftec 2010) report that supports the revised Flood and Coastal Erosion Risk Management Appraisal Guidance (FCERM-AG) (Environment Agency 2010a).

1.3 Planning, assessment and design costs

Unless the habitat creation aspects are carried out separately, it is likely that the technical feasibility of habitat creation/restoration aspects will be covered within an overall flood risk management scheme. For habitat creation schemes the strategy set out in Figure 1.1 is typically followed.

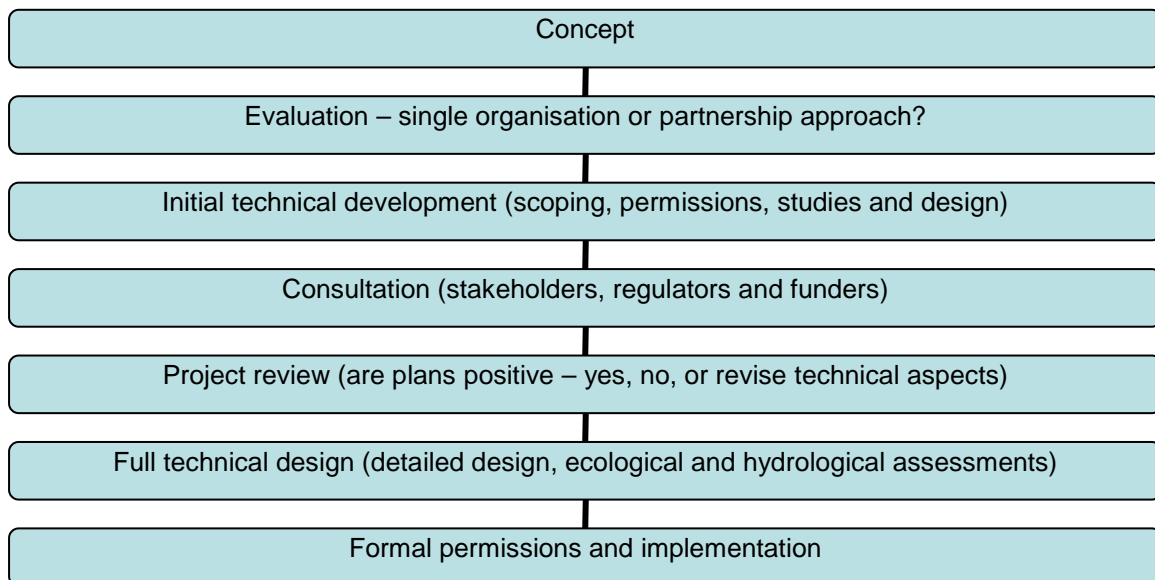


Figure 1.1 Strategy for habitat creation schemes

Regardless of whether the habitat creation aspects are included within a wider flood risk management scheme or strategy, it is likely that additional studies will be required to ensure the desired outcomes are achievable. Therefore specialist ecological, topographic, hydrological, hydromorphic and archaeological surveys may be required.

As with any other project, site design proposals will be required for the habitat creation/restoration activities and the costs for this aspect should not be overlooked.

Habitat creation or restoration measures will also require a degree of stakeholder engagement and liaison to ensure that landowners are:

- aware of the proposals
- provided with sufficient understanding of the objectives and process involved

- given the opportunity to provide their own comments and opinions on the proposals

The degree of stakeholder involvement will depend on the type and scale of the project. Costs associated with this are likely to include staff time associated with:

- correspondence
- planning
- production of presentational material
- attendance at meetings with the relevant stakeholders
- writing up of notes and/or action points from the meetings

It is suggested that the basic costs for project administration, associated advice, monitoring and evaluation work of a typical habitat creation project will account for approximately 15% of the total delivery costs (UKBAP 2006).

1.3.1 Consent and licence application costs

Other aspects that may be relevant include any legal and planning considerations, such as consent or licence applications, statutory designations and the disposal or sale of spoil or materials associated with the works. Possible consents for habitat creation works are listed in Table 1.1.

Table 1.1 Possible consents needed for habitat creation works

Likely consent	Organisation	Comment
Permitted development rights	Environment Agency	The Environment Agency has permissive rights under the Land Drainage Act 1991 and Water Resources Act 1991 to carry out necessary restoration works within main rivers. If a river is a main river, works within the channel do not require planning consent. The permissive rights extend to 9 m either side of the main channel. Local planning authorities will be consulted to determine if any aspects of proposed river restoration schemes require planning permission.
Environmental Impact Assessment (EIA) (statutory/non statutory)	In accordance with Environment Agency EIA policy.	If the Environment Agency considers the restoration options to have a high level of environmental risk, a full EIA (Environmental Statement) may be required.
Listed building consent	Local planning authority	If any of the works involve alterations to listed buildings or structures, consultation with the relevant conservation officers from the local authorities will be required. A separate Listed Building Consent may be required from the local authority for works affecting listed buildings or structures.
Consent for works affecting	Environment	It is essential that anyone who intends carrying out works in, over, under or near a watercourse or flood

Likely consent	Organisation	Comment
watercourses and/or affecting flood defences	Agency	defences (including sea defences) contacts the Environment Agency to obtain any necessary consents before starting the work. This may include the need for a formal Flood Risk Assessment.
Assent under Section 28 of the Countryside and Rights of Way Act	Natural England	Natural England will need to give their written assent for any works to be carried out within a Site of Special Scientific Interest (SSSI). Proposals should be developed in partnership with Natural England, and assent will be obtained prior to any works starting on a SSSI.
Habitats Regulations Assessment	Natural England	Confirmation of the need for an assessment under Regulation 48 of the Habitats Regulations 1994 (Appropriate Assessment) will be required from Natural England if a designation such as a Special Area of Conservation (SAC) are applicable.
Protected species and associated licences	Natural England	A consent letter from Natural England may be needed before any works can begin. Protected species will require some mitigation measures as part of the scheme. Consent from Natural England will be required to carry out mitigation activities if these require, for example, trapping or a destructive search for water voles.
Environmental permit	Environment Agency	In England, it may be necessary to obtain an environmental permit or an exemption from permitting. Different rules could apply in other UK nations.
Landowner, land manager and riparian user consents	Various landowners, land managers and riparian users	Liaison with key landowners, land managers and riparian users (for example, fishery/angling groups, canoe clubs) is required.

1.4 Land acquisition

In some cases habitat creation or restoration may be developed in agreement with landowners. Where this is not the case, land purchase may be required. In many cases land purchase is not necessary and can be assumed to be zero where appropriate management can be met under private ownership, using appropriate incentives.

However, for some habitats, such as the creation of saltmarsh and mudflat through managed realignment schemes, land purchase has a major role to play and can therefore represent a high proportion of the total cost. An English Nature report indicates that land purchase costs can account for 80–85% of the overall costs for habitat creation projects (English Nature 1999).

The Environment Agency has the power to purchase land for creating habitat where internationally designated habitat – Special Protected Area (SPA) or SAC – is being lost as a result of flood risk management activities or structures. This is typically associated with the loss of designated SPA and SAC habitat along coastal and estuarine areas due to sea level rise. The Environment Agency cannot purchase land solely for any other habitat creation purpose.

Land prices will vary according to the site characteristics and depend on the existing land use and any revenue generated from it. Prices may also vary depending on the willingness of a landowner to sell the land, although it is hoped that there would have been liaison with landowners and work to make the public aware of the project to ensure that landowners understand the aims, objectives and reasons behind the proposals and are willing to cooperate.

Indicative land valuations for a particular rural land use and grade of land are available which are suitable to provide approximate costs for inclusion into broad scale cost estimations. Detailed studies may require the services of an agricultural surveyor to determine an appropriate land value.

Land acquisition costs will also need to incorporate legal and professional fees and any personnel costs associated with any additional liaison not covered elsewhere.

1.5 Capital costs

Specific costs that may need to be included within an overall cost estimate are:

- water management costs (for example, removal or relocation of flood banks, installation of water level control devices, ditch construction/restoration and scrape/pool construction)
- vegetation introduction and management (seed/plant purchase, sowing/planting, scrub removal and so on)
- species and habitat translocations (if applicable)
- site infrastructure (stock fencing, gate installation, rights of way diversions)

For a detailed assessment at the site level, each of these aspects should be considered and costs determined for all elements.

For detailed cost estimates once designs, site conditions and methodologies are well understood, working up costs using standard rates and a bill of quantities will be appropriate. Guidance on detailed engineering costs is provided in standard price estimating books such as SPONS (Davis Langdon 2011) and the Institution of Chemical Engineer's CESMM price database (ICE 2012). A further key dataset is the annual John Nix Farm Management Pocketbook (John Nix 2014) which includes typical rates for agricultural machinery and labour, conservation rates and land prices.

For a higher level assessment, indicative costs for a particular habitat creation/restoration measures may be more suitable to include within a flood management study. A number of costs have been collated by various research projects including the following:

- *Preparation and Presentation of Habitat Replacement Costs Estimates: Using Examples of the Restoration and Creation of Coastal and Floodplain Grazing Marsh, Reedbeds and Lagoons* (English Nature 1999)
- *Managed Realignment Review* (Defra and Environment Agency 2002)
- *National Evaluation of the Costs of Meeting Coastal Environmental Requirements* (Defra and Environment Agency 2006)

- *Management of Third Party Flood Risk Assets and the Habitats Directive* (Environment Agency 2010b)
- *Impact Assessment of the River Basin Management Plan for Scotland River Basin District* (Scottish Government 2008)
- *Preparing Costings for Species and Habitat Action Plans. Revising the Costs of Delivering Habitat Action Plans* (UKBAP 2006)

Each of these reports provides useful information and are reviewed below.

1.5.1 Habitat replacement costs (English Nature)

The English Nature report focused on habitat replacement (both restoration of existing degraded habitat and the creation of entirely new habitat) in coastal and floodplain grazing marsh (English Nature 1999). The costs of recreating three types of habitats – coastal and floodplain grazing marsh (three case study sites), reedbed (four sites) and coastal lagoon (two sites) – were taken from the report to give the indicative costs shown in Table 1.2.

Table 1.2 Cost of habitat creation per hectare

Type	Cost per ha (1999 cost) ¹
Grazing marsh	£890–1,241
Reedbed	£2,800–5,045
Coastal lagoon ²	£4,200–57,000

Notes: ¹ Excluding land purchase costs.

² The large variation is due to the more expensive case study site; one of the lagoons was created from scratch and a specific objective was to provide more complex environmental objectives.

Source: English Nature

Land purchase costs were the single largest cost element for the coastal grazing marsh schemes, accounting for 80–85% of the overall costs. For reedbeds and lagoons, however, they were significantly lower, accounting for a maximum of 45% in the case of reedbeds and as low as 4% in the case of a lagoon.

1.5.2 Managed realignment review (Defra/Environment Agency)

The managed alignment review (Defra and Environment Agency 2006) summarises the technical findings of the study ‘Implementing Managed Retreat as a Strategic Flood and Coastal Defence Option’ (Joint Defra/Environment Agency Flood and Coastal Erosion Risk Management R&D Programme project FD2008). The report provides some additional cost information for studies undertaken in the USA. These costs are not provided here.

1.5.3 NEOCOMER (Defra/Environment Agency)

The National Evaluation of the Costs of Meeting Coastal Environmental Requirements (NEOCOMER) report – produced as part of the Joint Defra/Environment Agency Flood and Coastal Erosion Risk Management R&D Programme project FD2017 – provided costs for a number of habitat creation types typical of vulnerable fresh water and brackish Natura 2000/SSSI/Ramsar sites in England (Defra and Environment Agency 2008). Costs were derived for a number of habitat types based on estimated costs rather than out-turn project costs. The costs were reviewed and updated within a later Environment Agency study and are included in the next section.

1.5.4 Management of third party flood risk assets (Environment Agency)

The report, Management of Third Party Flood Risk Assets and the Habitats Directive (Environment Agency 2010b) reviewed the above project and collated its costs with other habitat creation costs to provide the comprehensive list of habitat creation/restoration costs applicable to the UK given in Table 1.3. This information is provided as it currently represents the most comprehensive list of habitat creation costs for use within national and strategic assessments in the UK.

Table 1.3 Summary of habitat creation costs

Habitat type	Replacement cost (per hectare)	Replacement cost (per hectare) without land purchase	Date of cost	Source	Comment
Inland water bodies and lagoons	£23,174	£17,000	2006	FD2017	Land purchase, topographic assessment, hydrological assessment, design/construction of water control structures
Wet grasslands	£15,174	£9,000	2006	FD2017	Land purchase, topographic assessment, hydrological assessment, design/construction of water control structures, grazing management, water management plan (£500 only for grazing management costs)
Drier grasslands	£7,174	£1,000	2006	FD2017	Land purchase, manual seeding and management for establishment
Bogs, marshes, fens	£14,424	£8,250	2006	FD2017	Removal of nutrient rich layer of silt, removal of scrub/trees, excavation of ditches, vegetation management, construction of water control structures, water level management plan, topographical survey, hydrological assessment, land purchase (£2,250 only for removal of scrub, silt and vegetation management)
Heath, scrub and open vegetation	£11,174	£5,000	2006	FD2017	Management to establishment (such as grazing or burning), scrub clearance, land purchase
Grazing marsh – low		£250	2002	CIRIA C565	Based on payments for restoration/ management of historic water meadows.
Grazing marsh – medium		£890	2002	CIRIA C565	Based on costs of restoring historic water meadows.
Grazing marsh – high		£4,000	2002	CIRIA C565	Based on estimated costs of recreating grazing marsh.

Habitat type	Replacement cost (per hectare)	Replacement cost (per hectare) without land purchase	Date of cost	Source	Comment
Broad-leaved and mixed woodland	£9,174	£3,000	2006	FD2017	Includes land purchase costs.
Broad-leaved woodland – low		£5,000	2002	CIRIA C565	Tree planting density of one tree every 2 m
Broad-leaved woodland – high		£7,500	2002	CIRIA C565	Tree planting density greater than one tree every 2 m
Wet woodlands	£9,674	£3,500	2006	FD2017	Hydrological and water level management assessment, establishment costs, land purchase (£3,000 for establishment costs)
Coniferous woodland	£8,674	£2,500	2006	FD2017	Includes land purchase costs.
Reedbed habitat – low (freshwater)		£2,800	2000	CIRIA C565	No attempt to recreate species rich communities
Reedbed habitat – high (freshwater)		£7,700	2000	CIRIA C565	Some attempt to create a species rich community
Mudflats – low		£5,500	2000	CIRIA C565	Direct economic costs; includes creation of a counterwall
Mudflats – medium		£15,000	2000	CIRIA C565	Direct economic costs plus some landscaping
Mudflats – high		£45,000	2000	CIRIA C565	Landscaping, earth movement, design and creation of hole in sea wall to allow water to enter
Hedgerow		£2/metre	1999	Manual of River Restoration Techniques	Cost of laying, coppicing, planting and management
Hedgerow		£4/metre	1999	Manual of River Restoration	Cost of laying, coppicing, planting and management of closely spaced hedgerow plants

Habitat type	Replacement cost (per hectare)	Replacement cost (per hectare) without land purchase	Date of cost	Source	Comment
Techniques					

Sources:

Defra, 2006. *National Evaluation of the Costs of Meeting Coastal Environmental Requirements*, R&D Technical Report FD2017/TR.

Postle and Vernon, 2001. *Guidance on the Costing of Environmental Pollution from Construction*, CIRIA Report C565.

River Restoration Centre, 2002. *Manual of River Restoration Techniques*, 2nd edition.

The costs given in Table 1.3 are based on the assumption that these options are carried out independently and for environmental gain drivers. They may therefore include costs for associated hydrological assessments, topographic surveys, and the design and construction of water control structures and water level management plans. It is therefore important not to double count costs associated with these aspects if they are being undertaken as part of a wider flood risk management strategy.

The analysis does not attempt to make fine comparisons between the costs associated with different habitats and options, but presents the order of magnitude of these costs and the relative differences between various habitat types.

The costs given in Table 1.3 are useful for providing indicative costs for habitat replacement activities where these are undertaken independently as part of a wider scheme/strategy. Variations in costs are likely to be highly site specific and dependant on a number of factors. Factors that influence the cost estimates are summarised in Table 1.4.

Table 1.4 Key factors influencing habitat creation costs

Factor influencing costs	Impact on cost estimation
Type of habitat to be restored	See Table 1.3 for indicative values.
Extent of damage and/or size of zone to be created/restored	Larger sites will have economies of scale. For example the NEOCOMER study suggests that if the size of a site is increased from 5 ha to 10 ha the cost per ha would reduce from £23,000 to £14,600.
How permanent repairs need to be, and whether the site will be self-sustaining or not	Affects ongoing maintenance and monitoring costs.
Specific driver for works based on a particular species	Schemes are likely to be more expensive than some of the simple habitat creation schemes.
Work may be undertaken by volunteers	If works is being undertaken by suitably supervised volunteers then the costs can be reduced substantially.
Use of landowners to undertake works or be included within the tendering list	Local landowners may have the necessary resources (for example, machinery and skilled operators) to complete the excavation and spoil movement and have local knowledge that could reduce costs.

1.5.5 UK Biodiversity Action Plan

The UK Biodiversity Action Plan (UKBAP) sets out the government's commitments to conserve and enhance biodiversity in the UK through a series of individual Habitat Action Plans (HAPs) and Species Action Plans (SAPs). Targets are set for the conservation of habitats and species with associated actions designed to meet these targets. In 2005 a study was commissioned to review existing costs of habitat and species creation and to update these estimates.

The UK Biodiversity Action Plan report (UKBAP 2006) includes unit costs for 30 types of habitat. Below is a summary of the most important water-related habitats that may be of use for river and coastal flood mitigation projects. The costs were developed

primarily from costs associated with incentive-based schemes and consultation with key stakeholders and therefore may not be fully representative of the costs associated with habitat creation works. However they do provide a relative indication of the costs associated with management, restoration and creation for a range of applicable habitat types.

Lowland raised bog

Table 1.5 gives unit costs for lowland raised bog management, restoration and re-establishment.

Table 1.5 Summary of lowland raised bog restoration and re-establishment costs

Location	Management	Restoration (capital and land purchase)	Re-establishment
England	£150/ha/year	£4,975 capital/land cost/ha + £150 /ha/year annual cost	£815 capital cost/ha + £380 /ha/year annual cost
Northern Ireland	£48/ha/year	£4,975 capital/land cost/ha + £48 /ha/year annual cost	£815 capital cost/ha + £92 /ha/year annual cost
Scotland	£60/ha/year	£4,975 capital/land cost/ha + £60 /ha/year annual cost	£815 capital cost/ha + £250 /ha/year annual cost
Wales	£40/ha/year	£4,975 capital/land cost/ha + £40 /ha/year annual cost	£815 capital cost/ha + £310 /ha/year annual cost

Notes: Costs based on 2005-2006 prices.
It is suggested that an additional 15% is added to allow for administration and land management costs, plus a further 5% to cover the wider costs associated with implementation including research, monitoring, communications, publicity and advice.

Coastal and floodplain grazing marsh

Table 1.6 gives unit costs for the management, restoration and re-establishment of coastal and floodplain grazing marsh.

Table 1.6 Summary of floodplain grazing habitat costs

Location	Annual management costs	Annual restoration costs	Annual re-establishment costs	Capital restoration/re-establishment costs
England	£200/ha/year	£200/ha/year	£315/ha/year	£1,280/ha
Northern Ireland	£125/ha/year	£125/ha/year	£250/ha/year	£1,280/ha
Scotland	£125/ha/year	£125/ha/year	£125/ha/year	£1,280/ha
Wales	£102/ha/year	£102/ha/year	£125/ha/year	£1,280/ha

Notes: Costs based on 2005-2006 prices.
It is suggested that an additional 15% is added to allow for administration and land management costs, plus a further 5% to cover the wider costs associated with implementation including research, monitoring, communications, publicity and advice.

Fens

The table below gives units costs for the management, restoration and re-establishment of fens.

Table 1.7 Summary of habitat costs associated with fens

Location	Management	Restoration (capital and land purchase)	Re-establishment
England	£60/ha/year	£575 capital/land cost/ha + £60 /ha/year annual cost	£815 capital cost/ha + £380 /ha/year annual cost
Northern Ireland	£92/ha/year	£575 capital/land cost/ha + £92 /ha/year annual cost	£815 capital cost/ha + £92 /ha/year annual cost
Scotland	£96/ha/year	£575 capital/land cost/ha + £96 /ha/year annual cost	£815 capital cost/ha + £250 /ha/year annual cost
Wales	£35/ha/year	£575 capital/land cost/ha + £35 /ha/year annual cost	£815 capital cost/ha + £310 /ha/year annual cost

Notes: Costs based on 2005-2006 prices.
It is suggested that an additional 15% is added to allow for administration and land management costs, plus a further 5% to cover the wider costs associated with implementation including research, monitoring, communications, publicity and advice.

Reedbeds

Table 1.8 gives units costs for the management, restoration and re-establishment of reedbeds.

Table 1.8 Summary of reedbed habitat costs

Location	Management	Restoration (capital and land purchase)	Re-establishment
England	£60/ha/year	£817 capital/land cost/ha + £150 /ha/year annual cost	£1,361 capital cost/ha + £380 /ha/year annual cost
Northern Ireland	£92/ha/year	£817 capital/land cost/ha + £48 /ha/year annual cost	£1,361 capital cost/ha + £92 /ha/year annual cost
Scotland	£100/ha/year	£817 capital/land cost/ha + £60 /ha/year annual cost	£1,361 capital cost/ha + £250 /ha/year annual cost
Wales	£35/ha/year	£817 capital/land cost/ha + £40 /ha/year annual cost	£1,361 capital cost/ha + £310 /ha/year annual cost

Notes: Costs based on 2005-2006 prices.
It is suggested that an additional 15% is added to allow for administration and land management costs, plus a further 5% to cover the wider costs associated with implementation including research, monitoring, communications, publicity and advice.

Mudflats

Table 1.9 gives units costs for the creation of mudflats.

Table 1.9 Summary of mudflat habitat creation costs

Item	Cost (£)	Unit
Habitat creation	15,000	Per ha

Notes: Costs based on 2005-2006 prices.

Saltmarsh

Based on a review of habitat creation and management costs, the following unit costs are proposed:

- Creation – £15,000 per hectare
- Management – £51 per hectare per year, for 50% of habitat area

These figures include project management and administration costs.

Saline lagoons

Table 1.10 gives units costs for the management, restoration and re-establishment of saline lagoons.

Table 1.10 Summary of saline lagoon habitat costs

Location	Creation	Restoration	Management
England	£26,250/ha	£1,140/ha	£136/ha/year
Northern Ireland	£26,250/ha	£1,140/ha	£34/ha/year
Scotland	£26,250/ha	£1,140/ha	£34/ha/year
Wales	£26,250/ha	£1,140/ha	£34/ha/year

Notes: Costs based on 2005-2006 prices.

Coastal vegetated shingle

Table 1.11 gives units costs for management, restoration and expansion of coastal vegetated shingle.

Table 1.11 Summary of coastal vegetated shingle habitat costs

Maintenance	Restoration	Expansion
£50/ha/year	£3,100/ha capital cost followed by annual maintenance cost	£10,000/ha capital cost followed by £260/ha annual cost for 10 years

Notes: Costs based on 2005-2006 prices.

Coastal sand dunes

Table 1.12 gives units costs for management and restoration of coastal sand dunes.

Table 1.12 Summary of coastal sand dune habitat management/restoration costs

Location	Management	Restoration from forestry (capital cost)	Restoration from scrub or bracken (capital cost)
England	£140/ha/year	£2,000/ha	£550/ha
Northern Ireland	£80/ha/year	£2,000/ha	£550/ha
Scotland	£80/ha/year	£2,000/ha	£550/ha
Wales	£50/ha/year	£2,000/ha	£550/ha

Notes: Costs based on 2005-2006 prices.

It is suggested that an additional 15% is added to allow for administration and land management costs, plus a further 5% to cover the wider costs associated with implementation including research, monitoring, communications, publicity and advice.

1.5.6 Proxy capital costs from incentive-based schemes

The need for society to engage farmers in conservation activities has been officially acknowledged in the European Union Common Agricultural Policy (CAP) since the beginning of the 1990s. The McSharry reform in 1992 (limiting rising agricultural production, while at the same time adjusting to the trend toward a more free agricultural market) led to the widespread implementation of agri-environmental measures in the CAP. Since then, voluntary agri-environmental schemes have become a key policy instrument for conserving and enhancing the environment. Agri-environmental schemes have become the dominant instrument of EU agri-environmental policy.

By participating in agri-environmental scheme contracts, farmers and land managers voluntarily commit themselves to adopting practices that go beyond the minimal practice of 'good farming' to delivering environmental benefits. In return, they are entitled to payments meant to compensate for incurred costs and foregone income.

The UK introduced agri-environment schemes in 1986 with the start of the Environmentally Sensitive Area (ESA) Scheme. At the time of writing the current agri-environmental scheme in England is the Environmental Stewardship Scheme (since 2005), currently managed by Natural England on behalf of Defra.

Environmental Stewardship is open to all farmers and is funded by the UK government and the European Union. Farmers and land managers across England enter into voluntary management agreements with Natural England to put the scheme in place. In return for looking after England's countryside – wildlife, landscapes, historic features and natural resources (soils and water) – and providing new opportunities for public access in some cases, the scheme provides farmers and land managers with a financial incentive that supports and rewards them for this work.

Environmental Stewardship has three elements:

- Entry Level Stewardship (ELS)
- Organic Entry Level Stewardship (OELS)
- Higher Level Stewardship (HLS)

The primary objectives are to:

- conserve wildlife (biodiversity)
- maintain and enhance landscape quality and character by helping to maintain important features such as traditional field boundaries
- protect the historic environment, including archaeological features and traditional farm buildings
- promote public access and understanding of the countryside
- protect natural resources by improving water quality and reducing soil erosion and surface run-off

Within the primary objectives, Environmental Stewardship also has secondary objectives of genetic conservation and flood management.

An alternative approach to cost estimation of habitat creation and restoration measures for more detailed studies is to use proxy capital values for certain aspects from incentive-based schemes.

Two reports have reviewed these payment schemes with a view to using these as a proxy for habitat creation and restoration/management costs for flood and coastal erosion schemes. The reports are the:

- *Delivery of Making Space for Water. HA6 Catchment Scale Land-Use Management. HA7 Land Management Practices.* (Environment Agency 2008)
- *UK Biodiversity Action Plan: Preparing Costings for Species and Habitat Action Plans. Revising the Costs of Delivering Habitat Action Plans* (UKBAP 2006)

Full details of the annual payments for a range of habitat creation and restoration options are provided in these reports. Important payment options relevant to flood and coastal activities include:

- woodland creation and management measures
- options to create and manage uncultivated land
- water level management
- managed realignment options

The example below gives a suggested approach with regard to how the above proxy payment values can be used to generate capital values or costs applicable to habitat creation measures. While it is not possible to determine which values we should consider as included in the proxy values, and additional costs may be expected on top of these, they provide an estimate of the likely costs but should be regarded as lower bounds for any analysis.

Example of the use of proxy payment scheme costs to determine capital costs

Given a 100-year time horizon, standard Green Book declining discount rates (HM Treasury 2003) and the proxy habitat values of £355 per ha per year for the creation of wet grassland for breeding waders, this suggests an approximate proxy capital cost per ha for wet grassland of £10,000.

1.6 Bioengineering

Bioengineering solutions can offer a cost-effective and sustainable alternative to problems that have traditionally been approached with hard engineering solutions. Costs associated with the supply and installation of a range of products for use within protection, river restoration and habitat restoration/creation works have been provided by Salix River & Wetland Services Limited. These are given in the channel management evidence summary but are repeated here for completeness in Table 1.13.

Table 1.13 Summary of bioengineering costs

Product	Supply unit	Install unit	Total
Willow spilling	£40–60/m	£40–60/m	£80–120/m
Willow brush mattress	£20–40/m	£30–60/m	£50–100/m
Live willow faggot/fascine	£7–10/m	£10–20/m	£17–30/m
Coir rolls (planted with suitable vegetation)	£18–25/m	£8–15/m	£26–40m
Coir pallet (planted with suitable vegetation)	£18–25/m	£5–10/m	£23–35/m
Coir roll (unplanted)	£10–15/m	£7–12/m	£17–27/m
Deadwood faggots/fascines	£7m–10/m	£10–20	£17–30/m
Plug planting	£4–7/m	£3–5/m	£7–12/m
Rock roll	£18–24/m	£18–24/m	£26–44/m
Biodegradable coir blanket	£1.50–2.50/ m ²	£1–1.5/m	£2.5–4/m
Permanent synthetic Geomat™	£4–8/m ²	£4–8/m	£5–10/m

Notes: Costs supplied by Salix.

In terms of the bioengineering design elements, the indicative costs are:

- walk over survey: £1,000–2,000 per 500 m reach
- geomorphology survey: £3,000–10,000 per 500 m reach
- indicative design: £500–2,000
- detailed design: £2,000–15,000

The mobilisation of machinery, welfare and/or fencing is not included above. These items would typically range from £1,000 to £5,000 for a £20,000–40,000 project.

1.7 Aftercare and maintenance costs

Maintenance costs for a habitat creation/restoration measure are expected to be low over the long term as the habitats created should generally be self-sustaining and not require any major annual or intermittent maintenance activities. However, it is necessary to ensure that the required vegetation establishment is achieved and stable, and that the broad objectives of the habitat creation/restoration are being achieved

Initial aftercare maintenance activities will vary by size and scope of the project, and specialist advice should be sort with regard to the activities required. The costs for this aspect may be associated with the contractor or the organisation that implements or controls the site in the future – assuming that such an arrangement for long-term maintenance has been arranged. Longer term monitoring of a site should be allowed for and the costs for this determined if these are expected beyond the initial monitoring phase.

Salix River & Wetland Services Limited have provided some indicative costs for activities associated with post-installation aftercare/maintenance in its bioengineering works on rivers, namely:

- walkover survey: £1,000 per 500 m reach
- repair by hand: £500–700 per day (based on 10–30 m repair per day)
- riparian and bankside repair by machinery: £700–1,000 per day (based on 10–30 m repair per day)
- willow coppicing by hand: £500–700 per day (based on 50–300 m per day)

1.8 Monitoring costs

It is typical that a fixed period of monitoring which is defined by the design process as 'long-term monitoring' may not be required once the objectives have been achieved. Monitoring usually has to commence before restoration works start to collect baseline data and to allow a comparison of changes to be recorded as each phase is implemented.

As with maintenance activities the size and scope of monitoring activities will vary depending on the scale of project, potential impact and location of works. Specialist advice should be sought with regard to the activities and monitoring required.

A number of indicative costs for monitoring and further assessments are provided in the Practical River Restoration Appraisal Guidance for Monitoring Options (PRAGMO) (River Restoration Centre 2011). These are summarised in Table 1.14 the table below.

Table 1.14 Summary of monitoring costs

Method	Unit	Cost
River habitat survey	1 km reach	£340 per km
Urban river survey	1 km reach	£300 per km
Habitat mapping/river corridor survey	1 km reach	£400 per km
Invertebrate survey	1 km reach	£2,000 per km
Macrophyte survey	1 km reach	£400 per km
Geomorphological mapping	1 km reach	£3,000 per km
Fluvial audit	1 km reach	£200 per km
LiDAR survey	1 km reach	£300 per km
Aerial photography	1 km reach	£400 per km
Topographic survey	1 ha	£400 per ha
Cross-section survey	1 km reach (20 cross-sections)	£2,000–4,500

Source: PRAGMO (RRC 2011)

1.9 Cost estimation methodology

Figure 1.2 shows the most important aspects required to generate a whole life cost for habitat creation aspects of flood and coastal erosion projects.

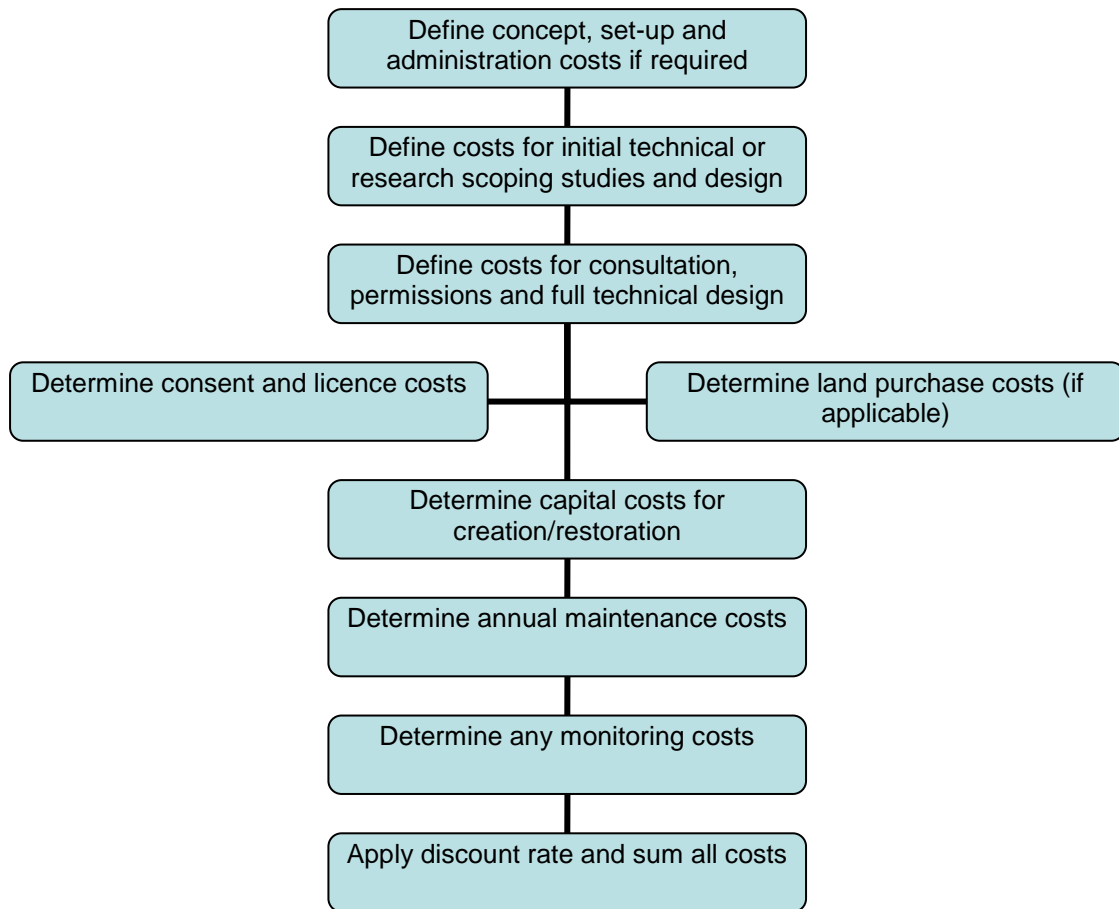


Figure 1.2 Flow diagram for habitat creation whole life costs

1.10 Checklist

Use the checklist to:

- identify the key cost elements required for watercourses
- ensure all relevant whole life costs are incorporated into the cost estimate

Whole life cost estimate checklist for habitat creation

Item	Description	Frequency	Comment
Initial costs			
Feasibility, design, permissions	Costs associated with modelling, feasibility studies, surveys and design	One-off	May be sunk costs at time of appraisal or included within overall scheme costs.
Consent and licence	Application and fees		
Management, liaison and publicity	Costs associated with initial planning and stakeholder consultation	Initial and ongoing	
Land acquisition costs			
Land purchase	Preliminary liaison and agreement Agent costs	One-off	
Capital			
Habitat creation, restoration or re-establishment costs	Site and drainage infrastructure, planting, seeding and habitat establishment costs	One-off	
Aftercare, maintenance and monitoring costs			
Monitoring	Aftercare and monitoring costs	Initial	May be required before works to record baseline.
Maintenance	Additional inspection and maintenance aspects to ensure long term sustainability of habitat	Initial	May be undertaken by other organisations. Long-term maintenance may not be needed after initial phases.

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