

Case study 58. Waldringfield Flood Defence Scheme, Suffolk

Author: Robert Harvey

Main driver: Improved defences and habitat restoration

Project stage: Constructed (2015 to 2016)



Photo 1: Saltmarsh on the River Deben at Waldringfield (source: Ipswich Star)

Project summary:

Following the tidal surge of December 2013, the businesses and residents of Waldringfield in Suffolk (Map 1) formed the Waldringfield Flood Defence Group. Working with the East Suffolk Internal Drainage Board, the Group has achieved a more resilient flood defence for the community along 1km of estuary frontage. The Group raised funds through the Coastal Communities Fund and other funding routes to pay for the works.

The work began in February 2015 and consisted of 2 phases. Phase 1 (south section) involved raising the brick wall to protect village properties fronting the estuary, along with a counterwall to separate this part of the flood cell from the north section. Phase 2 (north section) involved raising and widening the clay embankment together with saltmarsh restoration.

The Phase 2 design and build project aimed to create a higher wall, with a wider crest width and gentle back slope to withstand overtopping and breaching in the future. In addition, by winning all the material from the farmland behind the wall, a new freshwater wetland was created. This wetland provided suitable alternative habitat for water voles within a year of its construction. The East Suffolk Internal Drainage Board also designed and delivered a saltmarsh restoration pilot as part of the scheme to add further natural flood protection to the wall. The project was officially launched on 1 December 2015 and has been praised locally as a great model of partnership working. This project is a demonstration of what can be achieved at relatively low cost on rural flood defences.

Key fact:

Through a partnership approach incorporating both traditional and working with natural processes (WWNP) measures, significant improvements have been made to flood risk management for approximately 20 properties and a well-used public footpath, along with the creation of freshwater habitat and restoration of saltmarsh. Early monitoring results demonstrate that simple and relatively inexpensive brushwood structures can increase sediment accumulation within areas of eroded saltmarsh, providing benefits to both flood defence and habitat.



Map 1: Waldringfield (source: Ordnance Survey)

1. Contact details

Contact details	
Name:	Karen Thomas (East Suffolk Internal Drainage Board)
Lead organisation:	Waldringfield Flood Defence Group
Partners:	East Suffolk Internal Drainage Board, Environment Agency
e-mail address:	karent@wlma.org.uk

2. Location and coastal/estuarine water body description

Coastal/estuarine water body summary	
National Grid Reference:	TM 28497 44855
Town, County, Country:	Waldringfield, Suffolk, UK
Regional Flood and Coastal Committee (RFCC) Region:	Anglian
Transitional and coastal water body size (km²):	Not available
Transitional and coastal water body and location:	Deben Estuary
Water Framework Directive water body reference:	Not available
Land use, geology, substrate, tidal range:	Clay and estuarine gravels and sands Village, cattle and sheep grazing, arable

3. Background summary of the coastal/estuarine water body

Socioeconomic/historic context

In 2013, Waldringfield on the River Deben in south Suffolk had a low standard of protection compared with other estuary communities. In 2003, the community had turned down an Environment Agency scheme as it would have involved a sheet piled option that many of the waterfront property owners could not accept as it came very close to properties and obscured views of the river. During the December 2013 flood, 18 properties in Waldringfield were flooded, whereas those communities which had historically received improved flood defences were protected.

The Waldringfield Flood Defence Group was formed as a community-led project to provide increased flood risk management to the village. The project received support from the Environment Agency to complete the outline design of flood defences to protect homes and businesses in Waldringfield and the land to the north (Flood Cell 10 of the Deben Estuary Plan). The project aimed to:

- provide flood and coastal erosion risk management
- retain and improve the public footpath along the defences – a valuable recreational resource bringing economic benefits to the community at Waldringfield
- create or restore both intertidal and freshwater habitat

In November 2013 the project was incorporated into the Deben Estuary Plan.

The Environment Agency is keen to use this project as a pilot or proof of concept scheme to demonstrate how private stakeholders and local and central government agencies can collectively achieve what either party has historically struggled to achieve individually.

Flood and coastal erosion risk management problem(s)

Flood risk management to Waldringfield was provided by a clay bank that was vulnerable to overtopping during surge events. The Environment Agency forecast a 1 in 5 year risk of flooding.

Other environmental problems

Saltmarsh along the shore of the Deben immediately north of Waldringfield was becoming eroded and degraded. This would likely increase the long-term vulnerability of the clay bank flood defence north of the village to erosion and wave overtopping.

4. Defining the problem(s) and developing the solution

What evidence is there to define the flood and coastal erosion risk management problem(s) and solution(s)

The risk of flooding at Waldringfield was borne out by a near miss in November 2007, the December 2013 flood and another near miss in October 2014.

What was the design rationale?

Phase 1 (led by the Environment Agency)Phase 1 (led by the Environment Agency)

The principal flood defence measure (non-WWNP) consisted of the construction of a brick-clad wall (Photo 2) along the crest of the existing defence embankment, together with a counterwall running inland along the northern flank of the village. Pedestrian access through the wall was provided by closable flood gates to each property. The design height of the defence was +3.8m Ordnance datum (OD). Most of the wall is approximately 0.6m in height (Area 2), increasing to 1.3m at the southern end (Area 3) and 1.0 to 1.6m for the northern counterwall (Area 1).

Phase 2 (led by the East Suffolk Internal Drainage Board)

The clay embankment (Photo 3) north of Waldringfield was raised and widened to increase the standard of flood protection (non-WWNP), but no brick wall was constructed in this section. In addition, measures were implemented to restore and reinstate saltmarsh north of Waldringfield by encouraging accretion of fine sediment (WWNP). These measures consisted of placing brushwood faggots held in place by chestnut stakes in a variety of configurations including shore parallel, shore normal (miniature groynes) and to form enclosed polders. The project has focused on 3 distinct areas of work designed and built by the East Suffolk Internal Drainage Board.

(i) Toe protection for the flood defence (Photo 4)

In the central section north and south of the main sluice, there is little or no saltmarsh at the toe of the flood defence. Historically this frontage had been excavated to allow large boats to moor up alongside the old lime kilns. As a result, this area is very vulnerable to undercutting by tidal processes. A low faggot fence was installed in this section and runs parallel to the entire frontage either side of the sluice. The fence is set off the toe of the wall to:

- encourage accretion between the wall and the fencing
- promote new saltmarsh growth
- provide some protection from waves and currents

The fencing accommodates wildlife through a series of gaps or fish passes. There are also small 'groyne' structures spanning from the main fence, which aim to push flows away from the toe of the wall- further encouraging accretion. This work was completed in July 2016.



Photo 2: Brick-clad defence



Photo 3: Clay embankment



Photo 4: Low faggot fence

(ii) Stilling ponds (Photo 5)

This approach aims to use the materials to create low fences across small embayments to trap sediment and promote saltmarsh growth. These areas are common along the sides of larger creeks and within the marsh. It is hoped that these areas will create 'still water' allowing sediment to drop out of the water column and build up the intertidal area behind the fence. The conditions of the Marine Maritime Organisation (MMO) do not allow creeks to be closed off and the project has abided by these licence conditions. Most of this work is in the southern section of the marsh and fencing has been deployed along the sides of larger creeks and channels to capture bays for sedimentation to occur. Work was completed in September 2016.



Photo 5: Stilling ponds

(iii) Internal marsh protection to reduce fragmentation (Photo 6)

The Waldringfield marshes have been identified as ‘fragmented’ by Natural England and the Environment Agency. The creek systems are joining up and, as tidal flows then increase, saltmarsh is eroded. In a departure from the fencing approach, a different design is being trialled in those areas where this occurs. The aim is to create a ‘raised bed’ using hazel rafts and to try to separate the creek flows. The materials are laid out like a mattress and secured in position using similar methods to the fencing approach. In these locations, raising the mudflat by a few centimetres will hopefully reduce the connectivity between creeks and create new watersheds, thus reducing internal erosion of the marsh.

This work is largely complete at both the northern and southern ends of the marsh. It has been used most extensively at the northern end of the site where the marshes are very badly eroded and where creeks have joined and flows have increased as a result. The rafts should serve to slow flows and increase siltation locally, which in turn should create raised mudflat which in turn could become marsh. Most of this work has been completed in August 2016.



Photo 6: Internal marsh protection

Project summary

Area of transitional and coastal water body or length benefiting from project:	1.5km of defence frontage
Types of measures/interventions used (Working with Natural Processes and traditional):	<ul style="list-style-type: none">• Brick wall and flood gates (non-WWNP) (500m)• Embankment raising and widening (non-WWNP) (1km)• Saltmarsh restoration (WWNP) (800m of fencing)
Numbers of measures/interventions used (Working with Natural Processes and traditional):	3

Standard of protection for project as a whole:	Brick wall and flood gates: 1 in 100 years Embankment raising: 1 in 75 years Saltmarsh restoration: not available
Estimated number of properties protected:	Phase 1 (brick wall and flood gates): 18 Phase 2 (embankment raising and saltmarsh restoration): 2 residential properties and a sewage treatment works

How effective has the project been?

The standard of flood risk management has been significantly increased. Since the wall was built there was a tidal surge in January 2017 and the boat yard, which in the absence of the project would have been flooded, was protected.

5. Project construction

How were individual measures constructed?

Phase 1

The brick wall and food gates were constructed from imported materials.

Phase 2

The embankment was raised and widened using material sourced from borrow pits landward of the embankment, which were landscaped to create a new freshwater wetland.

Work on the saltmarsh restoration phase of the Waldringfield Flood Defence Group project started in June 2016 and involved stakes and brushwood being installed in eroded areas of marsh. Stakes came from Norfolk and hazel faggots were sourced from Kent, where they were cut by hand to order. Tidal working restrictions and wet weather made initial progress difficult. Heavy rain was problematic for operatives to work and it adversely affected ground conditions within the site for transferring materials. However, the weather in July and August 2016 improved and the scheme was delivered to time and budget.

How long were measures designed to last?

- Brick wall and flood gates: 50 years
- Embankment raising: 50 years
- Saltmarsh restoration: materials should last 25 years.

Where there any landowner or legal requirements which needed consideration?

The project was delivered by a partnership between the Waldringfield Flood Defence Group and the Environment Agency for Phase 1, and Waldringfield Flood Defence Group with the East Suffolk Internal Drainage Board for Phase 2. Landowners were represented within the Waldringfield Flood Defence Group.

In addition, a Memorandum of Understanding between the East Suffolk Internal Drainage Board, the Waldringfield Flood Defence Group and with Pretymen-Waller Trustees (landowner of the northern section) allowed for access and creation of freshwater wetland as part of Phase 2, along with agreements on future maintenance responsibilities and monitoring requirements.

6. Funding

Funding summary for Working with Natural Processes (WWNP)/Natural Flood Management (NFM) measures

Year project was undertaken/completed:	2015 to 2016
How was the project funded:	<ul style="list-style-type: none"> Coastal Communities Fund Flood Defence Grant in Aid Waldringfield Flood Defence Group
Total cash cost of project (£):	<p>Phase 1: £1.1 million (~£400,000 from Waldringfield Flood Defence Group)</p> <p>Phase 2: Embankment £360,000; saltmarsh restoration £98,000 (funded by Waldringfield Flood Defence Group with £10,000 from the AONB Sustainable Community fund)</p>
Overall cost and cost breakdown for WWNP/NFM measures (£):	WWNP measures cost £98,000. There are no additional costs to the Waldringfield Flood Defence Group. All materials have been used within the project and some funds are ring-fenced for monitoring)
WWNP/NFM costs as a % of overall project costs?	WWNP measures represented 21% of the Phase 2 costs and 6% of the overall project costs.
Unit breakdown of costs for WWNP/NFM measures:	WWNP measures were implemented along an 800m section of frontage. Cost £122.5 per metre and includes baseline and 3 additional surveys over next 10 years.
Cost–benefit ratio (and timescale in years over which benefit cost ratio has been estimated):	<p>Phase 1: benefits over 50 years</p> <p>Phase 2: not calculated (private defences)</p>

7. Wider benefits

What wider benefits has the project achieved?

Environmental benefits include:

- saltmarsh restoration
- freshwater wetland creation
- water vole habitat creation and relocation
- fish habitat (thin-lipped mullet, bass, common goby all recorded using saltmarsh as a nursery and feeding area and new structures provide refuge for fish fry)
- carbon sequestration
- footpath restoration (1 km)

The project is acting as a pilot for a new Suffolk Saltmarsh Fund, which will use evidence from this site to scale up likely funding needs for similar projects across Suffolk – led by the East Suffolk Internal Drainage Board and Suffolk County Council. This project will also be part of the Defra Marine Pioneer programme, which will focus on Suffolk.

How much habitat has been created, improved or restored?

- Saltmarsh restoration (10ha, of which restoration measures have been installed within

approximately 3ha)

- Freshwater wetland creation (0.75ha)
- Water vole habitat creation and relocation (1,400m in place of 700m)

8. Maintenance, monitoring and adaptive management

Are maintenance activities planned?

- Standard maintenance activities to seawall
- Replacing brushwood periodically

Is the project being monitored?

Annual inspections of sea wall and salt marsh structures are conducted.

On behalf of the Waldringfield Flood Defence Group, the East Suffolk Internal Drainage Board set up a monitoring programme within the marshes using simple ground survey methods coupled with remote sensing (drone) techniques. A full baseline survey in June 2016 used aerial photography and captured marsh topography. In addition there are also transects across the marsh, which allowed visual inspections of siltation to be made and used to ground truth the aerial data. The East Suffolk Internal Drainage Board also installed 2 large gauge boards to allow the Waldringfield Flood Defence Group and local visitors to see any change in marsh levels visually from the wall.

Following a survey of the initial 200m of saltmarsh structures completed in November 2015, the June 2016 survey picked up a 7–10mm rate of accretion landward of the fencing. This is very positive feedback after 6 months, as it shows sediment is accumulating behind the polder fencing and bodes well for the fencing installed in 2017.

The East Suffolk Internal Drainage Board has made a commitment to the Waldringfield Flood Defence Group and the MMO to conduct 3 further surveys in years 1 to 5 and year 10.

Natural England has shown interest in the monitoring approach and is considering rolling the technique across the Deben Estuary as it successfully captures a lot of data quickly and cheaply. If this happens, it will lead to a greater understanding of saltmarsh erosion throughout the estuary and may provide evidence for greater government investment in the future.

While applying for the MMO licence, the Waldringfield Flood Defence Group was approached by the River Deben Association to deploy additional monitoring equipment within the marsh. The River Deben Association is keen to look at any biological factors affecting saltmarsh erosion. Consequently the Waldringfield Flood Defence Group has enabled another community project as the East Suffolk Internal Drainage Board was able to add the River Deben Association's monitoring approach to the Waldringfield Flood Defence Group MMO licence.

Has adaptive management been needed?

No structures have had to be relocated. If excessive scour occurred, then structures may be removed or amended.

9. Lessons learnt

What was learnt and how could it be applied elsewhere?

- Value of community engagement through strategic plans and strategies
- Some funding (for example, from the Coastal Communities Funding) was opportunistic and to gain access it was valuable to have a scheme ready to implement.
- Value of communication with partners through weekly updates/newsletters

- Value of volunteers to help their own community
- Saltmarsh monitoring needs to address quality not just area, and there is a need to analyse the data that are collected.
- A Memorandum of Understanding was very valuable in providing a framework for partnership funding.
- MMO licences are not well oriented to saltmarsh restoration work, being time-consuming and expensive to obtain for small-scale environmental improvement works

10. Bibliography

None provided

Project background

This case study relates to project SC150005 'Working with Natural Flood Management: Evidence Directory'. It was commissioned by Defra and the Environment Agency's [Joint Flood and Coastal Erosion Risk Management Research and Development Programme](#).