

Case study 48. Nigg Bay Coastal Realignment Project

Authors: Steph Elliott

Main driver: Improved defences and habitat creation

Project stage: Completed 2003



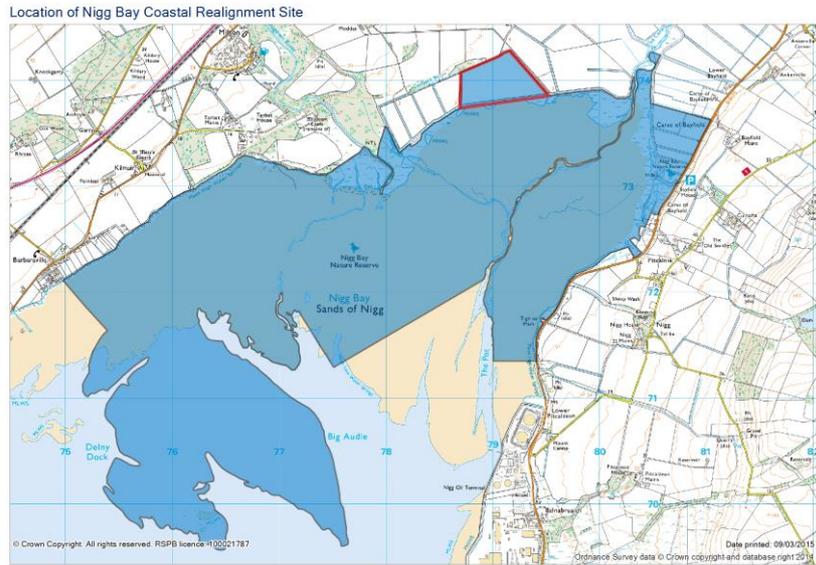
Photo 1: Nigg Bay management realignment (source: N. Russell, RSPB)

Project summary:

The project was the first time coastal realignment had been undertaken in Scotland. A 25ha field on the edge of Nigg Bay (Map 1) was reconnected to the sea after reclamation in the 19050s (Photo 1). Two 20m breaches were dug into the existing sea wall in 2003 to allow the tide to re-establish saltmarsh to replace habitat lost in the past and for future losses due to sea level rise for the benefit of waterbirds and flood risk.

Key facts:

A total of 25ha of new intertidal habitats were created, increasing the area of saltmarsh in Nigg Bay by 23%. As this area is the last part of Nigg Bay to be covered by incoming tides, it becomes an essential high tide refuge for up to 2,000 waterbirds during the highest spring tides and/or cold and windy conditions.



Map 1: Location of Nigg Bay coastal realignment project (source: RSPB)

1. Contact details

Contact details

Names:	Steph Elliott, site manager, Central Highland Reserves, RSPB Scotland
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Partners:	
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2. Location and coastal/estuarine water body description

Coastal/estuarine water body summary

National Grid Reference:	NH790740
Town, County, Country:	Cromarty Firth, Highland, Scotland
Land use, geology, substrate, tidal range:	Farmland. Bedrock geology. tides in Nigg Bay are semi-diurnal, with mean spring tidal ranges of 3.5 m

3. Background summary of the coastal/estuarine water body

Socioeconomic/historic context

An RSPB study showed that 39.4ha of the saltmarsh in Nigg Bay had been lost between 1946 and 1997, representing a 36% loss. A further 93ha of intertidal mudflat was claimed for the building of an oil terminal and fabrication yard between 1970 and 1979.

There has been a long history of claiming land from the sea in the Nigg Bay area. Around 700ha of land lie below the 5m contour in the Nigg Valley, which drains into Nigg Bay. Much of this land has been

claimed from the sea or drained over hundreds of years.

Flood and coastal erosion risk management problem(s)

Loss of saltmarsh means raised sea levels, increased sea wall maintenance costs and increased likelihood of sea wall overtopping.

Other environmental problems

important Site of Special Scientific Interest (SSSI) and Special Protection Area (SPA) designated intertidal habitats, such as saltmarsh and mudflats, had been lost which were important for internationally important numbers of wintering waterbirds.

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)

RSPB has been involved in managing land in Nigg Bay since the 1990s. In 1997, the RSPB made an approach to a landowner about the possibility of purchasing the intertidal land at the head of Nigg Bay. At that stage, the RSPB was asked if it would also be interested in the Meddat Field, which became the coastal realignment site. The seawall was under considerable pressure and had become badly eroded, so was becoming uneconomic to repair. The RSPB decided that this would be a good place to consider a coastal realignment. The subsequent design and impacts study showed this to be the case (Babtie 2002).

What was the design rationale?

Two 20m breaches were dug into the existing seawall defending the coastal realignment project site at Nigg Bay. Prior to breaching, an existing perimeter wall was built up to provide a secondary defence at 1 in 50 year flood event levels, with a 500mm freeboard. This was to prevent the risk of flooding the neighbour's land. Most new build defences would be required to be higher, but this was not required here as this secondary defence was of a higher standard than the primary sea defences elsewhere in Nigg Bay.

Four scenarios for design were considered by the design and impacts study (Babtie 2002):

1. No action
2. One 20m breach
3. Two 20m breaches
4. Total removal of the seawall

Option 3 (two 20m breaches) was the preferred option based on the results of modelling and a walkover survey of the site. These breaches lined up with the relict drainage channels and would provide faster inflowing tides and slower outflow, therefore increasing the sediment transport and subsequent saltmarsh development. Two breaches provided more optimal conditions than Option 1. Option 4 would have been more expensive and have led to the loss of sheltered conditions for vegetation establishment. Option 1 was rejected as it would not allow strategic placement of a breach, even though the wall was likely to breach naturally eventually.

Project summary

Types of measures/interventions used (Working with Natural Processes and traditional):

Two 20m breaches in an existing seawall

Numbers of measures/interventions used (Working with Natural Processes and traditional):	2
Standard of protection for project as a whole:	No information provided
Estimated number of properties protected:	No information provided

How effective has the project been?

Monitoring of the project has mostly been related to ecological outcomes because the RSPB does not have the skills or resources to monitor wider effects.

The main desired outcome was to create new intertidal habitats (saltmarsh and mudflats) to mitigate for past losses from reclamation and future losses due to sea level rise. Monitoring has shown that, 15+ years after breaching the seawall, 25ha of ecologically good quality saltmarsh and mudflat has been created.

5. Project construction

How were individual measures constructed?

Two 20m breaches were dug using a mechanical digger. The secondary sea defence was built up to 1 in 50 year height, also using a mechanical digger, with material won locally.

How long were measures designed to last?

Ongoing/indefinitely

Were there any landowner or legal requirements which needed consideration?

RSPB purchased the land where the project was undertaken to form part of its Nigg Bay nature reserve.

Various consents were required:

- SSSI consent
- Appropriate assessment under the Habitats Regulations
- Consent for coastal protection works
- Food and Environment Protection Act licence

Although an Environmental Impact Assessment was not required, the RSPB commissioned a 'design and impacts study' which included modelling of potential impacts to the wider estuary as well as various realignment design schemes.

6. Funding

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

Year project was undertaken/completed:

2003

How was the project funded:	Heritage Lottery Fund, Scottish Natural Heritage, Scottish Environmental Protection Agency (SEPA) and RSPB funded the project.
Total cash cost of project (£):	No information available
Overall cost and cost breakdown for WWNP/NFM measures (£):	£47,480 plus land purchase and staff time for project management
WWNP/NFM costs as a % of overall project costs:	No information available
Unit breakdown of costs for WWNP/NFM measures:	No information available
Cost–benefit ratio (and timescale in years over which it has been estimated):	No information available

7. Wider benefits

What wider benefits has the project achieved?

A total of 25ha of new intertidal habitats was created – 20ha of saltmarsh and 5ha of pioneer saltmarsh and intertidal mudflat. This created habitat for up to 2,000 wintering waterbirds. The site is particularly important on high spring tides and/or cold, windy conditions when it is the last part of Nigg Bay to be covered by the tide.

How much habitat has been created, improved or restored?

A total of 25ha of new intertidal habitats was created – 20ha of saltmarsh and 5ha of pioneer saltmarsh and intertidal mudflat. The site lies adjacent to the SSSI/SPA and is used by internationally important numbers of wintering waterbirds.

8. Maintenance, monitoring and adaptive management

Are maintenance activities planned?

Ongoing monitoring of the secondary sea defence takes place; so far this has not shown that any repairs are required. No other maintenance activities are planned.

Is the project being monitored?

Various monitoring activities have been carried out. Ecological monitoring has focused on:

- vegetation development
- colonisation by intertidal invertebrates (important food for birds)
- colonisation and use by wintering waterbirds

Some small-scale studies of sedimentation and secondary defence condition have also been made.

Six months after the seawall was breached, 3 species of saltmarsh plant had colonised the site. By 2011 (9 years after breach), all the vegetation monitoring plots, bar one, were saltmarsh. The development of saltmarsh has been quicker than expected. Very little saltmarsh has been lost from outside the coastal realignment site.

The 4 main 'bird food' invertebrates studied colonised more quickly than expected and the site now provides an important top-up feeding area for wintering birds. There has been ~20–30cm of

sedimentation in some parts of the site, with excellent saltmarsh creek development.

For further details see the 'Coastal Realignment at RSPB Nigg Bay Nature Reserve' report (Elliot 2015).

Has adaptive management been needed?

No

9. Lessons learnt

What was learnt and how could it be applied elsewhere?

The coastal realignment site at Nigg Bay was a good place to undertake a project of this kind for various reasons. The development of saltmarsh and mudflat habitats of benefit to large numbers of wintering waterbirds was relatively quick. This was probably because the field had only been separated from the rest of the estuary for about 50 years, and the field itself had not been ploughed. Therefore the field height was only a little lower than the rest of the estuary, so sedimentation to heights that allow saltmarsh development was quick. The lack of ploughing meant that the relict creek system was still there. At other sites that have been separated from the estuary for longer and/or ploughed, it may be necessary to import sediment and site engineering works may be needed to allow saltmarsh to develop more quickly.

10. Bibliography

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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](#).