

Case study 63. Pagham Harbour Bypassing

Authors: Roger Spencer, Uwe Dornbusch

Main driver: Improved defences

Project stage: Carried out in 2009



Photo 1: Beach recharge, Source: Uwe Dornbusch

Project summary:

The bypassing of shingle beach material from the Church Norton spit onto Pagham Beach in West Sussex (Photo 1 and Map 1) was carried out in 2009 to quickly address the loss of beach sediment from parts of Pagham Beach onto frontages downdrift from which it could not be recycled.

Key facts

- Bypassing was seen as an 'adaptive management' intervention that accelerated the expected future natural sediment movement.
- Implementation of bypassing was quicker and cheaper than for beach recharge.



Map 1: Location of Pagham (source: Channel Coastal Observatory) 2008

1. Contact details

Contact details	
Name:	Roger Spencer
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Partners:	Environment Agency
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2. Location and coastal/estuarine water body description

Coastal/estuarine water body summary	
National Grid Reference:	SZ 88908 96931
Town, County, Country:	Pagham, West Sussex, UK
Regional Flood and Coastal Committee (RFCC) region:	Southern
Transitional and coastal water body size (km²):	190km ²
Transitional and coastal water body and location:	Sussex
Water Framework Directive water body reference:	GB640704540003
Land use, geology, substrate, tidal range:	Open coast (leisure, recreation, residential). Mixed beach (shingle and sand). Mean spring tidal range: ~ 5.1m

3. Background summary of the coastal/estuarine water body

Socioeconomic/historic context

Since the early 20th century, summer beach chalets have been built on the previously non-existent Pagham Beach and subsequently developed into permanent houses amounting to over 300 residential and commercial properties along a stretch of ~1.43km.

Flood and coastal erosion risk management problem(s)

Loss of beach over a length of Pagham Beach was increasing the risk of loss due to erosion for 76 residential and commercial properties. Prior to the scheme, the risk had dropped from a target 1 in 200 years to about 1 in 150 to 1 in 180 years, and was assumed to reduce further during the winter of 2009 to 2010.

Other environmental problems

Church Norton Spit and Pagham Beach are part of the Pagham Harbour Special Protection Area (SPA), which is designated for vegetated shingle and the shingle spit and beach geomorphology, as well as nesting and overwintering of birds.

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 area has a long history of large-scale geomorphological change involving the location of the Pagham Harbour inlet and associated spits and beaches. This had been recognised in the Pagham to East Head Coastal Defence Strategy completed in 2009 through the shoreline management policy of 'adaptive management' (Environment Agency 2009).

Shingle loss on Pagham Beach, as well as the growth of Church Norton Spit, were well documented through data collected by the Coastal Monitoring Programme. Expert geomorphological assessment, together with online modelling, provided a forecast of future developments for this coastline. The short-term intervention described in this case study was expected to be followed up by additional beach recharge the following spring (2010).

What was the design rationale?

As the beach loss had to be addressed, there were limited options available including – the final option – recharge from land-based or marine sources. Harder options such as groynes and linear defences were ruled out due to technical uncertainties, environmental considerations and the long lead times for this type of option. Given the approaching winter and the significant transport disruption and additional costs associated with land-based import, the final option was deemed the best.

The dynamic situation in the Pagham Harbour area and the belief that the growing Church Norton Spit was the cause of the loss of shingle (due to a change in the hydrodynamics and resulting wave focusing) meant it was necessary to address the loss in a way that would have minimal impact on the environmental interest and at the same time provide a defence in line with the adaptive management policy.

In discussion with Natural England, 10,000m³ of recycling was considered the maximum volume of material that could be taken from the nearshore banks without unduly affecting the SPA designation.

A further 20,000m³ would be required to bring the beach back into a reasonable condition to provide a suitable defence. Procedures were put in place to enable this additional material to be provided by

bringing onshore material from licenced offshore dredging areas (at far greater cost). However, this was not possible until the spring when conditions for sea-borne methods were more practicable.

The design of the replenished beach was to replicate the beach as it was about one year before; concentrating on the upper profile which is the primary wave energy absorbing zone.

Pagham Beach is not only environmentally designated and quite densely populated, but the area is also used throughout the year for leisure purposes which increase in the summer.

Project summary	
Types of measures/interventions used (Working with Natural Processes and traditional):	Beach sediment bypassing and beach sediment recharge Previously, the beach had groynes, but an expansion of this regime was inconsistent with the adaptive management approach and the required speed of installation.
Numbers of measures/interventions used (Working with Natural Processes and traditional):	As well as the spring 2010 intervention mentioned above, there were a number of subsequent smaller scale interventions (just before and following the construction of the rock revetment some 500m west of the recycled area).
Standard of protection for project as a whole:	1 in 200
Estimated number of properties protected:	76

How effective has the project been?

The project achieved its aim to bypass shingle beach sediment from the ebb tide delta to the south of the Pagham Harbour inlet channel onto the beach to the north to both budget and time. The anticipated time of benefit was close to the actual.

There have been no perceived changes resulting from this Working with Natural Processes (WWNP) measure.

5. Project construction

How were individual measures constructed?

The material was dug with large, 360° excavator loading 'moxy' type dump trucks. These transported the material the 0.5km or so to the required location, where the material was spread and profiled by a bulldozer.

How long were measures designed to last?

5–10 years

Were there any landowner or legal requirements which needed consideration?

The area is highly designated – SPA, Ramsar, Site of Special Scientific Interest and so on – and so it was necessary to have detailed discussions with Natural England to ensure the designations were not adversely affected.

The foreshore is owned by the Crown Estate, but the Risk Managing Authority (Arun District Council) has a regulating lease. The area above mean high water is owned by a holding company, with whom

Arun District Council works quite closely, and which has an interest in protecting the area. There were therefore no objections to the works.

6. Funding

Funding summary for Working with Natural Processes (WWNP)/Natural Flood Management (NFM) measures	
Year project was undertaken/completed:	2009
How was the project funded:	Flood Defence Grant in Aid
Total cash cost of project (£):	£43,000
Overall cost and cost breakdown for WWNP/NFM measures (£):	Not applicable
WWNP/NFM costs as a % of overall project costs:	Not applicable
Unit breakdown of costs for WWNP/NFM measures:	Not applicable
Cost–benefit ratio (and timescale in years over which it has been estimated):	>3 to 1 10 year benefit period

7. Wider benefits

What wider benefits has the project achieved?

Transfer of shingle from the bare intertidal ebb delta across the Pagham Harbour outflow channel onto the beach to the north had a minimal impact at that time on the vegetated shingle and thus also on some aspects of the SPA and the people living on the beach and in Pagham.

The sediment bypassed would provide a benefit to beaches further down drift, both in terms of providing additional protection and potentially additional area for vegetated shingle to form.

How much habitat has been created, improved or restored?

No habitat area was created, but increasing the beach width would avoid or delay the loss of vegetated shingle landwards.

8. Maintenance, monitoring and adaptive management

Are maintenance activities planned?

As part of the adaptive management policy, future maintenance activities are possible but not planned.

Is the project being monitored?

The movement of beach material and its subsequent evolution had been monitored through regular monitoring through the Coastal Monitoring Programme, with an initial post-scheme survey following the works to establish a baseline.

Has adaptive management been needed?

No

9. Lessons learnt

What was learnt and how could it be applied elsewhere?

While the bypassing of comparatively small amounts of shingle from the ebb delta to the beach down drift was a cost efficient method to provide sediment to a frontage in deficit as a short-term measure, uncertainty in relation the impact on the future evolution of Church Norton Spit remains as the spit advanced over its ebb delta. In a highly dynamic environment, it is not easy to determine the impact of management interventions; however, somewhat similar but smaller scale interventions have been carried out over the winters from 2013 to 2016.

10. Bibliography

ARUN DISTRICT COUNCIL, 2009. Pagham Spit Removal Works – Project Appraisal Report. Littlehampton, West Sussex: Arun District Council.

ENVIRONMENT AGENCY, 2009. Pagham to East Head Coastal Defence Strategy [online; updated June 2014]. Worthing: Environment Agency. Available from: <https://www.gov.uk/government/publications/pagham-to-east-head-coastal-defence-strategy> [Accessed 4 April 2017].

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](#).