CASE STUDY

# Preserve and improve water's edge and bank side habitats

## Project Summary

**Title:** Shaldon Intertidal Habitat Enhancement
**Location:** Shaldon, Devon, England
**Technique:** Design modifications to ecologically enhance a flood wall
**Cost of technique:** ££
**Overall cost of scheme:** £££££
**Benefits:** ££
**Dates:** 2010-2012

## Mitigation Measure(s)

Preserve and improve water's edge and bank side habitats

## How it was delivered

Delivered by: Environment Agency
Partners: Interserve; Atkins Global; University of Exeter; Plymouth University; Treweek Environmental Consultants


**(1) Construction of two walls of the Shaldon and Ringmore tidal defence scheme, into which ecological enhancements were incorporated. May 2010**




**(2) Niche habitat colonisation after 18 months**

CASE STUDY

# Background / Issues

Shaldon and Ringmore on the River Teign in Southwest Devon suffered two near-miss flooding events in October 2004 and March 2008. In response to these events the Environment Agency (EA) secured funding and together with its contractors, Interserve and Atkins Global, designed an £8.3 million tidal flood risk management scheme (Figure 1). The scheme was designed to provide a 1 in 300 year standard of protection for 453 homes and businesses in Shaldon and Ringmore and was the first example of the EA's "Building Trust with Communities" approach to public engagement.

As several of the existing concrete walls were beyond repair, new walls were required in places. These were built from local stone with mortar pointing (Figures 3 and 4). This necessitated a modest 'advancement' of the line of protection (approximately 1 m). The new walls encroached onto the mixed sand and gravel foreshore, which was not designated for its ecology and was of modest ecological value due to degradation caused by compaction by human activity (e.g. walking and boating) on the foreshore. For these reasons, it was decided that restoration of the foreshore would yield limited ecological gains. However, the scheme required planning approval and the Environmental Impact Assessment required some form of ecological compensation to offset impacts.


**(3) Old flood wall with low numbers of species and individuals**


**(4) New flood wall with ecological enhancements. Note low visual intrusion**

# Step-by-step

*Proposal of ecological enhancements*

The decision not to offset the foreshore habitat directly, led to identifying alternative forms of mitigation to meet planning requirements. The scientific need for ecological enhancement of hard coastal structures is clear; hard coastal structures typically lack physical complexity and are poor surrogates for natural rocky habitats, often with fewer species. At Shaldon, ecological enhancements were initially proposed by the EA's NEAS team during the design phase, based on existing examples from Sydney and Seattle, which demonstrate the ecological and planning benefits of including niche habitats in the design of new flood walls and sheltered habitats under slipways.

*Scheme development*

During the development of the scheme at Shaldon, the NEAS team consulted ecologists and geomorphologists from two UK universities (Exeter and Plymouth) involved in complementary research on the influence of engineering design on the ecology of hard coastal structures. An initial meeting with these partners was held to discuss opportunities for enhancement based on existing scientific evidence from the UK and around the world, followed by a feasibility walkover survey on site. Three key recommendations were made: 1) that niche habitats could be incorporated into the scheme to meet local planning requirements and to provide much-need, scientific evidence to support further implementation of this type of enhancement in the UK; 2) that different niche habitat types should be tested (ranging from surface texturing to artificial rock pools made in the mortar pointing between stone blocks (Figures 5 – 8), and 3) that the niche habitats should be replicated within the walls (as discrete units) in order to achieve a scientifically robust experimental design. Following an iterative design process, a test wall was built to illustrate the different habitat niches, and the final designs were ultimately signed off by the lead engineer.

*Post-installation monitoring*

Post-installation monitoring (which is critical to evaluate the success of enhancement schemes) was completed for the statutory monitoring period (i.e. 18-months after colonisation). It was subsequently lengthened by an EU research grant. Macrobiota results showed a particularly clear response.



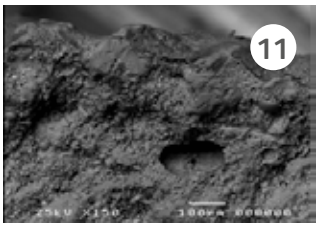


**(5) Normal mortar finish (= control)**
**(6) Brushed**
**(7) Holes**
**(8) Pool**

## Benefits

- Nineteen months after they were built, 9 species of macrobiota had colonised the walls. Species abundance and diversity was significantly greater in hole and pool niches compared with the control and grooved niches (Firth et al. in press; Figures 9 and 10).
- Microbiotic (i.e. less than 1 mm) communities were well-developed after 18 months for all niche types, which provide an important food source for macrobiota.
- Evidence of weathering of the construction materials associated with the intertidal setting was found (e.g. biochemical crusting, micro-cracking, salt crystallisation and granular disintegration), but there was no evidence that inclusion of the niche habitat enhancements exacerbated these processes in any way (Figure 11).
- Simple and inexpensive (< 0.3 % of the total project budget) manipulations to the design of hard coastal structures can have a significant effect on ecology, particularly macrobiota with no adverse effects on material properties, 18 months after installation. These types of enhancements can therefore provide cost effective offset and mitigation tools, particularly for mitigating hydromorphological impacts under the WFD.
- Inclusion of niche habitat enhancements helped the scheme win the 'Heath, Safety and Environmental Management' category in the 2012 Environment Agency Project Excellence Awards.
- This is the first known application of ecological enhancement in new hard structures in the UK. It thus serves as a full scale 'proof of concept' for this type of enhancement.
- This momentum of this work led to the creation of the first guidance on including ecological enhancements in the planning, design and construction of hard coastal structures.






**(9) Hole treatment pre-colonisation**
**(10) The same treatment 18 months after colonisation**
**(11) Scanning electron photograph of brushed mortar showing no deterioration after 18 months**

## Lessons Learnt

- Ecological enhancement of hard coastal structures can be inexpensive to implement and post-construction monitoring has demonstrated its effectiveness for increasing the numbers and species present.
- Knowledge brokers are critical to ensure that habitat enhancements are progressed from the idea phase to installation. They are especially helpful for working through concerns by members of the project team.
- Input from Universities is critical to delivery as existing operational evidence is limited but quickly building momentum.
- Environmental Impact Assessment was the driver for this enhancement; it also helps maximise ecological potential
- Monitoring for longer than the required 18 months produced stronger evidence of the successful ecological and geomorphological outcomes of the enhancement.
- Only some parts of schemes may be suitable for intertidal ecological enhancement; enhancements on part of a structure or scheme can still have considerable benefits. The environmental and ecological context has to be considered on a case by case basis in order to maximise the ecological and geomorphological potential of enhancements.
- Unforeseen engineering (i.e. needing to install weep vents) and/or build phase changes may happen – we recommend designing in a few extra enhancements to accommodate these changes and still obtain robust evidence.

Project contact: Dr. Deborah Dunsford, NEAS team, Environment Agency and Dr. Martin Coombes (University of Oxford), Dr. Larissa Naylor (University of Glasgow), Prof. Richard Thompson and Juliette Jackson (Plymouth University)