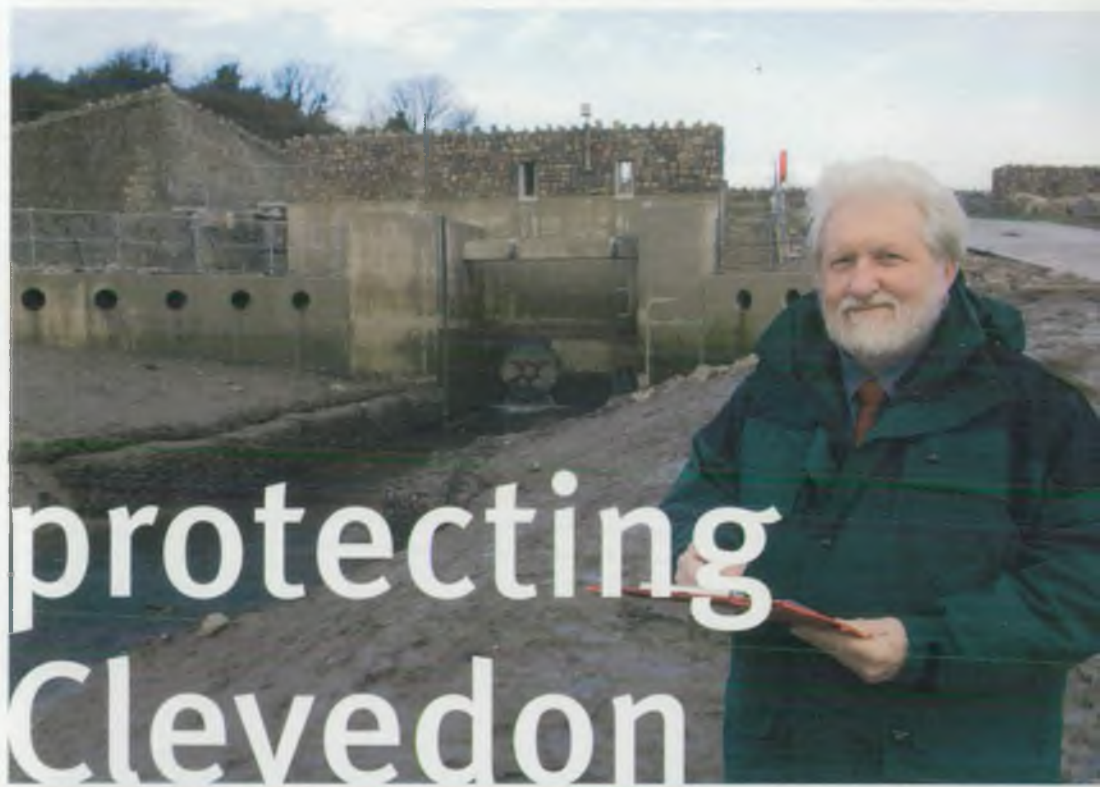


BA SOUTH WEST Box 17



protecting Clevedon

Tidal defences for Clevedon,
North Somerset

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Three structures - the Land Yeo outfall, Blind Yeo sluice and Marshall's Bank - reduce the risk of flooding for more than 4,700 properties in Clevedon, North Somerset.

All three - located on the edge of the Severn Estuary - have been significantly improved by the Environment Agency.

This leaflet describes our work on the Land Yeo outfall and Marshall's Bank, carried out in 2005/2006, and the Blind Yeo sluice, carried out in 2004.

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background

The Land Yeo drains mainly rural land upstream of Clevedon - including the low-lying Tickenham, Nailsea and Kenn Moors Site of Special Scientific Interest.

When the M5 motorway was built in the 1970s the River Yeo was divided into two watercourses upstream of Clevedon - the Land Yeo and the man-made Blind Yeo. They are connected by the Yearling Ditch, which takes flow south from the Land Yeo to the Blind Yeo via a sluice at Cook's Clyse.

The Land Yeo outfall - where the river discharges into the Severn Estuary - was an old masonry structure, thought to date back to the 1880s. Records show there has been an outfall structure at this location since medieval times.

Marshall's Bank - a 500-metre long embankment that stretches between the Land Yeo outfall and the Blind Yeo sluice - also dates back to medieval times. Work took place in 1958 and 1984 to raise and strengthen the bank.

The Blind Yeo sluice is not as historic as the other two tidal structures, but its purpose is no less significant.

The sluice lies at the tidal outlet of the Blind Yeo, where it meets Clevedon Pill and the Severn Estuary.

The sluice comprises two gates, known as the north and south eyes. The south eye dates from around 1952 and the north eye was added in the early 1970s to handle the extra water run-off from the M5.

Damage to the western end of Clevedon sea wall following the storm of December 1981



The problem

The three tidal defence structures are located next to the Severn Estuary. The estuary has the second highest tidal range in the world.

The most recent flooding happened in December 1981, when a large surge on a modest spring tide flooded 305 properties and land up to two kilometres from the sea. Since that time many hundreds of properties have been built in the tidal floodplain.

Engineers found the previous Land Yeo outfall was in poor structural condition and nearing the end of its useful life. The outfall was also no longer watertight, did not control upstream water levels as required and did not meet health and safety requirements for operation and maintenance.

Although Marshall's Bank was structurally stable, erosion and settlement had significantly reduced its height and width. In an extreme tidal event waves would overtop the

low, narrow bank and cause further erosion and structural damage, and could eventually cause a breach of the defence.

The Blind Yeo's north and south eyes - constructed of reinforced concrete - were in need of structural, mechanical and electrical refurbishment.

The three tidal defence structures were only capable of preventing flooding from an extreme tidal event with a 1 in 25 (4 per cent) chance of happening in any one year.

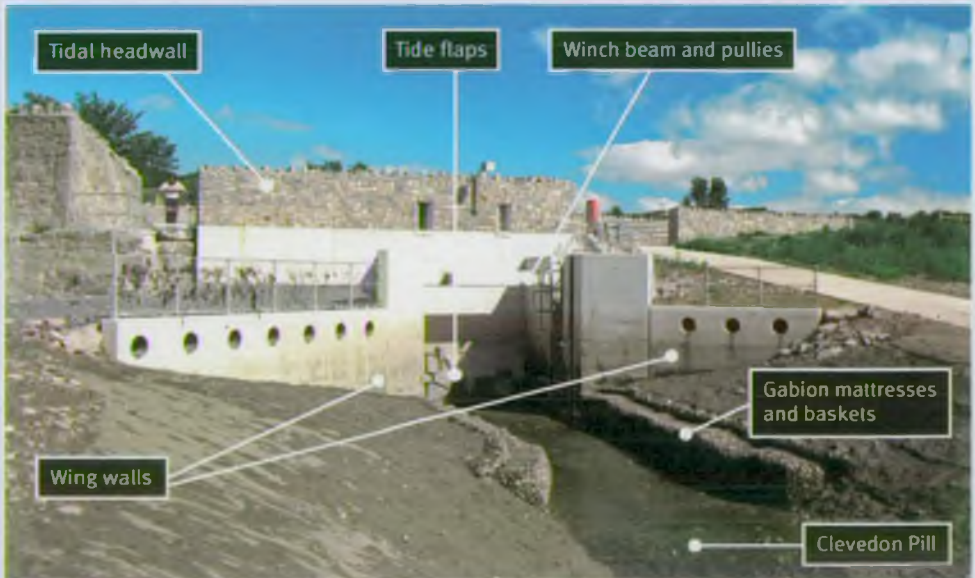
The Environment Agency's national target is to provide protection against a flood with a 1 in 100 to 1 in 300 (1 per cent - 0.33 per cent) chance of happening in any one year.

In 2004 we carried out a £1 million project to refurbish the Blind Yeo sluice, and in 2005/2006 a £3.2 million scheme was completed on the Land Yeo outfall and Marshall's Bank.

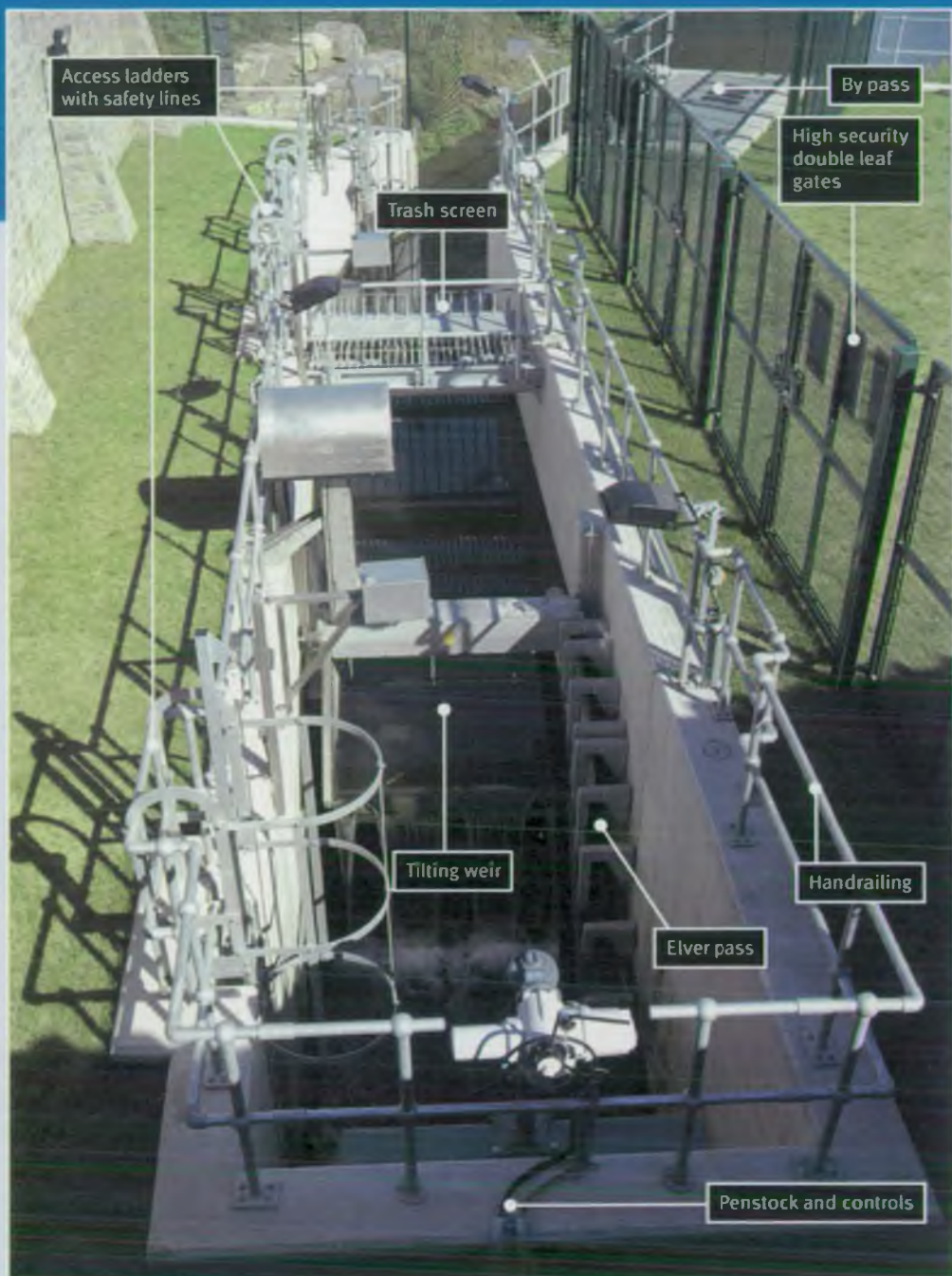
construction work

At the **Land Yeo outfall** we installed:

- tide flaps that prevent tidal flooding of the Land Yeo and Clevedon, but allow the river to discharge once the tide has receded
- powered automatic sluice gate (penstock) in case the tide flaps should block or fail
- a tilting weir to maintain water levels in the Land Yeo through Clevedon. This can be lowered to allow high river flows through the outfall
- water level monitoring equipment to allow automatic and remote control of the sluice gate (penstock) and tilting weir
- a trash screen to collect debris and prevent blockages to the new equipment
- vehicular and pedestrian access for maintenance purposes.



Tidal outfall structure



Access ladders
with safety lines

Trash screen

By pass

High security
double leaf
gates

Tilting weir

Handrailing

Elver pass

Penstock and controls

Downstream view of river intake structure

construction work continued

Floodwalls were constructed around the outfall and linked with the higher ground at Wain's Hill to the west and Marshall's Bank to the east. The new walls were raised and faced with natural limestone and cock and hen coping to match the nearby boat store.

At **Marshall's Bank** we:

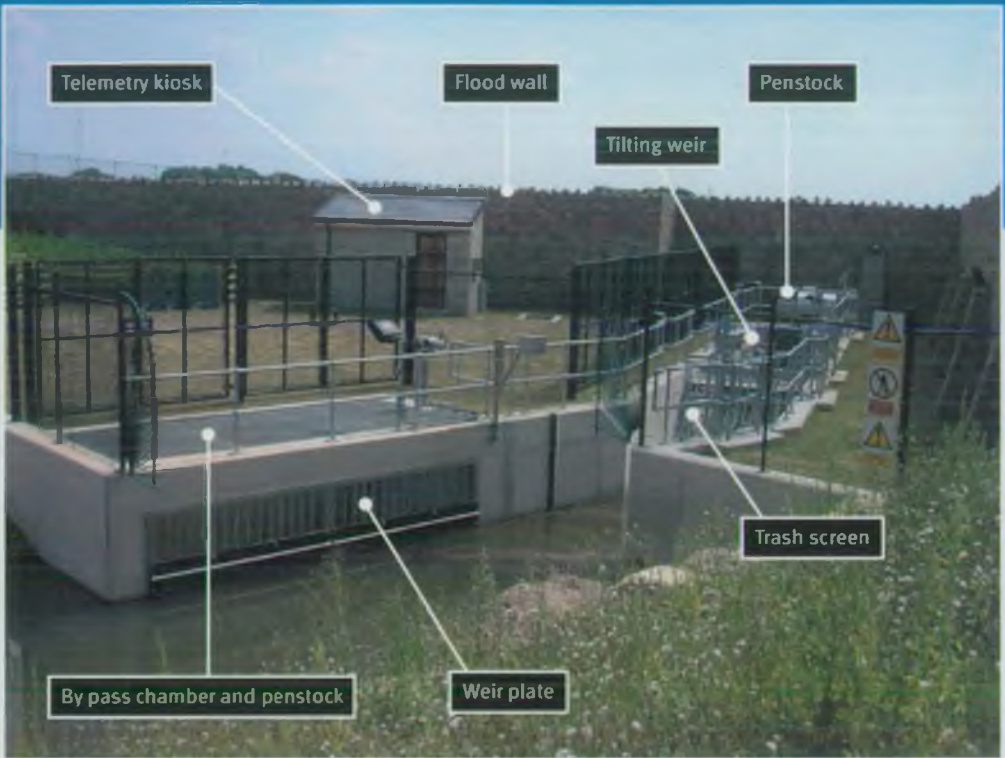
- raised 500 metres of the bank and surfaced its crest in crushed stone to minimise erosion and make a new footpath
- provided vehicular and pedestrian access for maintenance purposes
- provided an access ramp - suitable for disabled access - onto the bank and into Marshall's Field.



A footpath runs along the crest of Marshall's Bank



Local limestone was used to match existing boat store



Land Yeo river intake structure

At the **Blind Yeo sluice** we:

- replaced major sections of the mechanical and electrical components of both eyes and refurbished the remaining elements
- installed remote water level monitoring equipment to provide better control of the sluice
- repaired the existing structure and access road
- newly equipped the control room and gave it an independent power supply
- addressed operational safety issues to bring it in line with modern health and safety regulations
- installed steel stoplogs to assist future maintenance
- replaced the outfall revetment to strengthen the bank against erosion from the sea
- improved public access across the structure.

the Severn Estuary

The Severn Estuary is protected under both international and national law, reflecting the conservation importance of its habitats and species.

It is designated as a Special Protection Area (SPA), a Ramsar site - a wetland of international importance - and a Site of Special Scientific Interest (SSSI). Its immense tidal range and its classic funnel shape make the estuary unique in Britain and rare worldwide.

Its intertidal zone of mudflats, sandbanks, rocky platforms and saltmarsh is one of the largest and most important in Britain. The saltmarsh has a range of plant species such as glasswort, common cord grass, annual sea blite, corn parsley, common saltmarsh grass, sea club rush, sea clover, sea couch and sea milk wort.

The mudflats support many important invertebrates, with high densities of lugworm and ragworm - an important food source for birds. These include internationally important populations of waterfowl including Bewick's swan, teal, ringed plover, dunlin, whimbrel and redshank. In late winter and early spring there are also nationally important populations of shelduck and wigeon.



Redshank

Environmental considerations

The boundary of the Severn Estuary SPA and SSSI lies at the base of Marshall's Bank. The new works were designed and built to avoid adverse impacts on the saltmarsh habitat.

Construction activities were timed to reduce disturbance to waders and waterfowl and there was continued liaison with Natural England throughout the project.

Where possible local materials were used in construction - hence local limestone was used around the Land Yeo outfall to match the local boat store. Numerous trees and shrubs were planted.



Bewick's swan

The area is very popular with dog walkers and birdwatchers. Throughout construction every effort was made to ensure access was maintained.

Both the Land and Blind Yeo have healthy coarse fisheries - which include bream, roach, carp, gudgeon, perch and eel. Every summer the Blind Yeo sluice dams up water that maintains levels essential for livestock and farming. It also benefits coarse and eel fishermen and many types of flora and fauna. The works to the Land Yeo outfall will further enhance the habitat and amenity value of the Land Yeo upstream through Clevedon.

The projects to improve Land Yeo outfall, Marshall's Bank and Blind Yeo sluice were funded by the Department for Environment, Food and Rural Affairs.

Work on the Land Yeo and Marshall's Bank scheme was carried out by consultants Black and Veatch Ltd and contractors Carillion Regional Civil Engineering.

Consultants for the Blind Yeo sluice project were Jacobs Babbie; the electrical and mechanical parts of the scheme were carried out by KPR Engineering Ltd and Avonmouth Ship Repairers and civil construction by Van Oord.

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