

The Problem

Many weirs and sluices form major structural barriers to fish migration preventing watercourses, in part, from achieving Good Ecological Status (GES) or Potential (GEP) under the Water Framework Directive (WFD), including the Pembroke River which traverses through the historic home town of King Henry VII, Pembroke in Wales and three ponds – the first being the Mill Pond, then Middle Mill Pond, followed by the Castle Pond which is below Pembroke Castle. These ponds are collectively called the Pembroke Mill Ponds. The Pembroke Mill Ponds were formerly part of a tidal creek which extended eastwards to the north of Pembroke Castle.

However, the Castle Pond Tidal Barrage and Mill Bridge Weir, present significant barriers to the upstream migration of Atlantic salmon (*Salmo salar*) sea trout (*Salmo trutta*), European eel (*Anguilla anguilla*) and designated fish species of the Pembrokeshire Marine SAC.

As such Royal HaskoningDHV have been working with the West Wales Rivers Trust towards increasing fish and eel migration through the Pembroke Mill Ponds in order to provide access to valuable nursery and spawning habitat in the Pembroke River upstream of the Mill Ponds. This will overall benefit both designated and non-designated migratory fish associated with the Pembroke River.



The Approach and Key Constraints

The overall approach undertaken for the Pembroke Mill Ponds Fish Passage Project included:

- ⇒ **Site Walkover** to assess constraints associated with proposed fish passage solutions at Castle Pond Tidal Barrage and the Mill Bridge Road Weir.
- ⇒ **Environmental Constraints and Sensitivity Analysis** regarding key environmental receptors associated with the Pembroke Mill Ponds.
- ⇒ **Fish Passage Solutions and Concept Designs** including the detailed appraisal of identified fish passage solutions through an engineering and environmental assessment of the fish passage solutions against key environmental and engineering receptors.
- ⇒ **Selection of the Preferred Fish Passage Solution** in which outcomes of the appraisal enabled the selection of the preferred fish passage solutions for the Pembroke Mill Ponds and development of outline designs.

Key project constraints:

- ⇒ Grade II Listed Mill Bridge
- ⇒ Reservoirs Act 1975 (for example changes in water levels)



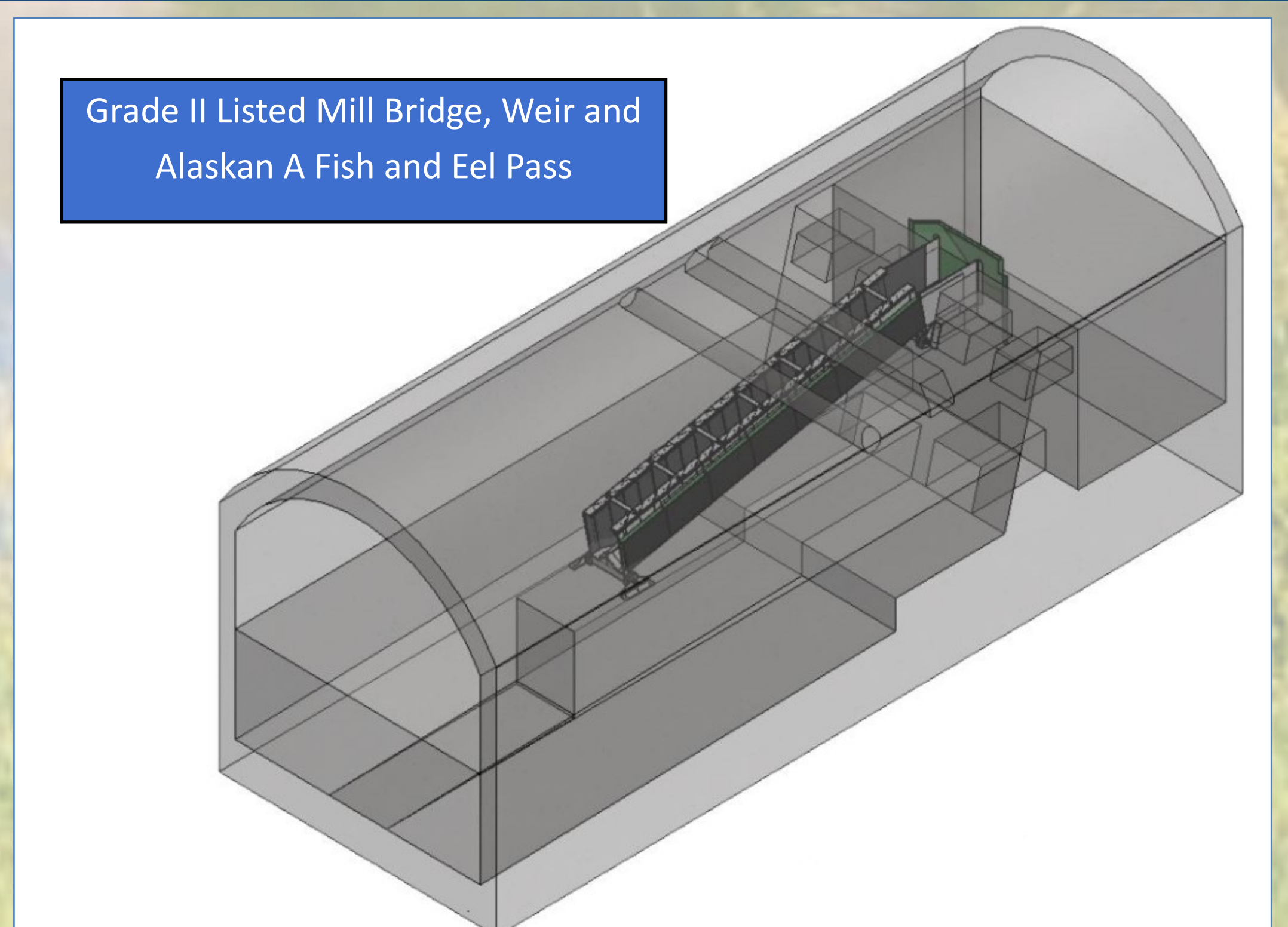
Grade II Listed Mill Bridge and Weir

The Solutions

Based on the outcomes of the appraisal for the Mill Ponds Fish Passage Project, innovative solutions for the Castle Pond Tidal Barrage and the Mill Bridge Road Weir were proposed, such as an **Alaskan 'A' Fish and Eel Pass** which will be constructed upon a weir, which was not possible to remove due its historical importance beneath the Grade II Listed Mill Bridge in the heart of Pembroke. The Alaskan 'A' Fish and Eel Pass will also not impact the visual setting of the listed structure in response to the pass being fully contained within the arch of the bridge.

Wider identified fish and eel passage associated with the Castle Pond Tidal Barrage included **Tidal Gate Dampers** on the existing fish friendly tidal flap; and **Flex Split Eel Brush** fixed to the trash screen weir.

The fish and eel passage solutions will overall provide improved access to valuable fish and eel habitat upstream of the Pembroke Mill Ponds and contribute towards actions to address habitat fragmentation and connectivity with the surrounding terrestrial and marine environment.



Grade II Listed Mill Bridge, Weir and Alaskan A Fish and Eel Pass