

# DULVERTON WEIR



**A report by Dulverton Weir and Leat Conservation Group  
on the history, structure and condition of Dulverton Weir**

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This document has been compiled by Dulverton Weir and Leat Conservation Group (DWLCG) for the purpose of sharing an accumulation of information concerning the weir with all interested parties.

It is not intended to be an academic paper or a definitive technical document. It is simply the collation of the combined knowledge, observations and research of the Group with the assistance of local residents, many of whom have lived with the weir for decades.

While every effort has been made to ensure the accuracy of the content, it is quite possible that there is room for improvement. We welcome any suggested amendments or additional information. In any event, there will be updates as a result of our continuing research.

To contact DWLCG phone 01398 323526 or preferably e-mail: [hull@weirhead.net](mailto:hull@weirhead.net)

## Background

In December 2012, the River Barle flooded, not only causing damage to some properties but also causing two breaches to the crest of the weir, most probably from impact by trees washed down the river. No immediate remedial action was taken with the result that, over a short period of time, the breaches enlarged due to the water flow washing out the exposed substructure of the weir. The photograph on the front cover shows the main breach in March 2013.

An attempt to temporarily stop up the breaches using sand-filled 'dumpy bags' resulted in failure as the river simply washed them away.

In August 2014, a further temporary repair was made using rock-filled gabion baskets. In the process, the contractors removed a quantity of oak stakes from the structure of the ancient part of the weir. On seeing this happen, a small group of local residents 'rescued' the stakes.

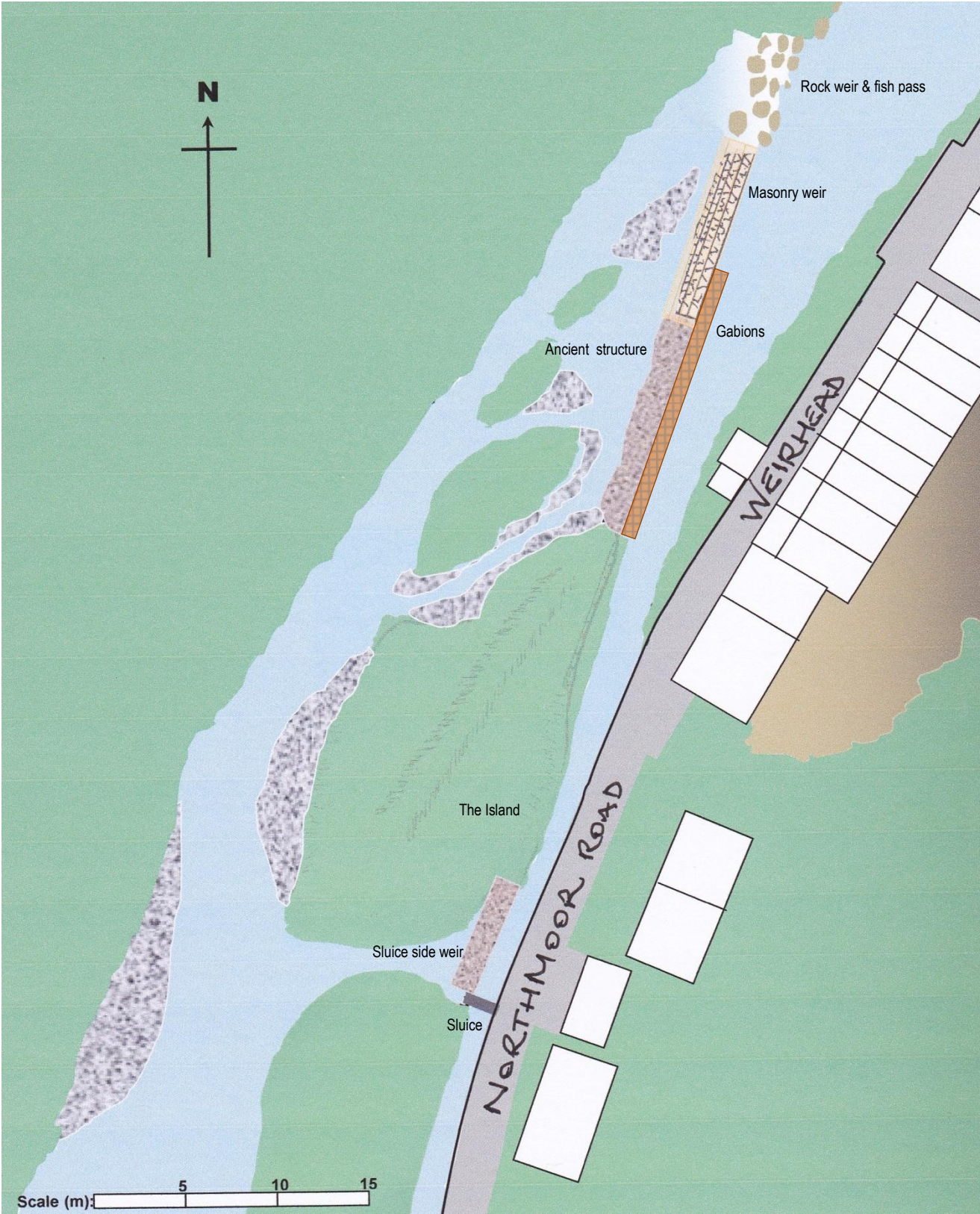
At times of low water some of the stakes had been visible so the presence of the stakes in the weir had been known to locals for years. On recovering the stakes, the residents were concerned that possibly archaeology had been damaged. They were therefore interested to know the age of the stakes so they took them for Dendrochronological Analysis (tree-ring dating).

Whilst waiting for the dating results, they began to research the history of the weir which revealed that, in fact, the weir was part of an extensive Urban Watermill Landscape. A survey by English Heritage (Gathercole 2003) indicates that a water mill in Dulverton dates back to at least 1331. The existence of a mill implies the existence of a leat and a weir to feed it. In 1568 there were at least 6 mills in the Dulverton area (Gathercole 2003) and DWLCG have found evidence of 9 waterwheels powered by the leat together with an industrial history that goes back to the 14<sup>th</sup> Century or before.

In so far as there was at least one mill recorded in 1331, it is reasonable to deduce that there has been a weir at the site for 700 years or possibly more. The remaining ancient structure of the weir is not inconsistent with the style of weirs of Norman date although the style alone does not preclude it from being of anglo-saxon, later medieval or even post medieval construction. In any case, it seems clear that this is a multi-period monument, repaired many times by people who were masters of their craft over the last thousand years, keeping the basic form and integrity of the original while doubtless replacing many of the component parts.

On learning that the test results showed the stakes were over 200 years old, it became apparent that this weir is actually something very special. It is not only an ancient structure and heritage asset but the ingenuity of the design represents a forgotten craft. Incredibly, it is not protected. It is not even included in the Dulverton Conservation Area.

Consequently, the Dulverton Weir and Leat Conservation Group has been formed with the ambition of ensuring that the weir is properly restored, protected and maintained along with the leat.



Dulverton is the southern gateway to Exmoor National Park. The small town stands between the rivers Barle and Exe, which converge a mile down the valley. The weir is located on the River Barle on the upstream side of Dulverton. The Dulverton mill leat starts at Weir Head, where it leaves the river Barle to flow south through the western side of the town before rejoining the river south of Dulverton bridge.

Dulverton Weir diagonally crosses the River Barle in broadly a north/south axis, in a slight 'crescent' shape with the inside of the crescent facing upstream. The current visible structure is 65 metres long. The southern (downstream) end, consists of a 26.7 metre section constructed of stakes and rounded stones faced with flat larger stones.

The middle part of the weir consists of a 22 metre long section which was repaired in sandstone in two phases in 1993 and 2000. The northern end of weir (upstream) consists of a 16 metre long section made up of large rocks that serves as a fish pass, and which has been placed and replaced sporadically over the last 20 years.

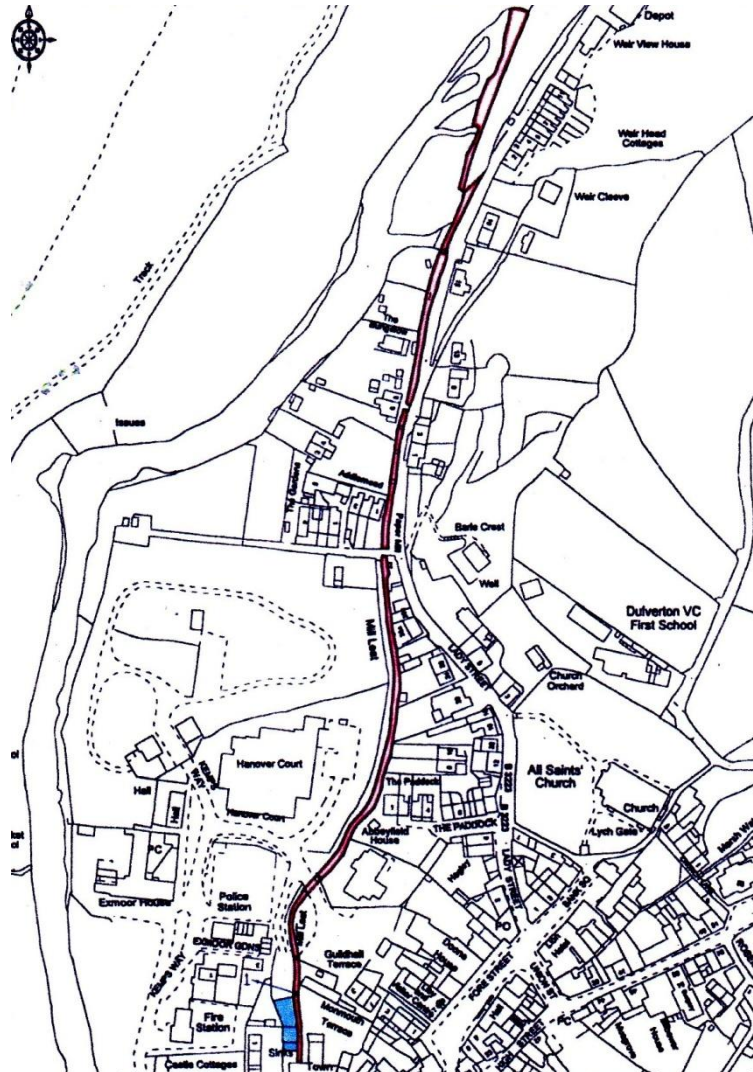
A further 48 metres of structure exists downstream of the weir in a 'feeder' leat with facing stones placed where the bank was raised to contain and funnel the head of water through a sluice and down into the town. Adjacent to the sluice is a 7 metre long side weir.

An additional 16 metres existed upstream of the current weir (now buried in the river bank) which is identifiable in a 1930's photograph (right) showing that the weir started much further upstream than can be seen today. There are identifiable stones from this section still in the bank. In 2012 after extensive flooding more stakes were visible in the bank further upstream than the 1930's photograph shows. These have now disappeared from sight once more under shingle. It is therefore likely that the entire weir structure was at least 130 metres long.



The weir and northern section of the mill leat were originally in the ownership of Town Mills. After milling ceased in 1972 and the subsequent redevelopment to residential accommodation, there was no commercial benefit to Town Mills continuing ownership and the liability for maintenance of the weir and leat would have rested with the residents' management company. Consequently, in 1999, West Somerset District Council agreed to take ownership.

Below is the Registry Plan of HM Land Registry Title N<sup>o</sup>: ST 185806



The following covenant operates on the owner:

"The Transferee on behalf of itself and successors in title hereby covenants with the Transferor and its successors in title for the benefit of the Transferors retained land shown edged green on the attached plan to keep the Property hereby transferred in good repair and condition and not to impede the flow of water along the leat and to maintain an adequate flow of water along the Leat."

The summary of the report by Dr Andy Moir is shown below.  
Copies of the full report are available by e-mail to [hull@weirhead.net](mailto:hull@weirhead.net)

## **DENDROCHRONOLOGICAL ANALYSIS OF OAK TIMBERS FROM DULVERTON WEIR, NORTHMOOR ROAD, DULVERTON, SOMERSET, ENGLAND**

**Dr Andy Moir**

### **Tree-Ring Services Report: TADW/25/14**

#### **SUMMARY**

Measured tree-ring series from thirteen stakes recovered from Dulverton Weir are matched together to form an 87-year site chronology, which is dated to span AD 1717 to AD 1803.

Two stakes probably converted from the same tree are identified to have been felled around AD 1784. The dating of just these two stakes provides tentative evidence for a phase of construction or repair around AD 1784.

Three other stakes identified as having been felled around AD 1801, AD 1803 and AD 1803, together with consistent felling-date ranges produced from all the other stakes dated provide strong evidence that a further major phase of construction or repair of the weir occurred around AD 1803.

While this analysis identifies two likely phases of construction or repair of the Dulverton Weir, it is important to understand that weirs are often periodically damaged by floods and repaired. Therefore, as historical evidence suggests, the stakes dated here may not necessarily be as old as the weir itself. Additional analysis of stakes from other parts of the weir may identify other earlier phases of construction or repair.



The full cohort of stakes recovered from the weir



Thirteen sub-sections of stakes that underwent dendrochronological analysis

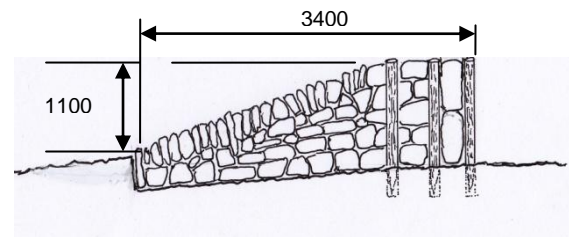
## Dulverton Weir

Date of construction: 12<sup>th</sup> to 13<sup>th</sup> Century

Original length: 65.0 metres (approx)

Length remaining: 26.7 metres

## Ancient Structure



Cross section dimensions (in millimetres)

It is widely recognised that the technology of water powered mills was introduced to England by the Normans following the Conquest in 1066. By the time of the Domesday survey, just 20 years later, there were already around 6000 watermills recorded. All of these mills will have been dependent on the management or adaptation of watercourses for their power source so there was a proliferation of weir construction at that time.

The ancient (original) structure of Dulverton weir appears to have been built in a style that is typical of the Norman period. At first sight, the weir might appear to be a very simple structure. However, closer inspection reveals that the people that built this weir knew exactly what they were doing and clearly had experience.

The materials are local stone and timber stakes. The design comprises five elements with each element supporting the others. These are:

1. The "toe" of the weir - a step cut in the river bed for the structure to compress against.
2. Oak stakes – hammered into holes drilled into the rock bed of the weir to prevent horizontal slippage.
3. Facing stones – large flat stones laid on edge across the upstream face of the weir to prevent seepage.
4. Substructure – large random sized stones laid from the toe going forwards to support the stakes horizontally and the glacis stones vertically.
5. The glacis – rounded edge stones laid from the toe going forwards to form a slope from the crest of the weir down to the toe (approximate angle 20°).

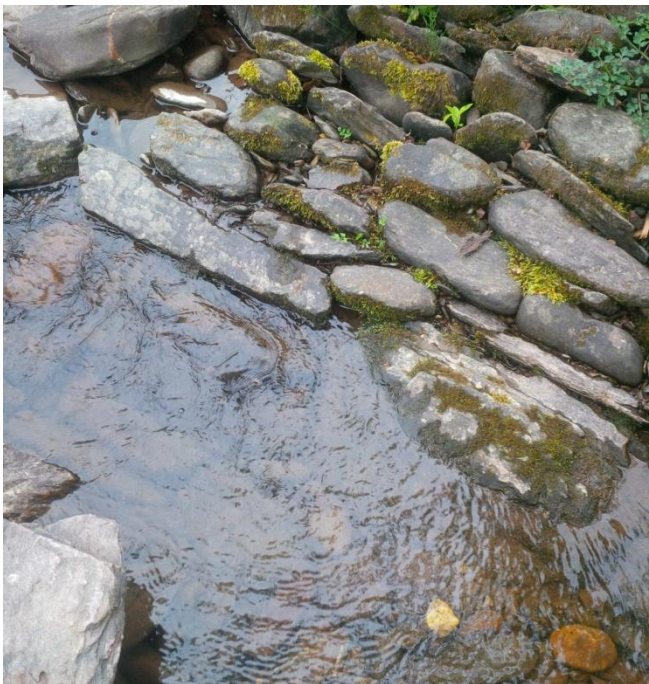


Photo showing flat stones at the "toe"

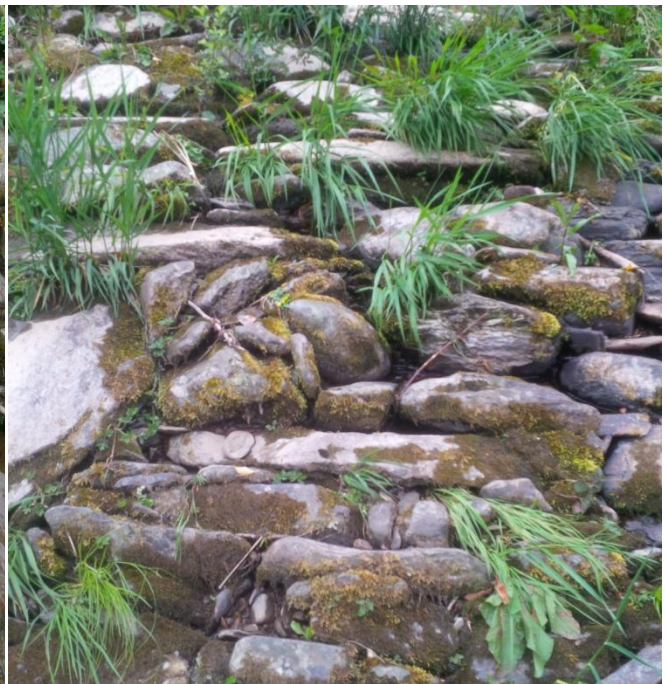
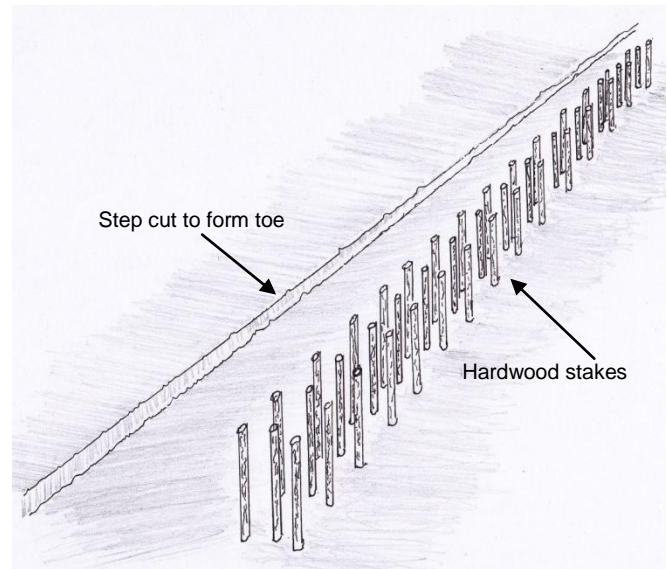


Photo showing rounded stones of the "glacis"

## How was the weir built?

The site was prepared by excavating the ground to form the weir pool and the level bed of the weir. A step was cut in the edge of the river bed to form the toe of the weir.

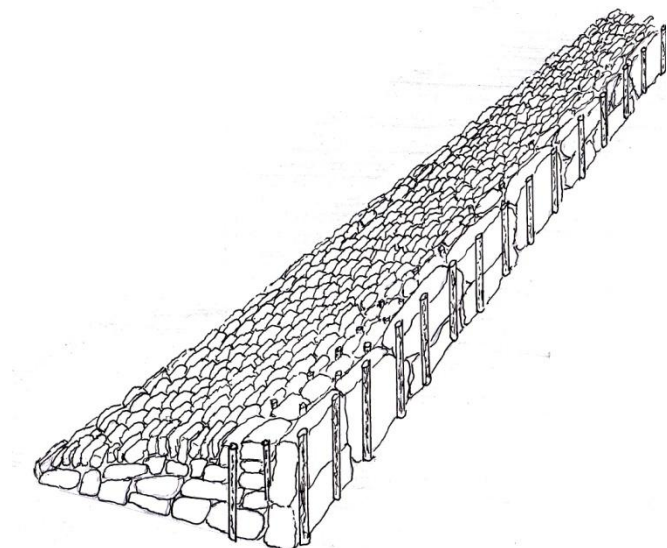
Holes were drilled in the rock to accomodate at least 3 rows of hardwood stakes about 600mm apart



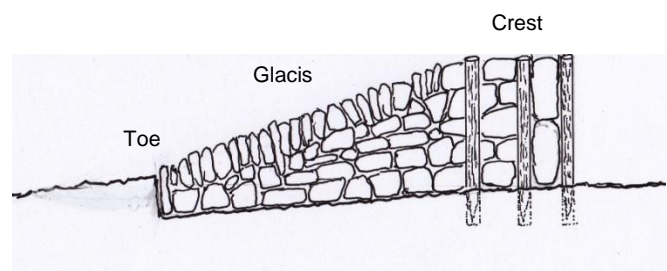
Between the first two rows of stakes, large flat stones were laid on edge across the face of the weir to prevent seepage.

From the toe going forwards, the substructure was laid to provide lateral support behind the facing stones and to form the "crest" of the weir.

Above the substructure, the "glacis" was formed by laying rounded stones on their thinnest edge, similar to a dry stone wall but at an angle of approximately 20° to the horizontal.



Under pressure from water, the resulting structure is always in compression against the toe and, therefore, is resistant to displacement of stones by the water flow. In effect, the pressure squeezes the stones against each other, holding them in place. As the rate of flow increases, the weir gets stronger.



Cross-section

## Flow characteristics and the weir

The River Barle can be a fairly gentle clear-running river but it can also be a raging torrent. The water level can rise by a metre in an hour and flooding occurs typically at least once in a decade. Incredibly, the ancient structure of the weir can withstand the relentless force of the water while modern designs and materials fail.

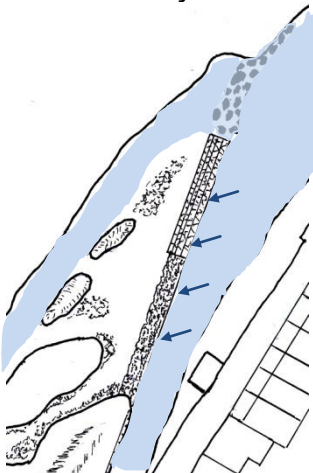


The river can be a picture of tranquillity with cows drinking from the gentle flow in the weir pool.



The river in spate turns brown with peat washed down from the hills of Exmoor

The weir is subjected to four different types of force according to the rate of flow:



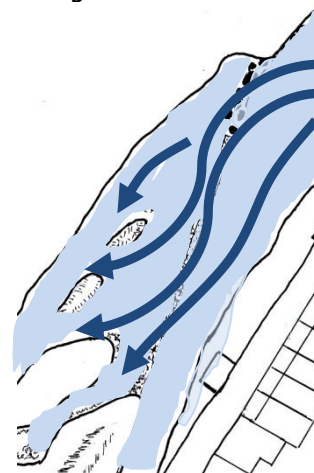
### Low flow.

The weir simply needs to contain the water in the weir pool. Large stones at the face of the weir are to prevent seepage that, in time, could wash out stones at the foot of glacis, weakening the structure.



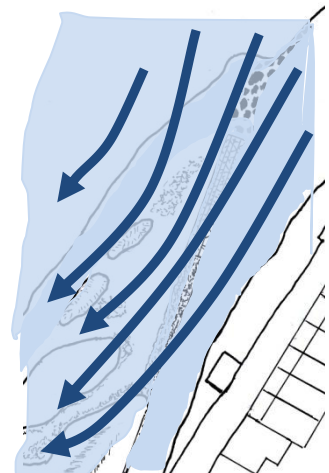
### Moderate flow.

Water spills over the crest and is let down gently over the glacis to rejoin the main stream of the river. If the glacis has stones missing, water can enter the substructure and will eventually wash away some of the glacis.



### In spate.

The upper water is a longitudinal force. The rounded stones of the glacis ease the passage of the water. Lower down, the face of the weir is under enormous load. This compresses the structure but the stones grip against each other making the whole structure stronger.



### In flood.

As in spate, the pressure makes the structure stronger. Wooden stakes at the face of the weir keep the facing stones located. The structure can withstand the flow but is prone to being struck by trees washed down which will damage the crest.

## Dulverton Weir

### Southern end of weir (3.7m)

Ancient structure still intact including original 'glacis'.



## Condition of the Ancient Structure

### Large breach from December 2012 (6.7m)

Water has washed through gabions and breach has returned but some original substructure remains below.



### Small breach from December 2012 (3.2m)

Water has washed through gabions and breach has returned but some original substructure remains below.



### Concrete skimmed section from earlier repair (13.1m)

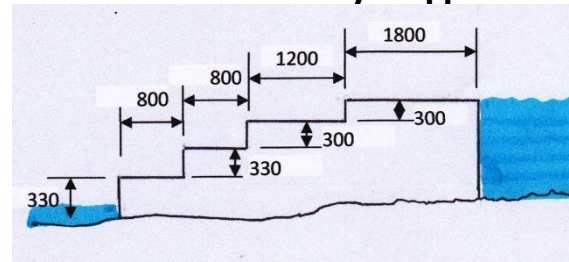
Structure probably still largely intact below concrete.

## Dulverton Weir

Date of construction: 1995

Length: 12.7 metres

### Masonry Stepped Weir 1



Cross section dimensions (in millimetres)



View from above



View from below

This is the first part of stepped masonry weir that was constructed in the late 20<sup>th</sup> Century to replace damaged original structure. The material is yellow sandstone cut mainly in triangular blocks and joints filled with mortar. Later patchwork has been done using concrete. It is not a solid masonry structure; the core was filled with stones from the riverbed.



Photo showing the crest in detail. Stones from the front face have been washed away leaving the rest of the structure vulnerable to seepage and further damage. The wet patches behind the crest show that seepage is already present.



Photo from the stepped side showing a void in the core where some of the river stone infill has been washed away.

## Dulverton Weir

## Masonry Stepped Weir 1

This section of weir is in poor condition for the following reasons:

1. Stones are missing from the crest.
2. Seepage through the joints of the remaining crest stones will eventually wash out the joints.
3. The void in the core makes the structure inherently weak.
4. There are reports from canoeists of canoes getting "pinned" under the masonry by the fish pass which suggests that the footing has been eroded.

There is a further problem in that the crest of the masonry section is higher than the rest of the weir. The photos below were taken at the same time in October 2008. It can be seen that the masonry part is dry whereas water is flowing over the original structure to the left. This concentrates the flow over the original section rather than spreading the load across the whole of the weir. It is further evidenced by the vegetation growing on the crest. It is the last part to get wet when the river level rises.

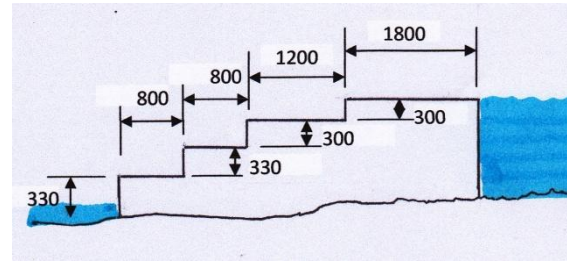


## Dulverton Weir

Date of construction: 2000

Length: 9.5 metres

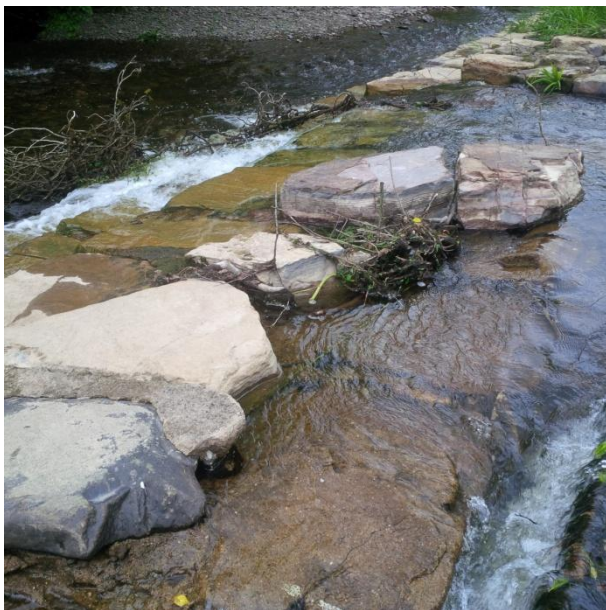
## Masonry Stepped Weir 2



Cross section dimensions (in millimetres)



The photo above, taken in 2008, shows the second section of masonry stepped weir. It was constructed in 2000 to remedy a breach of the original structure in 1999. It was built to replicate the adjacent section.



Photos above show the distressed state of this part of the weir in the present day. Stones are washed away from the crest and a new breach has formed.



2000 works in progress – damming of the weir pool



2000 works in progress - removal of the original structure and clearance of the bed of the weir.



2000 works in progress – substructure of 'dumpy bags' containing dry concrete mix.

Date of construction: 12<sup>th</sup> to 13<sup>th</sup> Century

Length: 48.3 metres Width: 23.0 metres



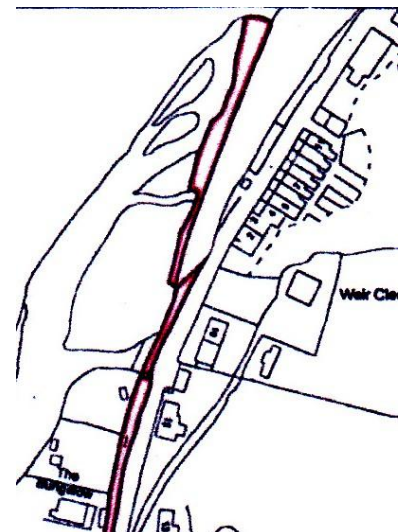
The island would have been formed when the leat channel was excavated as part of the original construction of the weir and leat.

It has quite a dense coverage of trees and ground vegetation and is essentially a wild landscape that undoubtedly provides a habitat for a variety of wildlife.

It is evident from Ordnance Survey maps and the Land Registry Title Plan (right) that about half of the east bank was also part of the weir, shown by the red line on the plan above.

There is a dried up channel almost bisecting the island, shown by the green line above.

In the 1990s, the leat channel was dredged and the spoil was dumped on the east bank. There is a strong likelihood that beneath the spoil will be found evidence of a continuation of the ancient structure of the weir.



## Dulverton Weir

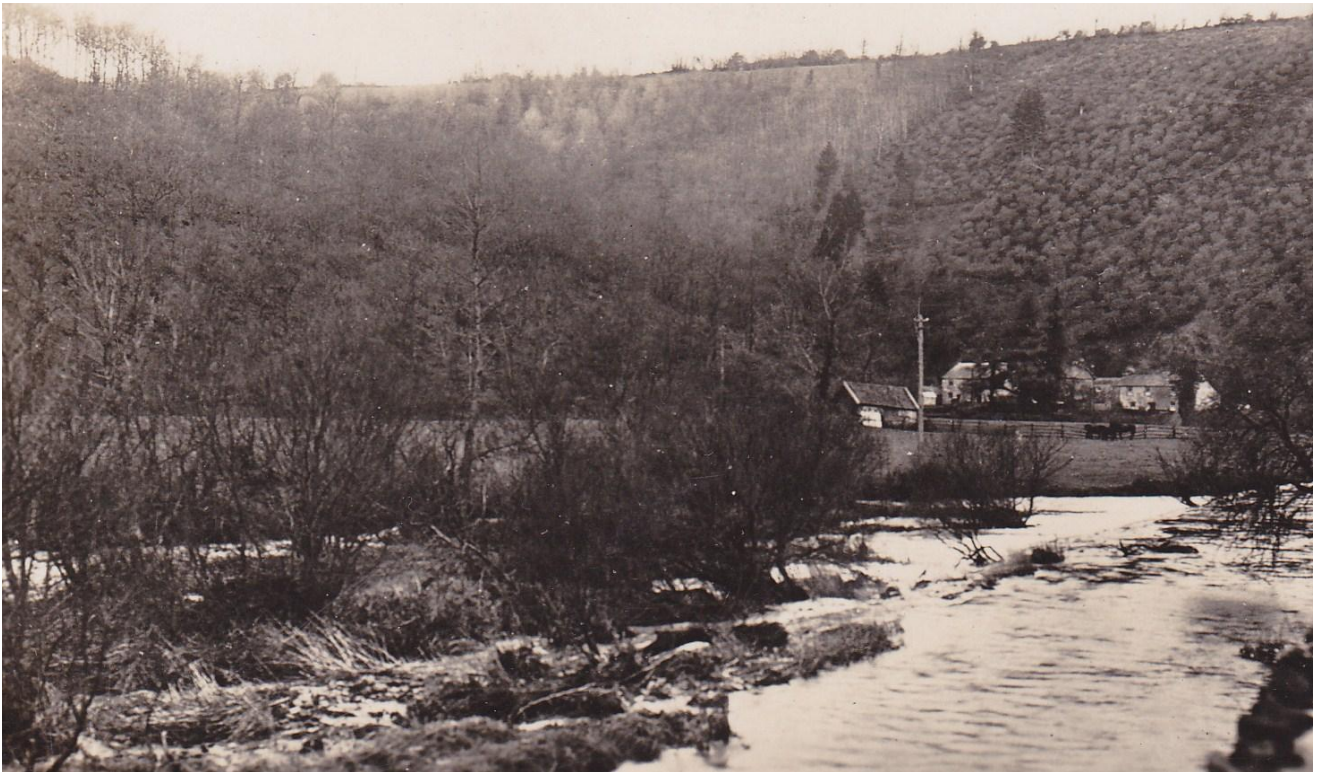
## The Island



View of the island from Northmoor Road.



The dried up channel across the island.



1930s postcard entitled "Weir Stakes and Cleeve".

In the foreground a channel can be seen flowing into the island.

An elderly resident recalled that many local people referred to the weir as "The Stakes"

Date of construction: 1993

Length: 16.0 metres

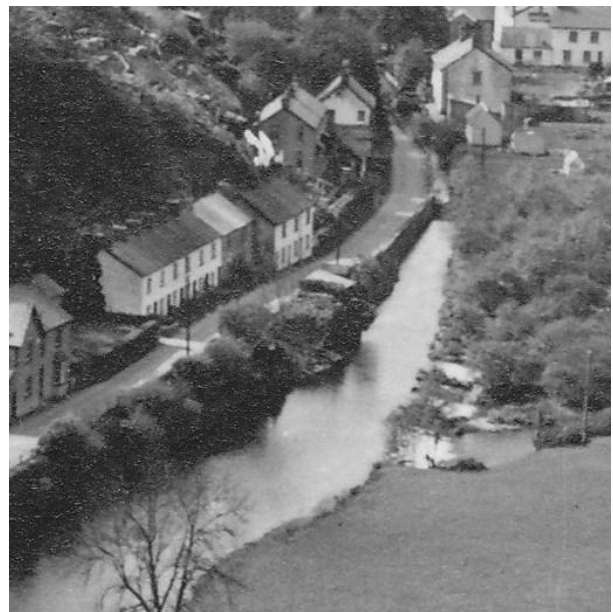


What we know today as the fish pass was built in 1993 to remedy the collapse of a section of the original structure of the weir that had caused the water level to be too low to feed the leat, thereby preventing the Dulverton Laundry from extracting water. The fish pass comprises a number of boulders laid roughly along the bed of the original weir. The work was carried out by local contractor, John Pugsley, who sourced the boulders from the riverbed.

Previously the original structure of the weir extended almost the full distance from the island to the east bank, as seen in the 1930's photograph (right).

There are locals that recall being able to walk the full length of the weir but having to jump the last 3 feet, where there had previously been gap in the weir to provide a fish pass.

There is evidence from the photograph and from wooden stakes that had previously been found in the east bank that the weir was some 7 metres longer than it is today.



## Dulverton Weir

## Sluice side weir

Date of construction: 2012

Length: 7 metres

The side weir is the final part of the weir before water passes through the sluice into the leat.

Previously reconstructed when the sluice was rebuilt around 1999, the side weir had become damaged over time resulting in the need for remedial works by 2011.

A first attempt failed due to the use of non-waterproof cement so the present structure is a second reconstruction done in 2012.

It has no historical value other than the fact that there has always been a side weir adjacent to the sluice.



Photo of the side weir

Date of construction: August 2014

Length: 34.0 metres

By the beginning of 2014, West Somerset District Council had been unable to arrange repairs to the breached weir. The water level in the weir pool was so low that the leat was dry.

As a temporary solution, WSDC decided to install a line of rock-filled gabion baskets along the upstream face of the weir in order to raise the water level sufficiently to feed the leat.

The work was carried out in August 2014 by local contractors C J Lynch. It was while clearing the line for the gabions that around 45 oak stakes were removed from the front of the weir together with a number of the flat facing stones that had remained in position.

An estimated 25 tonnes of stone was brought in from outside the area to fill the gabion baskets.

The stone was dropped in the gabions by mechanical shovel and the breach was filled with dumped stone from the riverbed.

After closing the baskets, the gabions were topped off with scalplings.

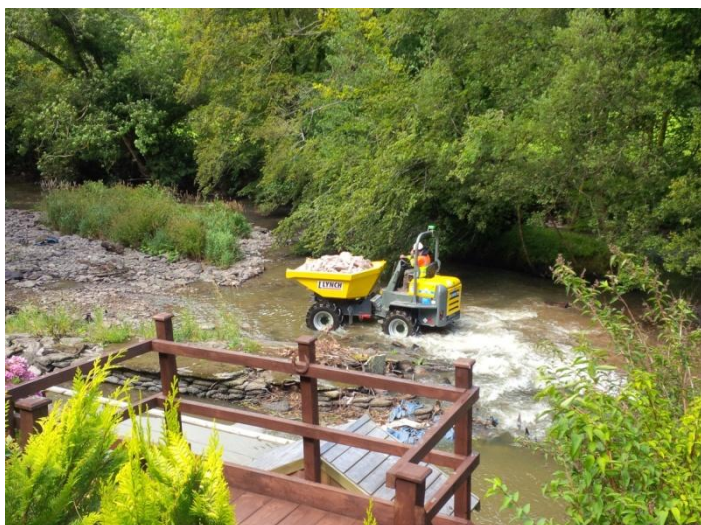


Photo showing stone being brought in by dumper



Photo showing the finished gabions

The first time that the river level rose above the gabions, the scalplings were washed away.

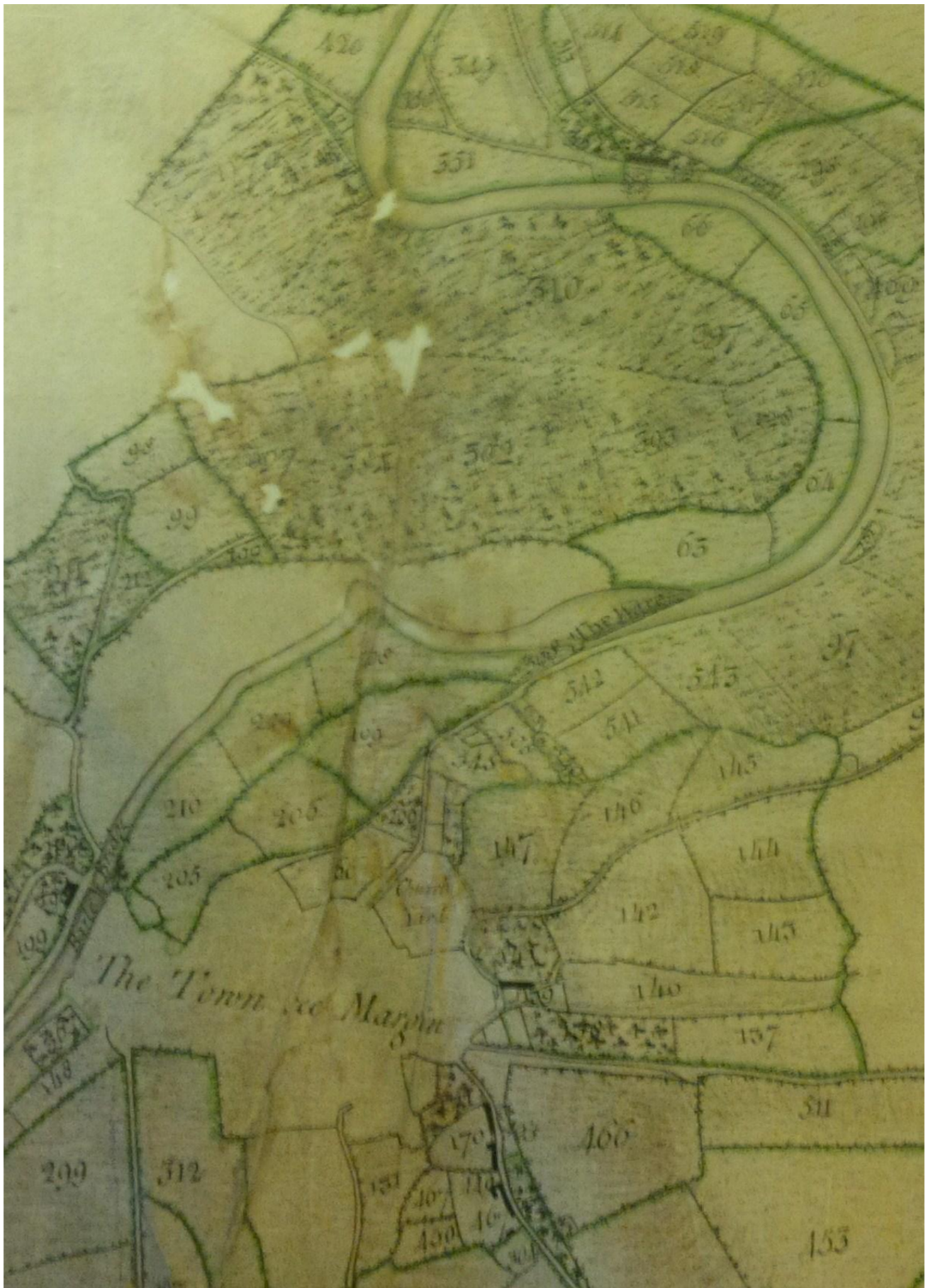
Without a waterproof barrier or membrane, the gabions are porous so that water passes through, washing away the dumped stone in the breach.

Ultimately, the gabion baskets will need to be removed to facilitate permanent repairs to the weir. It is unlikely that the stone can be removed mechanically; it will need to be done by hand.

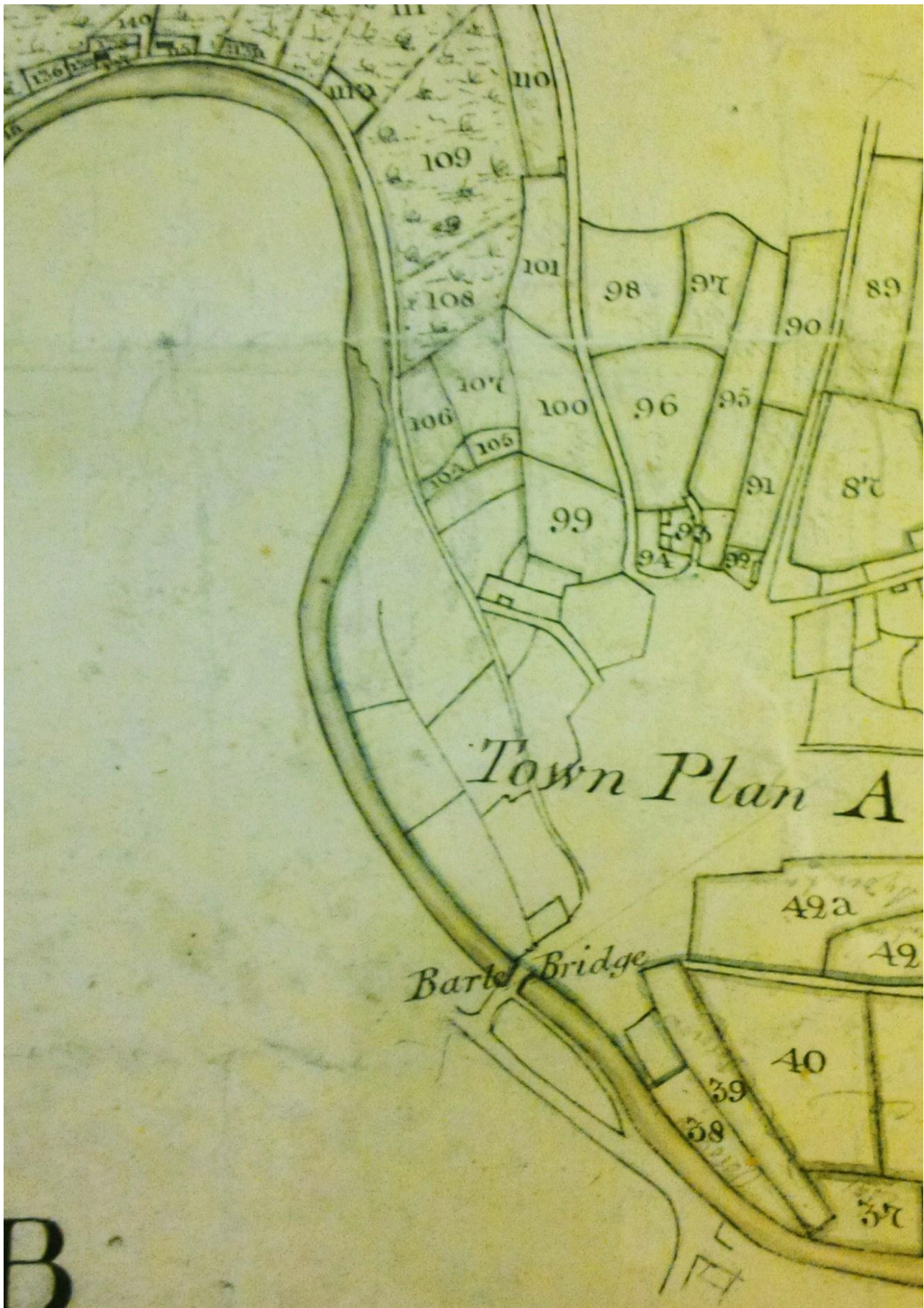


Photo showing porosity of gabions as water washes through

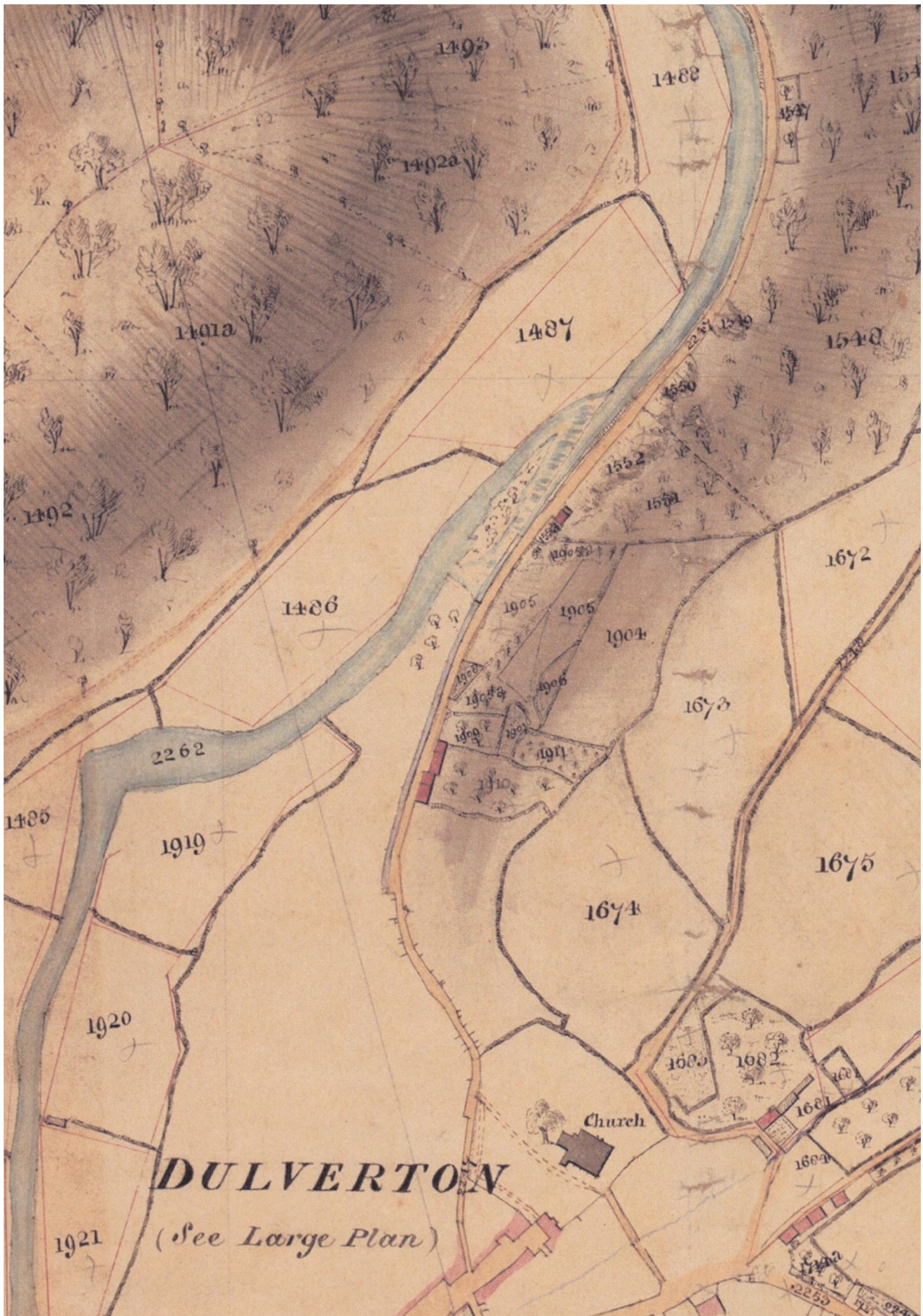
1790 Map. Weir marked as "The Ware".



1820 Plan of the Manor of Dulverton by Charles Chilcott, Surveyor, Crowcombe



1838 Tithe Map. Surveyed by E Harris







View of the weir from Weir Cleeve c.1920



Weir Head c.1920



View of the weir from Mount Sydenham c.1930



70.

WEIR STAKES & CLEEVE.

Weir Stakes & Cleeve c.1930