April 2018

Karen Anderson
andersonkaren@btinternet.com

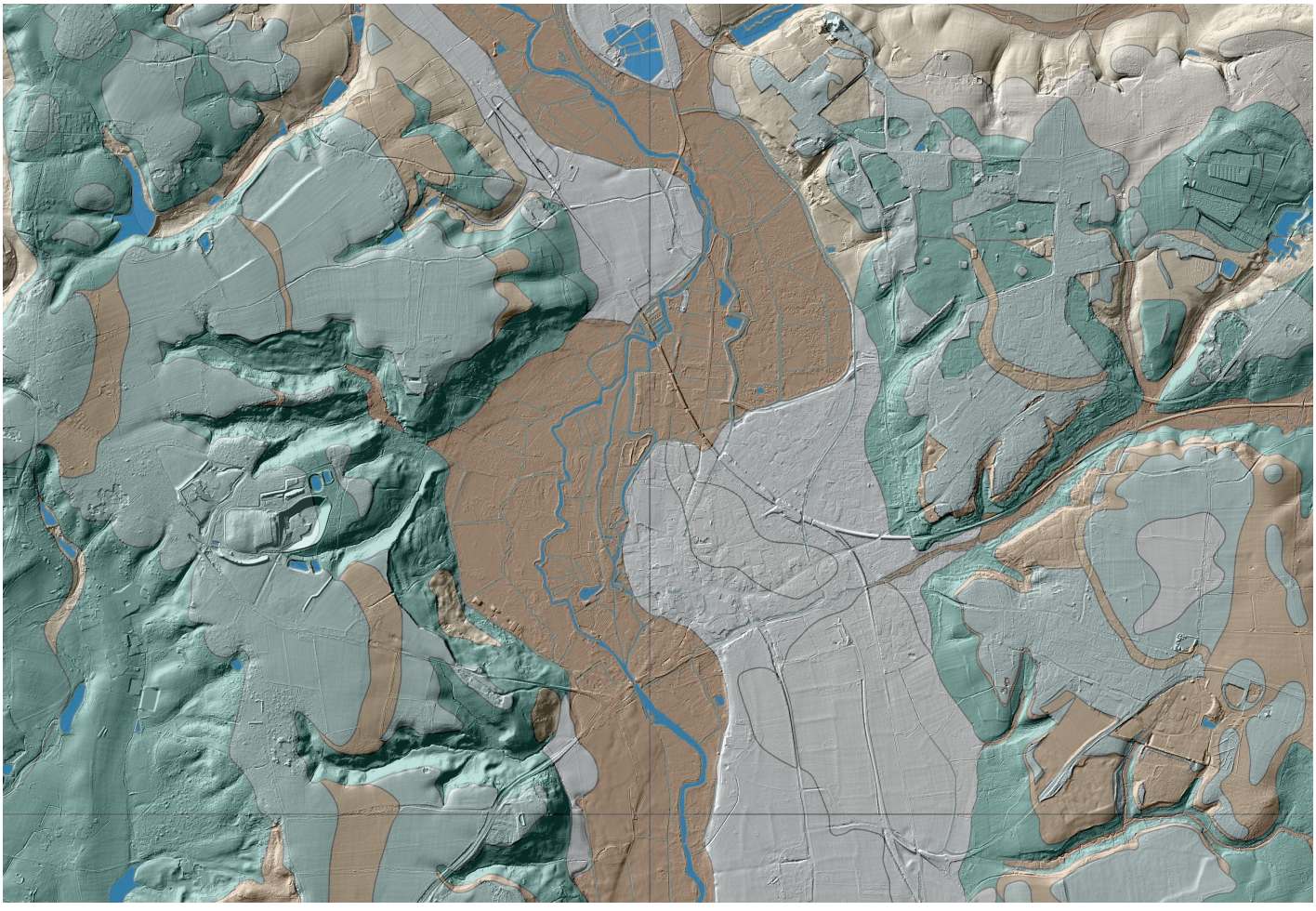
Engineering the Fishlake

The construction of the Fishlake was a sophisticated engineering project. It involved a high degree of engineering and surveying expertise in its conception, planning, organisation and execution. It could not have evolved gradually from a natural watercourse. Water does not flow out of a floodplain onto a river terrace. It can be taken onto a terrace by directing water from the river into a cut channel. The leat to Greatbridge mill is an example. Clearly, this would be possible only where the water could be sourced at a higher level than the intake and outflow of the cutting. Romsey could not have been supplied with water by digging a channel directly from the Test. Its unusual topographical location provided an opportunity to devise a, perhaps unique, two-part watercourse: the cutting through the terrace was supplied by an artificial, raised water carrier taking the water across and above the floodplain.

Romsey sits on a broad river terrace to the east of the Test floodplain. The terrace is truncated to the north by a wide bend in the floodplain. North of Greatbridge an area of river terrace juts out from the west side of the valley. The Test curves around the edge of this section of terrace. The Fishlake emerges from the side of the bend and heads south across the width of the floodplain while the Test continues flowing along the centre of the floodplain beyond Romsey.

It has been suggested that the Fishlake originated as a natural 'braid' of the Test. To support this, it was noted that the stream follows a typically meandering course, wending its way down the valley. Look more closely. The Fishlake doesn't meander, it zigzags. This is not a natural way for a stream to behave. Furthermore, constructing a raised channel along the course of an existing stream makes no sense. The stream would have cut into the floodplain; it would have to be filled in to raise the level of the water. It would also have been difficult to construct banks alongside flowing water. I think that the Fishlake is a totally artificial construction.

3D Geology: The map below shows the surface geology of the Romsey area superimposed on a LiDAR image. The broad, brown ribbon running



Providing Romsey with Running Water

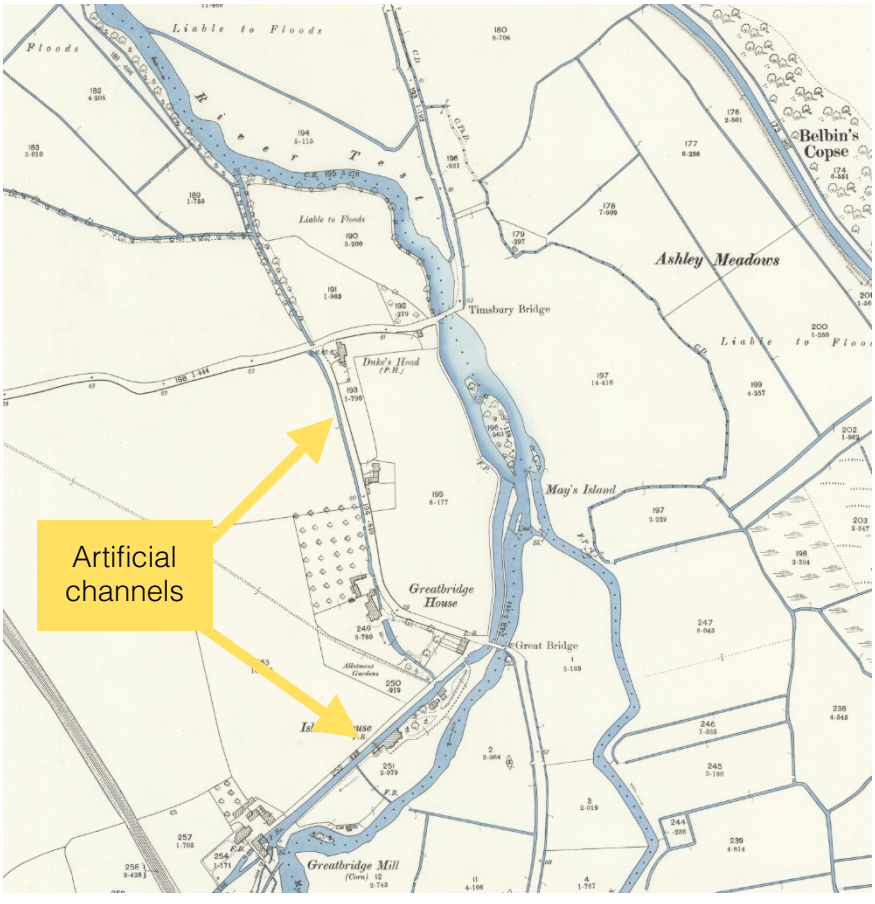
The construction of the Fishlake was a project of two halves. The relatively 'easy' bit simply involved digging a ditch from the edge of the terrace into Romsey. Getting the water to the terrace would have been more challenging. Overall it had to meet one basic requirement: the source of the water had to be at a higher level than the destination. The gradient between source and destination would have to be controlled to keep the water flowing at a sufficient rate to deliver the quantity of water required without damaging the structure carrying it.

The Test could provide a reliable, year-round supply of water fed by chalk aquifers upstream. It would have taken a very experienced water management engineer to recognise the potential in the relationship between the Test and the terrace. The practicality of the project would have to have been established by careful and accurate surveying. The fact that the Fishlake was built and continued to supply Romsey's water through to the 20th century confirms the abilities of those engineers and surveyors. They must have gained their experience on more straightforward projects.

In the Medieval period and beyond water was the main source of industrial power. Mills would have been sited where there was a consistent, controllable flow of running water. They would not have been built on the floodplain adjacent to a stream of the Test where both the mill and the roads accessing it would be at risk of flood damage. We don't know the location of Romsey's Anglo-Saxon mills. They could have been built on or near the sites of later mills, at the edge of the floodplain powered by water channeled from the Test.

Water management on the floodplain: Moving water within the floodplain would have been a relatively easy undertaking. The engineers would not have to rely simply on manpower; they could use the power of the water itself. By damming the water and releasing it into a small cutting, they could use the water to widen and deepen its own channel. The water could be deflected into any desired course that would take the water downhill. The main channel of the Test seems to have been moved from the west to the east side of the valley before the end of the 10th century.

Channeling water onto a river terrace: A mill located on the floodplain, even at its edge, would be at risk of flooding. A better option would be to build the mill on the terrace and bring water to it. This would involve digging a leat by hand, with pick and shovel, and channeling water into it from the river.



The map shows a section of the Test that loops around the edge of an area of river terrace on the west side of the valley. An artificial cut carries water directly from the river south across the terrace where it would have rejoined the Test downstream. Greatbridge House lies alongside this watercourse. Was this the site of an early mill?

The Greatbridge Mill marked on the map was supplied by a leat cut through the southern edge of the terrace. The water enters the cutting at a level higher than the adjacent river channel. It flows through an artificial channel that starts upstream, west of the northern tip of May's Island. The channel runs parallel to the Test, separated from it by a narrow bank. The Test follows the natural slope of the floodplain on a steeper gradient than the channel and thereby running at a lower level.

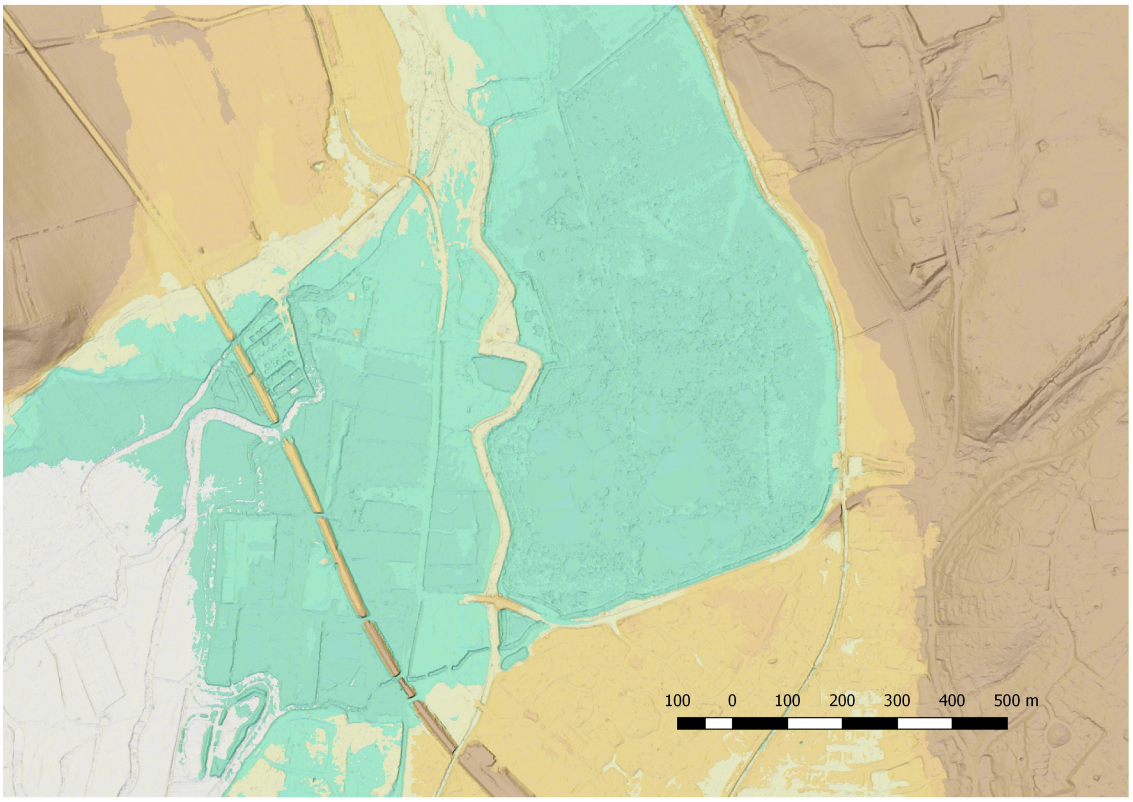
Left: The bank separating the Test on the right from the raised stream carrying water towards Greatbridge, looking north.

Above: The leat to Greatbridge Mill running across the river terrace.

Constructing a raised water carrier: The water feeding into the Greatbridge leat flows through an artificial channel bounded on one side by a bank and on the other by the river terrace. The Upper Fishlake, the section between the Test and the terrace, is enclosed on either side by artificial banks. In both cases, the objective was to supply water to a cutting on a river terrace. Both required sourcing the water at a distance from the entry to the terrace. Clearly, the construction of the two freestanding banks crossing a length of floodplain was a more complex undertaking. I am not suggesting that the Greatbridge leat pre-dates the Fishlake; it could be considerably later. However, I think that the engineers who built the Fishlake must have gained previous experience on water management projects similar to that at Greatbridge.

In designing and building the Fishlake, engineers were dealing with two elements - earth and water. The banks defined the water channel. The structural properties of the banks had to withstand the pressure and the erosive power of the water. The system had to deliver a sufficient quantity of water for whatever purpose it was intended to serve. Factors involved included the width, depth and profile of the channel and the rate of flow of the water. It would be easy to widen a dug channel to increase capacity; widening a raised water carrier would require completely rebuilding one bank. The engineers had to consider long term maintenance as well as functionality. A slowly flowing stream could deposit sediments that would block the flow. A fast rate would increase erosion.

Why does the Upper Fishlake follow its peculiar zigzag course? First consider the start and end points. It was necessary to divert water from the Test at a higher level than its destination. This restricted the choice of a starting point for the carrier to the bend in the river. An early 19th century survey of the Fishlake shows the height of the Test dropping relative to the Fishlake from this point. The choice of location for entry onto the terrace would effect the length and depth of the cutting carrying water into Romsey. It appears from an elevation map that the point chosen was on a sloping edge of the terrace. QGIS profiles further east show an abrupt drop from the terrace to the floodplain. A cutting to this area would have to have been longer and deeper.



Above: The map shows heights between 15 and 20 metres colour coded at one metre intervals. The pale grey areas are under 15 and the brown are over 20 metres. The Fishlake shows up very clearly as a raised channel crossing the floodplain.

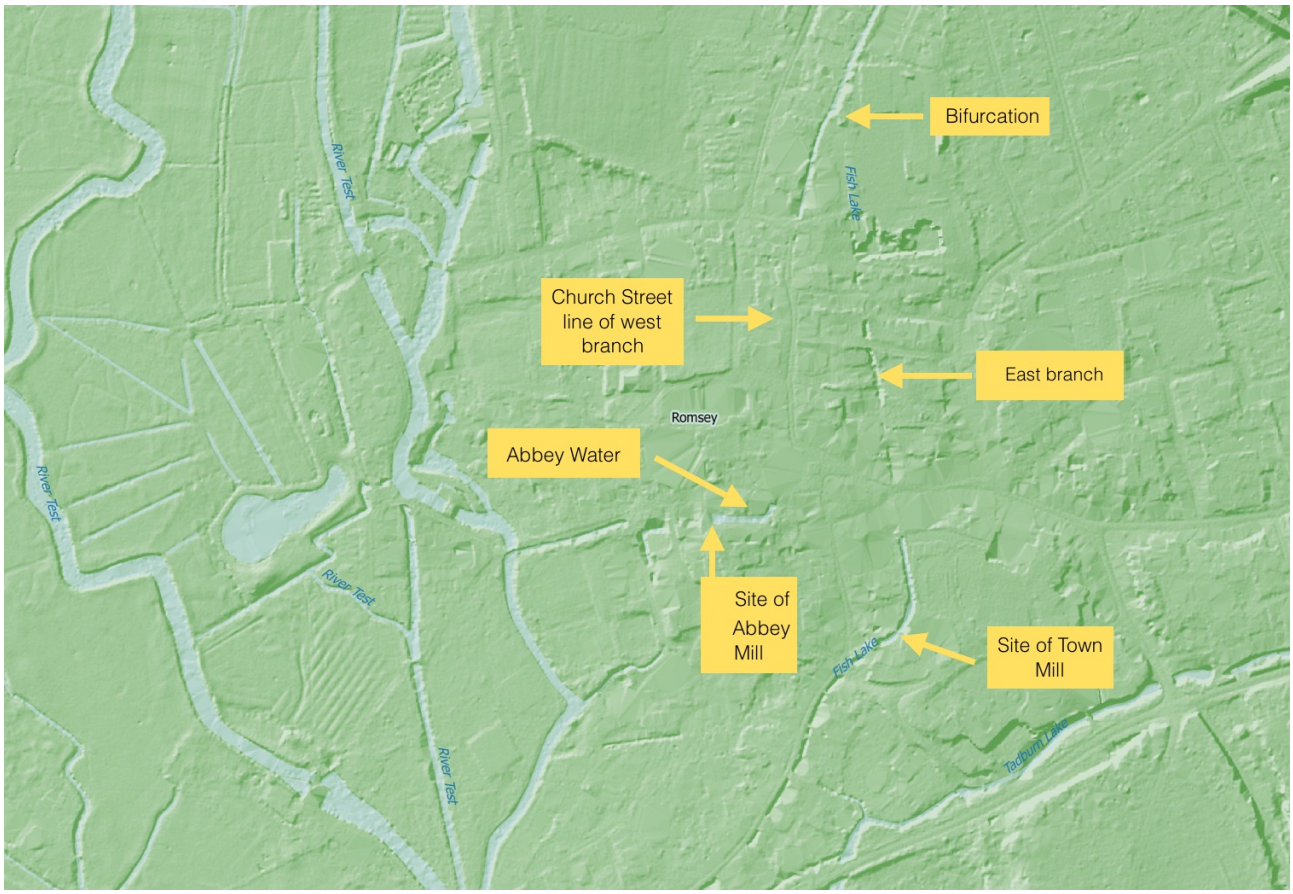
Right: The red line on the LiDAR map marks the location of the profile below. The line runs from the floodplain across the edge of the terrace and shows an increase in height of nearly 4 meters. Fishlake Meadows Road runs along the edge of the terrace; it crosses the Fishlake on a narrow causeway built over the floodplain.

The engineers had little leeway in selecting the the start and end points of the Upper Fishlake. Why didn't they join the points along a straight line? The zigzagging course considerably lengthened the banks. More building material, presumably chalk and clay, had to be acquired and transported to the site. They must have had a good reason to go to the extra effort. I think that they wanted to lengthen the channel to reduce the gradient. This would slow the rate of flow and reduce the erosive force of the water.

This is taken from an article on Roman aqueducts on Wikipedia: 'The ancient sources give two quite different figures for a minimal acceptable slope, and these are not uncommonly at odds with the gradient of a number of aqueducts. Vitruvius suggests 0.5% and Pliny specifies 0.02%. The aqueducts themselves range between 0.3% and 0.15%, with extremes of 0.07% and 3.0% at Nimes and Rome respectively.'

The Hampshire Record Office has a survey drawing (4M92/N240/6), dating from 1807, showing a longitudinal section of the Fishlake from its source to Town Mill. It gives the height of the water above OD and the distance from Timsbury Bridge for various points along its length. The height of the water at the sluice at the start of the Fishlake is 57.50 feet. The next measurement is at a point marked 'Ford'. The distance between this and the Bifurcation places it on the terrace in the present industrial estate. Here the height is 56.42 feet, a drop of 1.08 feet over a distance of 4340 feet. From these figures, I have calculated an approximate gradient of 0.025%. This is a very low gradient compared with existing Roman aqueducts, but slightly greater than Pliny's suggested value. We need to take measurements of the current water levels to check this calculation.

Crossing the terrace into Romsey: LiDAR shows the Fishlake heading in a straight line towards the Horsefair. North of the Horsefair is a bifurcation; the abrupt change of angle of the east branch suggests that it was constructed at a later date than the rest of the Fishlake. The west branch changes alignment slightly to run in a more southerly direction. Is it possible that it incorporated a boundary ditch surrounding the monastic precinct along the line of the later Church Street?

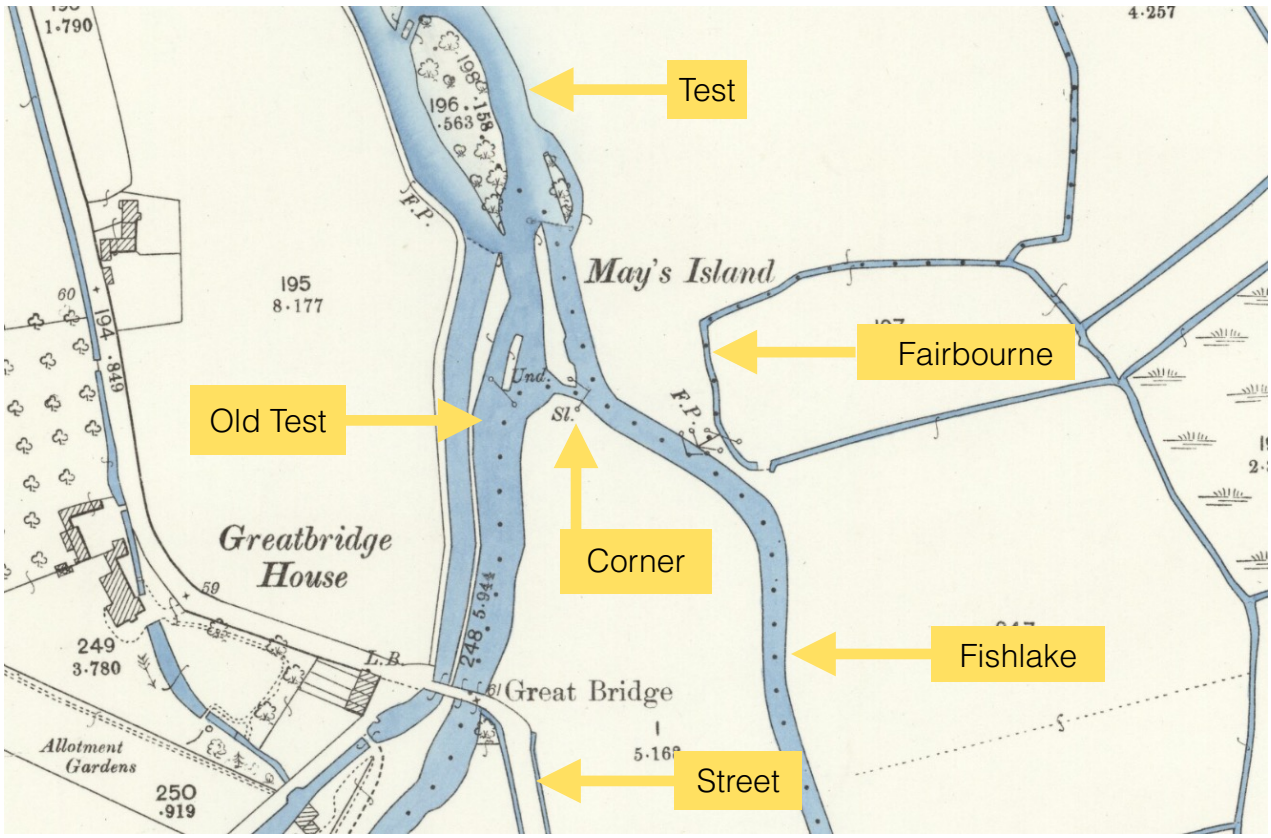


Building the Fishlake: When? Who? Why?

Determining the date of the Fishlake is essential before attempting to answer who built it and why. There could have been two phases of construction with the east branch a later addition. I think that the Romsey charter of c.970 might include a reference to the Fishlake. Changes along the shared boundary with Nursling with the appearance of the Old Test in place of the Test suggests that major water management engineering had taken place during the century separating the two charters.

The Romsey charter boundary clause starts: **Erest up and lang strete ðare ðat ðurstan seit and so to fareburne.**
- First up along the street there where the Test corners (my translation of **seit/scit**) and so to Fairbourne.

It ends: **in and ðan alde tersten ond ðe hit comeð in ðare streit ðare w/ðurstan seyt.**
- into the Old Test until it comes to the street where the Test corners (my translation of **seyt/scyt**).



Above: Features mentioned in the Romsey charter in relation to the Fishlake.

I think that the Street in the boundary clause refers to a paved roadway running along the causeway leading to Greatbridge. The land to the west of the Causeway was referred to in documents from the early 16th century onwards as Street Mead. The word I have translated as 'corners' is used in the North Stoneham charter at points where the next boundary feature continues at a right angle to the boundary up to that point.

The map above shows the boundary between Romsey and Timsbury as a dotted line - it goes north along the Test, turns a corner into the start of the Fishlake, then leaves the Fishlake and proceeds along the Fairbourne. This seems to me to fit in very closely with the description in the charter. The presence of the Fishlake would make sense of the last part of the boundary clause: the Old Test meets the Test near the Street. The creation of the Fishlake would have caused a considerable reduction in the flow of the Test from that point. This decrease in flow could have resulted in the silting up and narrowing of the channel. The Old Test was the channel that formerly carried the full flow of the Test. However the verb **scit** is translated, it is clear that some change occurred to the Test between the Street and the Fairbourne.

Although it doesn't form part of the boundary, the Street is mentioned twice in the Romsey charter. The perambulation begins by taking the witnesses up the Street to the first point on the boundary. From here it would probably have been possible to see the Fishlake 'corner'. The circuit of the boundary is completed by returning along the Old Test to the Street, the Test and the 'corner'. Why were the Street and the corner of the Test both mentioned? Presumably there was a bridge at the end of the causeway. Why wasn't that prominent landmark used as the start and end points of the boundary?

A street in an Anglo-Saxon charter is normally assumed to be a Roman road. There is limited evidence of settlement in Romsey during the Roman centuries, but none for a road. An earthen causeway would have had a similar appearance to the agger of a Roman road. Perhaps it was paved. It must have been a substantial structure to merit its description as a street. Unfortunately, it is probably inaccessible, lying underneath Greatbridge Road.

LiDAR images clearly show the causeway running 'parallel' to the line of the Fishlake. Could they both have been built at the same time? The banks of the Fishlake are higher than the causeway. They would have protected the causeway from floodwater flowing from the east down the floodplain. It could still have been flooded, but would have been largely protected from erosion. Are the Street and Fishlake mentioned together in the charter because they are both parts of a major engineering project?

Would it be reasonable to date the construction of the Fishlake to the period between the Nursling and Romsey charters, between 877 and 970? During this period, King Alfred and later his son Edward the Elder developed a network of fortified burhs. The conversion of Winchester into a burh included the creation of a network of watercourses by diverting streams north of the town. Houses in The Brooks would have had a supply of drinking water and a waste disposal system. (Hopefully, the two uses for the water were coordinated). Water was also channeled to power mills. By the mid 10th century there were two mills north of Winchester, three to the south, two within the city walls and another outside the East Gate. When St Ethelwold, bishop of Winchester from 962 to 984, rebuilt the cathedral, he provided it with running water. The people living in Romsey would have been aware of developments in Winchester. There were water management experts working nearby.

Who was responsible for the building of the Fishlake? The project could have been under either ecclesiastical or royal control. It would have benefited the Abbey, providing access to running water for sanitation and for powering mills. It would also have encouraged the growth and development of the town. Alfred's plan of creating urban centres for defence also encouraged a switch to an urban-centred economy. The growth of Romsey as a centre of industry and trade would have provided revenue for both the Abbey and the King.

The Fishlake south of the World of Water, looking north.