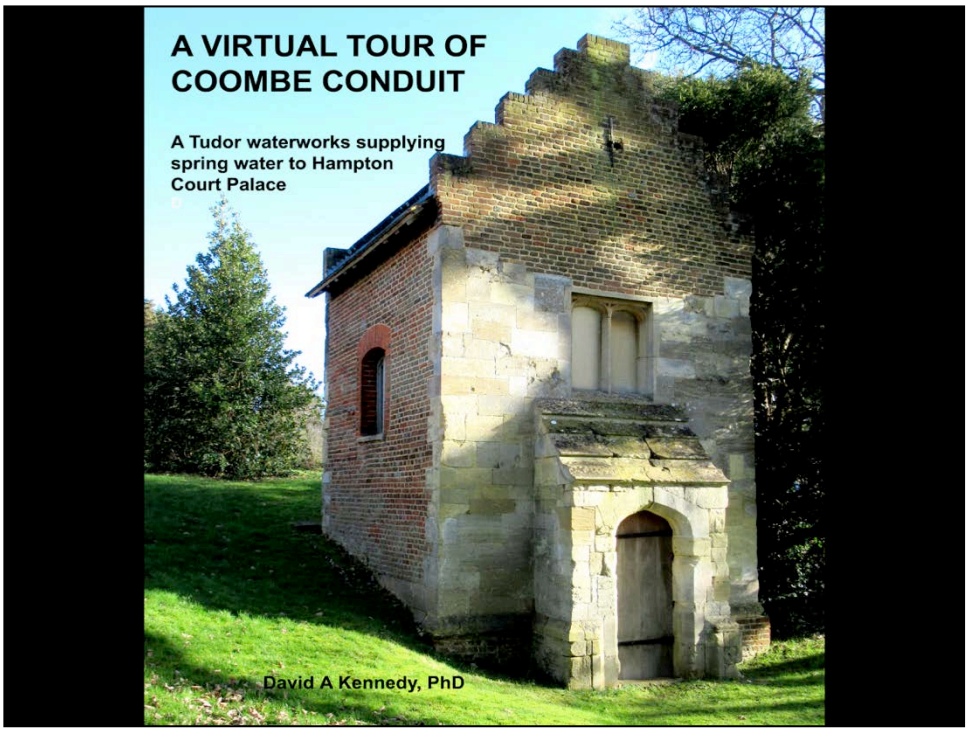
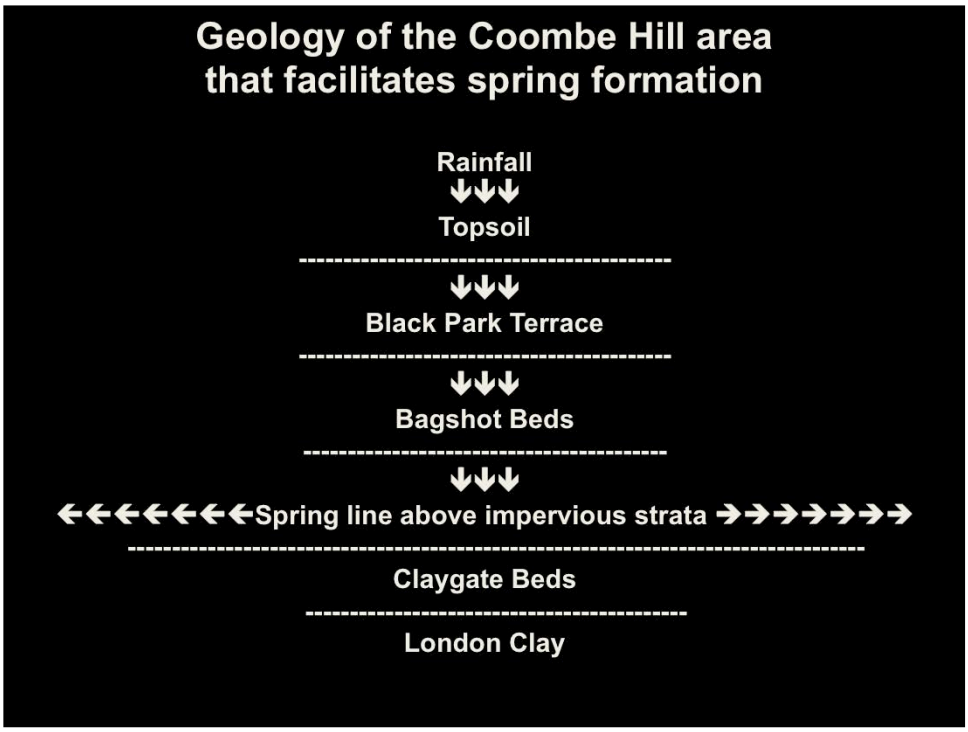


INTRODUCTION

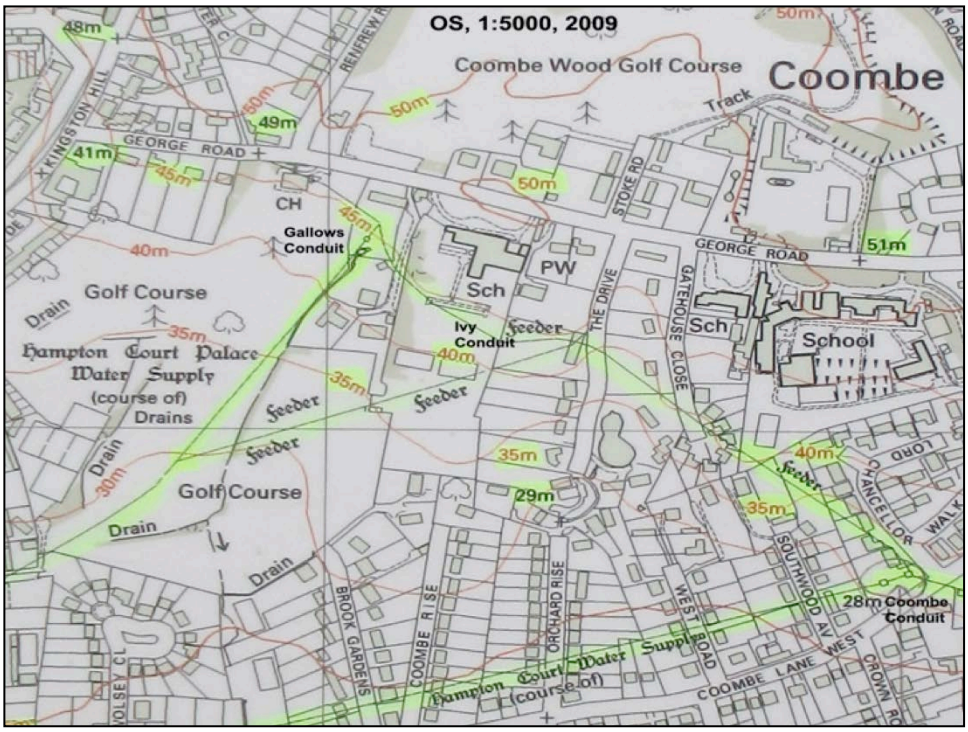
Coombe Conduit is a Grade II* Listed Building under the guardianship of English Heritage. Situated in the Royal Borough of Kingston upon Thames, it was part of the water supply system for Hampton Court Palace from Tudor times until 1876. The water came from springs on Coombe Hill and more will be said about them later. Guided tours of Coombe Conduit are provided by volunteers from the Kingston upon Thames Society, on behalf of English Heritage. It generally is open on the second Sunday in the month from April to September, 1400-1600 hours, on Heritage Open Days and at other times by special arrangement. Ivy Conduit, also part of the system, is in the grounds of Holy Cross School and is usually opened to the public only on Heritage Open Days. Gallows Conduit, also part of the system, is in the grounds of *"Hampton Spring"*, a private residence, and is not opened to the public. This presentation is based on a talk given to the Friends of Kingston Museum & Heritage Service on 20 February 2020. It includes some points made in the standard guided tour. Themes include, springs and their exploitation, the buildings of Coombe Conduit, whether the waterworks were first built by Cardinal Thomas Wolsey or King Henry VIII, the spring water and the latter days of the waterworks. A bibliography is at the end. Images were prepared by the author except where stated.



SPRINGS & THEIR EXPLOITATION

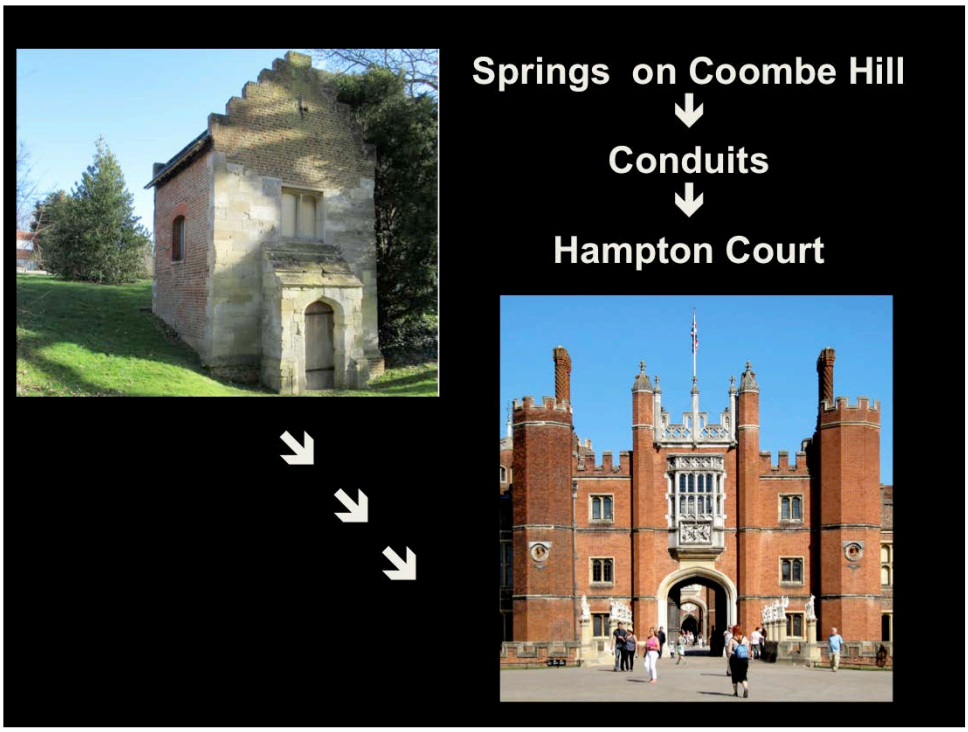
The geology of the Coombe Hill area facilitates spring formation. Rain falls onto the topsoil of a catchment area where Coombe Hill Golf Course [KT2 7DF] is situated today. Its elevation is about 50 m OD.[1] The water permeates the underlying Black Park Terrace gravels and the Bagshot Beds beneath. The spring line is above the impervious Claygate Beds which lie on the London Clay. One way to understand how a spring works is to imagine a sponge on a dinner plate. If water is allowed to drip onto the sponge, eventually it becomes saturated and the downward pressure forces water out onto the dinner plate. It has long been known that the springs were reliable sources of pure water and for this reason the area was settled from Neolithic times and later.

1. Ordnance Datum or sea level.



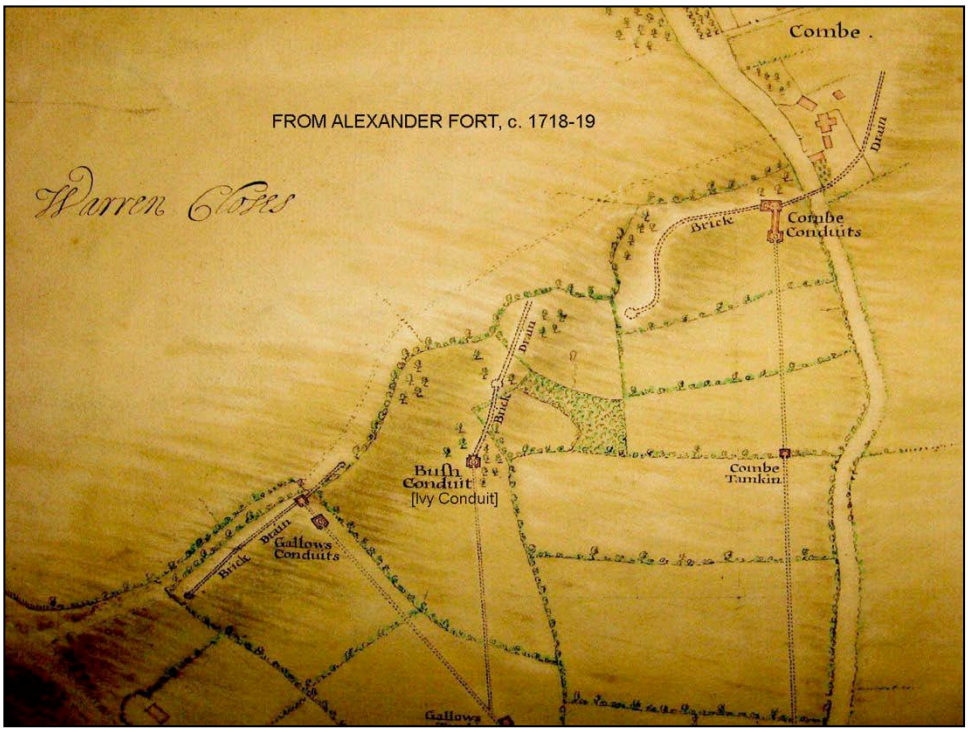
SPRINGS & THEIR EXPLOITATION

A modern OS map, scale 1:5000, shows that the elevation of the water catchment area around the Conduit houses is roughly 50 m OD. Gallows Conduit and Ivy Conduit are roughly 45 m OD. Coombe Conduit is roughly 28 m OD and was fed from the sources that fed the other conduit houses and another source, now in the grounds of Coombe Junior School, that was roughly 30 m OD.



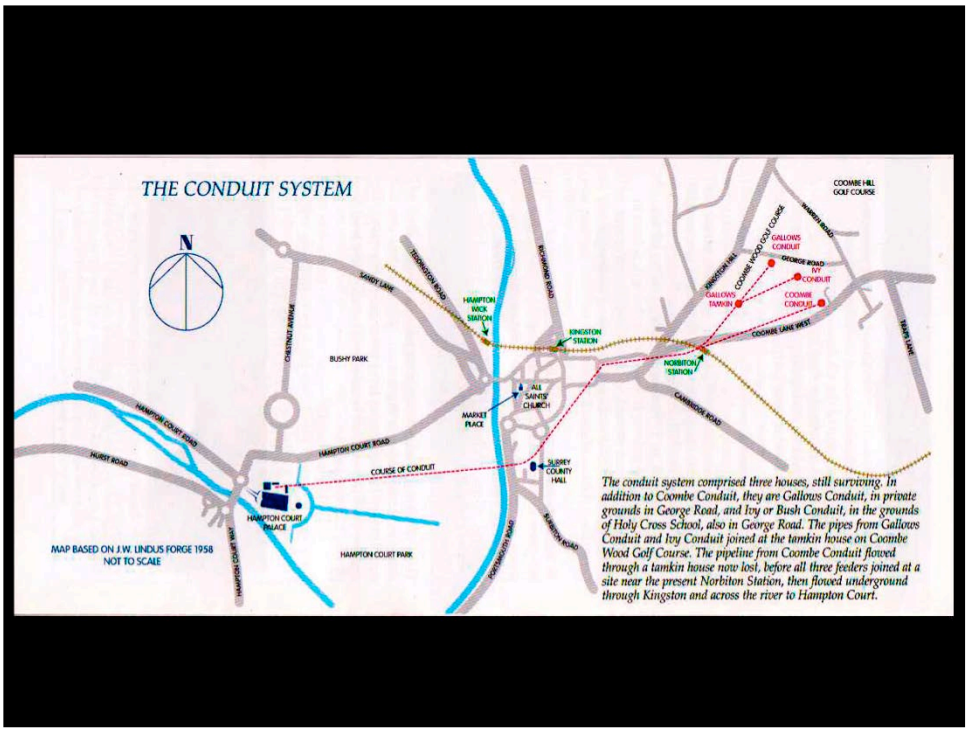
SPRINGS & THEIR EXPLOITATION

Gravity-fed water supply systems have existed since Roman times. The Pont Du Gard aqueduct delivered mountain water to Nemausus, modern day Nîmes, over a distance of about 51 km [roughly, 31 miles]. The 12th century conduit system for St. Augustine's Abbey in Canterbury delivered water to the Abbey from a spring on a hill about 2 km [roughly, 1 mile] away [Magnusson, 2001]. There were conduit house at Bolsover Castle and at some of the great residences used by Henry VIII including, those at Eltham, Greenwich, Beaulieu, Windsor, St James' Palace and Woodstock [Whelan, 2012]. The task for the Tudor civil engineers was to pipe the spring water from the Coombe Hill area to Hampton Court Palace where it could be delivered under pressure. They channelled the water into conduit buildings containing cisterns that acted as reservoirs. From the conduit cisterns, i.e., those in Ivy Conduit, about 49 m OD, Gallows Conduit, about 45 m OD, and Coombe Conduit, about 28 m OD,, they installed lead pipes that took the water to the Palace. The pipes were run in duplicate and further to enable maintenance. "*Plug Houses"*, otherwise called *"Tamkins",* were installed along the line of pipes. It is believed that these functioned as stopcocks. The pipes were laid in trenches up to six ft. [about 183 cm] deep in places. The backfilled trenches were covered in brambles as a security measure.



SPRINGS & THEIR EXPLOITATION

Alexander Fort's survey of the Hampton Court Palace's water supply, about 1718-19, shows the brick drains installed to collect water from the springs on Coombe Hill, and to channel it to Coombe Conduit, Bush Conduit [now called Ivy Conduit] and Gallows Conduit. Its name reflects its proximity to the old Kingston town gallows.

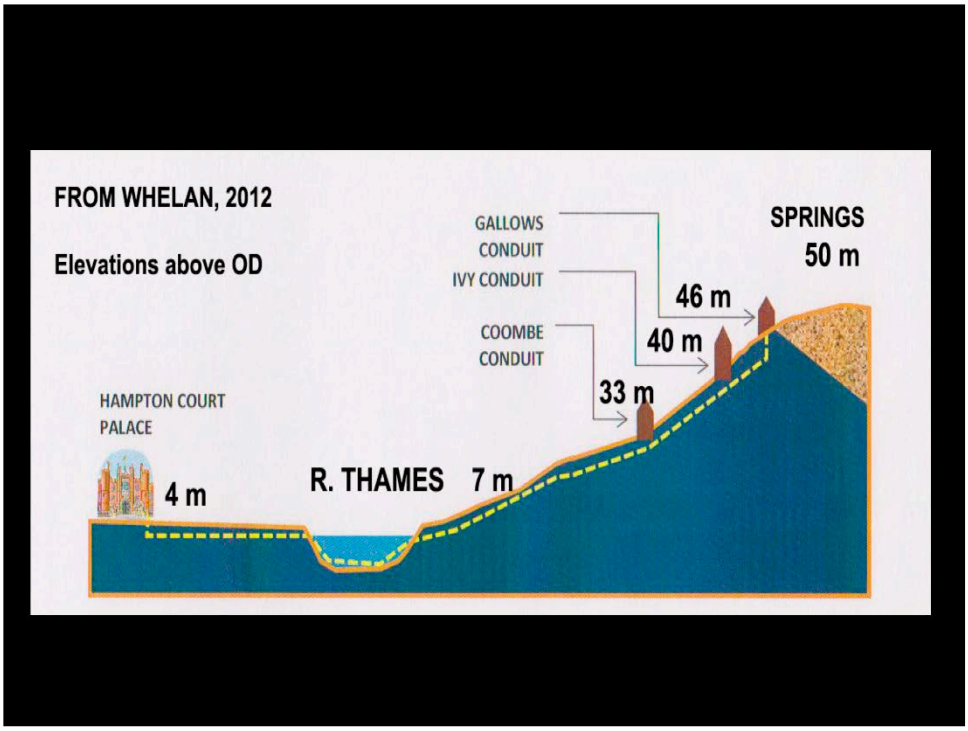


SPRINGS & THEIR EXPLOITATION

The underground pipes from Gallows Conduit and Ivy Conduit joined at the tamkin house on Coombe Wood Golf Course. The pipeline from Coombe Conduit flowed via a tamkin house, now lost, before all three feeder pipes joined at a site near the present Norbiton Station, The water then flowed in underground pipes through Kingston and across the bed of the River Thames to Hampton Court Palace [from the Coombe Conduit leaflet].

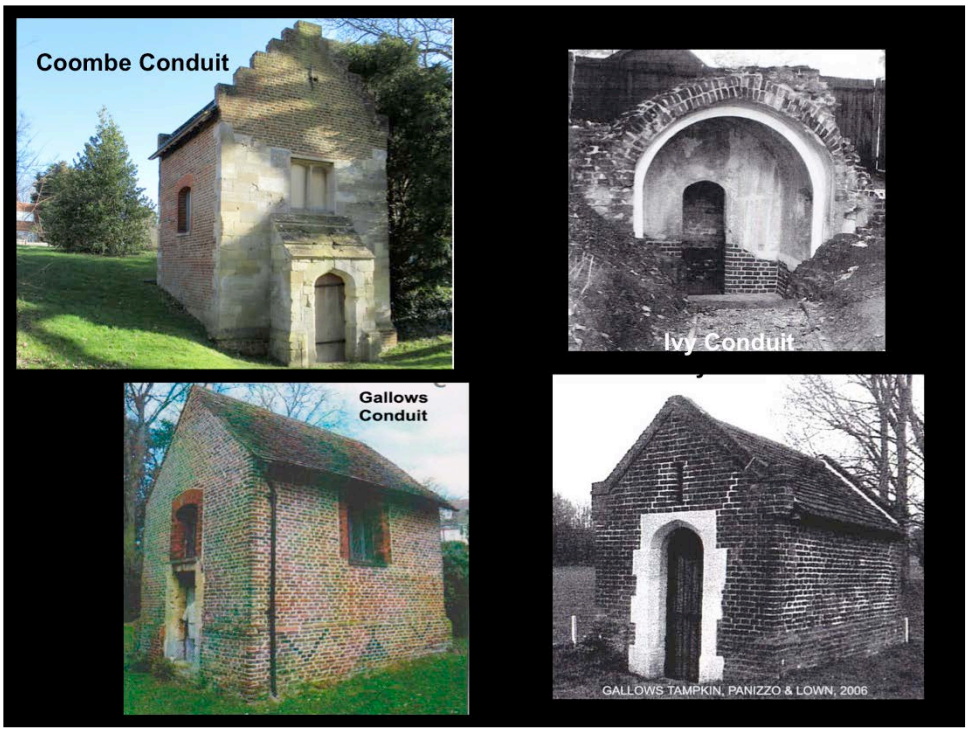
SPRINGS & THEIR EXPLOITATION

A cast iron marker, dating from the reign of King William IV, which once indicated the presence of underground conduit pipes, can be seen outside Kingston Museum [KT1 2PS].



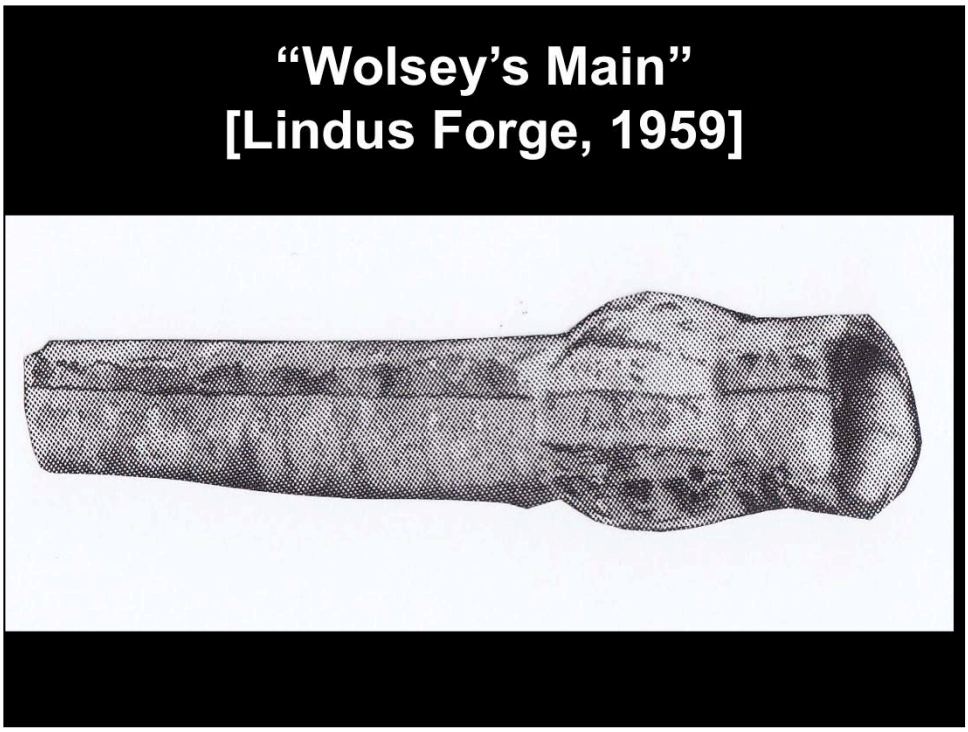
SPRINGS & THEIR EXPLOITATION

Diagram of the Hampton Court Palace water supply system showing elevations stated by Whelan, 2012. The springs were roughly 50 m above Ordnance Datum [OD] and the Palace was roughly 4 m OD. Thus a substantial head of pressure was possible. The pipes crossed the bottom of the River Thames. They also crossed the River Hogsmill. The Thames crossing points are indicated in the Andrews' survey made in the 1850s. In front of a house occupied by Dr. Roots, a prominent Kingston citizen, at the end of what is now Queen's Promenade, was a vault under the Portsmouth Road where the water pipes reached the level of the bed of the river. There was a tunnel under Dr. Roots' house which led to the vault. Thereafter, the pipes were laid on the riverbed and were covered by piles of stones intended to protect them from damage from passing boats. On the other side of the river the pipes emerged near what is now a house called *"The Wilderness"* adjacent to which was a tamkin. From there they crossed Home Park and, via Stud House, they entered Hampton Court Palace. An OS map dated 1912 indicated an air vent in the line of pipes between Stud House and the Palace. The pipes serviced the kitchens as well as other buildings [Thurley, 2003].



SPRINGS & THEIR EXPLOITATION

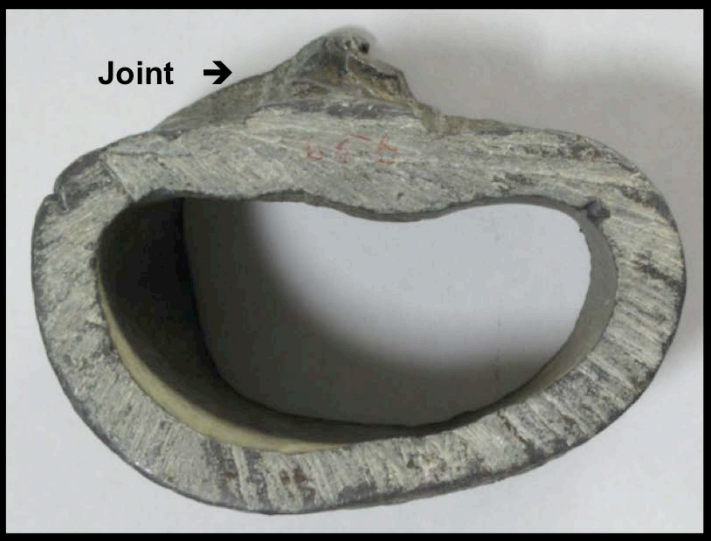
Images of surviving buildings of the Hampton Court Palace Water Supply. Those of Ivy Conduit and Gallows Tamkin are from Panizzo & Lown, 2006.



SPRINGS & THEIR EXPLOITATION

Section of a lead pipe that once was part of the Hampton Court Palace water supply. Note the fine *"grozed"* joint on the right hand side, formed by rubbing with a hot iron to seal the pores in the lead. Lindus Forge, 1959, called it part of *"Wolsey's Main"* because he believed that the system was installed at the behest of Cardinal Wolsey. More will be said about this later.[1] According to Law, 1885, originally the pipes were laid and jointed in lengths of approximately 8 m [about 25 ft]. Biden, 1852, reported that the pipes that crossed the bed of the River Thames were made of iron, with an internal diameter of 2 in [about 5 cm].

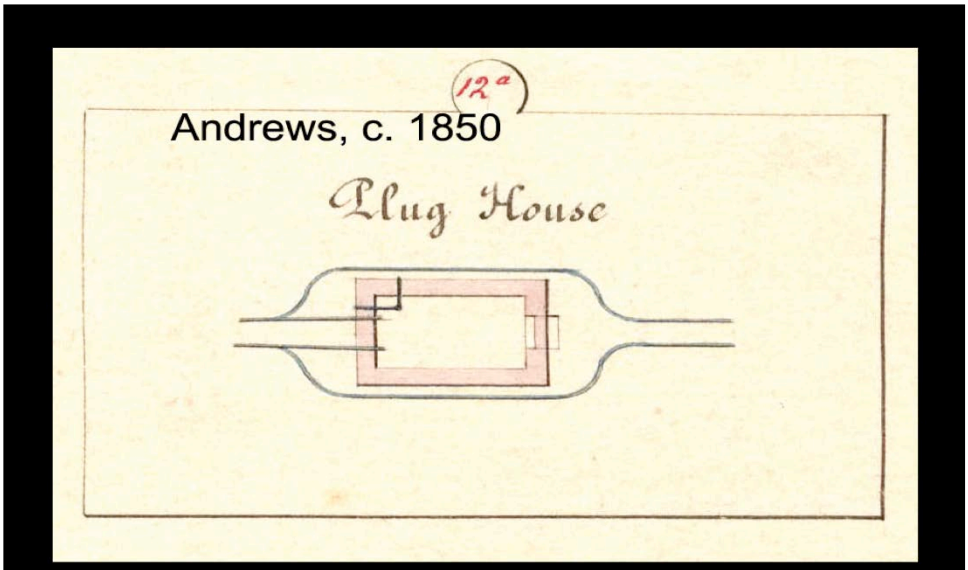
1. Lindus Forge indicated that this section of pipe was kept at The Science Museum in London or at Hampton Court Palace. He used the term *"grozed"* for a joint finished in solder by means of a plumber's grozing iron.



Section of Conduit lead pipe believed to have been cut from a damaged length found in Kingston's Fairfield. Original internal diameter about 3 in.

SPRINGS & THEIR EXPLOITATION

Section of a lead pipe that once was part of the Hampton Court Palace water supply. In the collection of the Kingston upon Thames Society, it is believed to have been cut from a damaged length of pipe found under the Fairfield in Kingston. Possibly it had been run over by a vehicle before being excavated. The original internal diameter was about three inches [about 8 cm]. The pipes were run in duplicate from Coombe Conduit to the Palace so that if a repair was needed on one pipe it could be isolated while water continued to flow in the other pipe. The inside of the pipe has a greyish layer, probably of lead sulphate, which can protect against lead poisoning, as was pointed out by Dr. William Roots – see later.

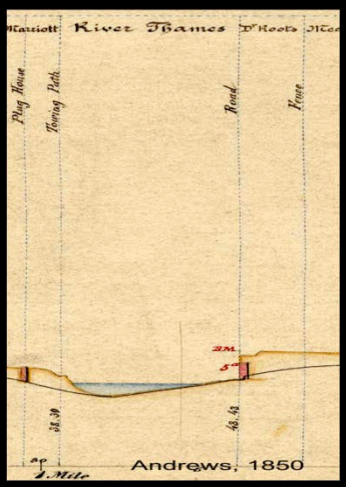


Plug House, or Tamkin

SPRINGS & THEIR EXPLOITATION

Drawing of the inside of a plug house, otherwise called a *"tamkin"*. It is believed that the installation functioned as a stopcock to isolate one of the pipes for repairs. From Andrews, *circa* 1850.

Thames crosssing, Andrews, 1850 & Aubrey, 1673

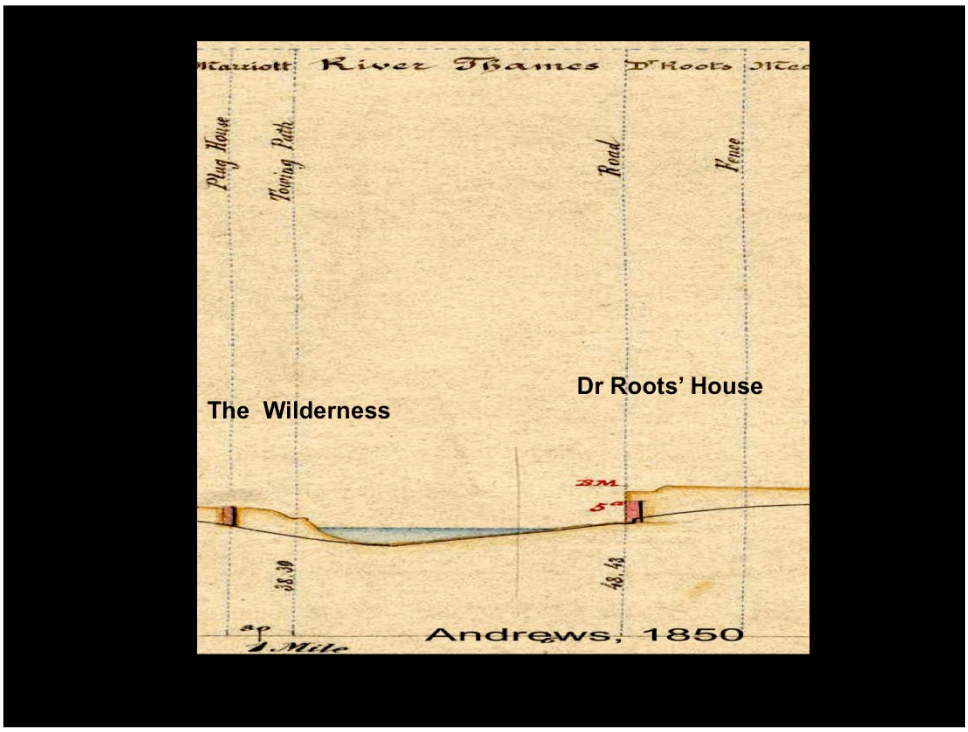


…near to Coombe House are certain springs from where the water is conveyed…to the Conduit *juxta Thames*… and so under the Thames… by the bowling green at Kingston is a fountain house or *spiraculum* with a door opening to the surface of the Thames…

John Aubrey, 1673

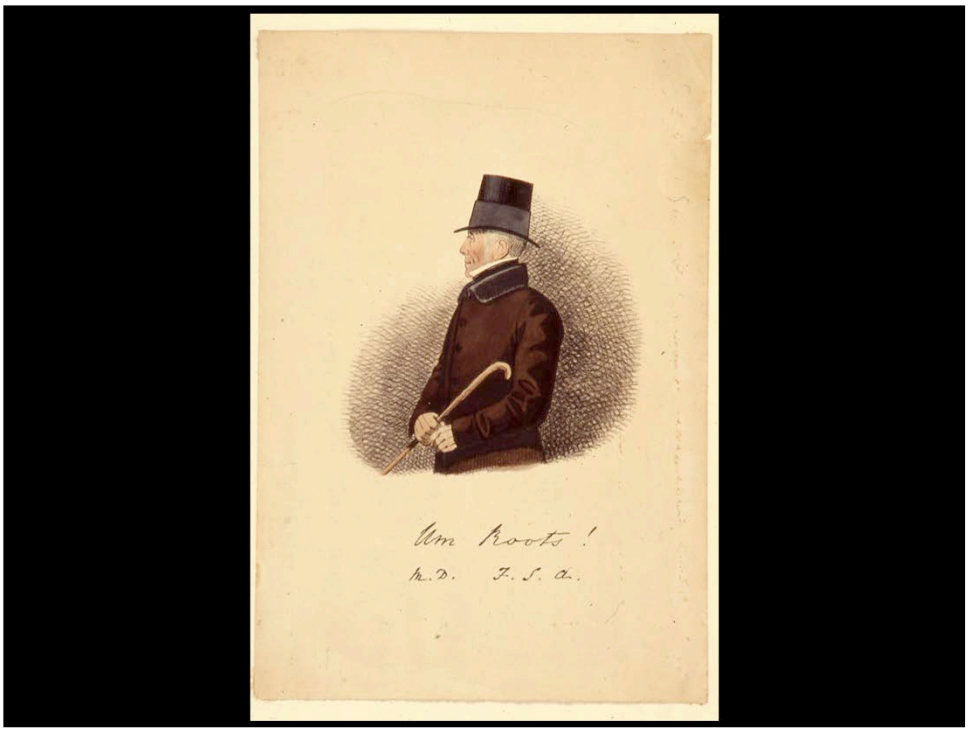
SPRINGS & THEIR EXPLOITATION - THE THAMES CROSSING

John Aubrey, 1673, described a fountain house or *spiraculum* near the bowling green at Kingston upon Thames with *"a door opening to the surface of the Thames"*. This accords with a plan made by Andrews in about 1850 which shows a chamber on the east bank [Surrey side] of the Thames near where the *Hermes Hotel* [KT1 2LU] is situated today. The conduit pipes entered this chamber and from there were laid on the bed of the river to convey water to the other side and from there to Hampton Court Palace.



SPRINGS & THEIR EXPLOITATION - THE THAMES CROSSING

Near to the *Hermes Hotel* once stood Dr Roots' House. Dr. Roots was one of a few people who legitimately could take water from the Conduit. On the other side of the river was a house called "*The Wilderness"*, the occupier of which was permitted to take water from the Conduit. More will be said about this later. Within the curtilage of the *The Wilderness* was a tamkin.



SPRINGS & THEIR EXPLOITATION

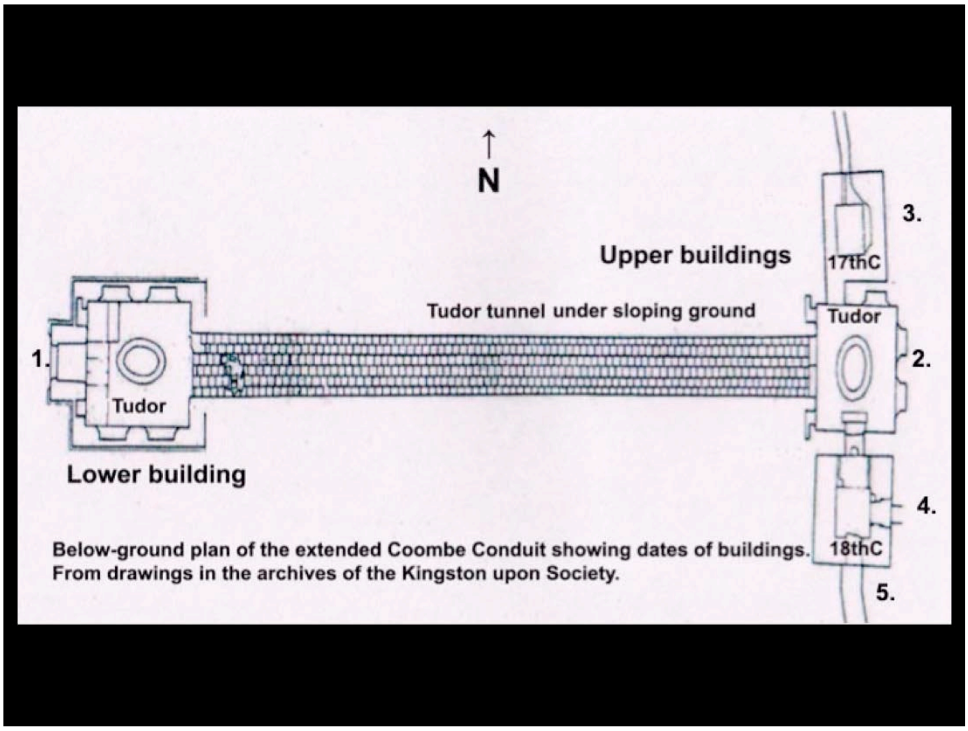
Dr. William Roots [1777-1859] was a physician, Justice of the Peace, Surgeon of the Kingston House of Correction and an antiquary.[1]

1. See D. A. Kennedy, 2016, A local prison for the poor. A study of the Kingston House of Correction, 1762-1852 www.kingstonhistoryresearch.co.uk

SPRINGS & THEIR EXPLOITATION - THE THAMES CROSSING

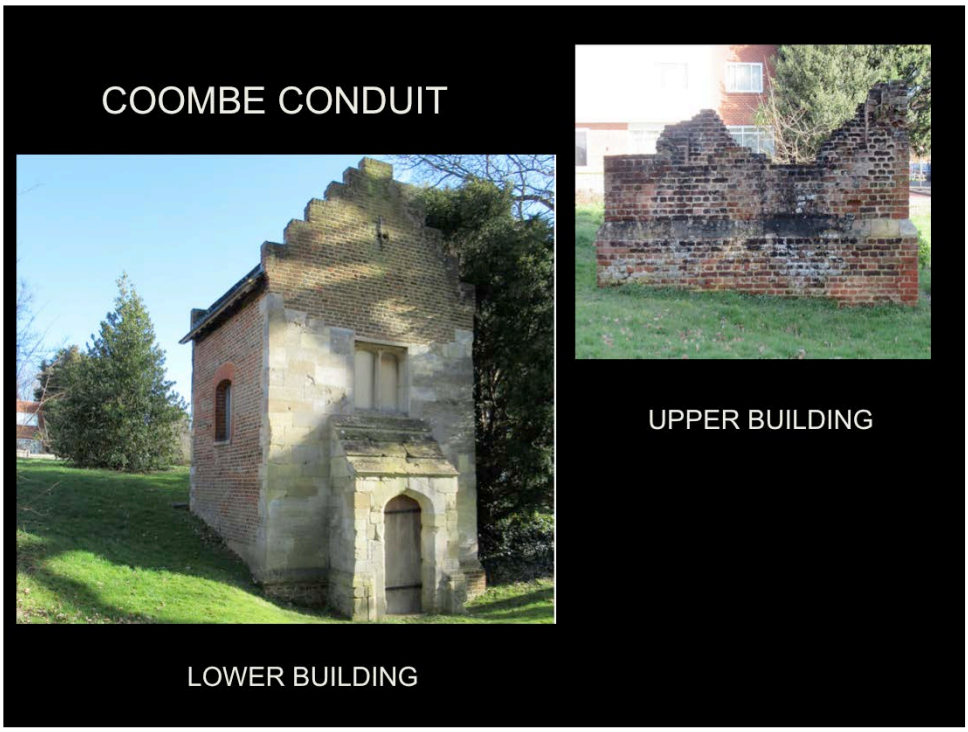
Dr. Root's House was to the right of the *Hermes Hotel*. *The Wilderness* can be seen across the river from the end of Queen's Promenade, near the *Hermes Hotel*.[1]

1. This is a Grade II Listed Building
https://historicengland.org.uk/listing/the-list/list-entry/1080044



COOMBE CONDUIT BUILDINGS – VIRTUAL TOUR

Below-ground plan of Coombe Conduit showing dates of buildings. The Conduit was extended in the 17th and 18th centuries, to exploit new springs to meet the demand for water at the Palace or because old springs were insufficient. Note that the ground rises from the lower to the upper above-ground buildings, i.e., from the west to the east. The tunnel is approximately 80 ft [24 m] long. Hereafter, this plan can be used to locate features being described. The features have been numbered for ease of identification.



COOMBE CONDUIT BUILDINGS – VIRTUAL TOUR
[NOS. 1 & 2 ON THE PLAN]

The well-preserved lower building and the ruined upper building. Note how the ground rises from the front of the lower building. In the left-hand picture the ruined upper building, on the higher ground, is obscured. It can be seen in the right-hand picture.

COOMBE CONDUIT BUILDINGS – VIRTUAL TOUR
[NOS. 1 & 2 ON THE PLAN]

A drawing by Phillip Hardwick of about 1820 showing the lower building of Coombe Conduit and part of the upper building; the rest being obscured by tree branches. The upper building was damaged by enemy action in WWII and by trees blown down in a gale in 1963. At the base of the rear of the lower building can be seen a triangular-section structure that resembles a buttress. More will be said about this later.

COOMBE CONDUIT BUILDINGS – VIRTUAL TOUR
[NO. 1 ON THE PLAN]

The front of the lower building. Note the crow-stepped brickwork that tops the building.

COOMBE CONDUIT BUILDINGS – VIRTUAL TOUR
[NO. 1 ON THE PLAN]

A view of a section of the front of the lower building. Note the Tudor bricks and what appears to be reclaimed stonework. Possibly this came from Merton Priory after its dissolution in 1538. Coombe Conduit stands on ground once owned by Merton Priory. The finely-jointed stonework and jigsaw fit of the reclaimed stones from different sources indicates workmanship of a high standard.

COOMBE CONDUIT BUILDINGS – VIRTUAL TOUR
[NO. 1 ON THE PLAN]

The north side of the lower building. Note the Tudor brickwork and the Victorian brickwork around the glazed window. Whelan, 2012, carried out a brick survey and concluded that Coombe Conduit was constructed of bricks made in time of King Henry VIII. More will be said about this later.

COOMBE CONDUIT BUILDINGS – VIRTUAL TOUR
[NO. 1 ON THE PLAN]

A close-up of the window surrounded by Victorian brickwork. Records show that previously the windows on either side were barred. This picture tells us that Coombe Conduit had a working life from Tudor to Victorian times, i.e., from about 1540 to 1876.

COOMBE CONDUIT BUILDINGS – VIRTUAL TOUR
[NO. 1 ON THE PLAN]

The structure at the east side of the lower building which resembles a buttress. This was shown in the drawing by Phillip Hardwick of about 1820. It is made of Tudor brickwork faced with more modern engineering bricks, probably part of an earlier restoration.

COOMBE CONDUIT BUILDINGS – VIRTUAL TOUR
[NO. 1 ON THE PLAN]

The *"buttress"* is an enigma. It does not function as a normal buttress which is designed to support a building that has a tendency to lean over. In this case, it would have the opposite effect. Various theories about the structure have been proposed. Lindus Forge, 1959, conjectured that possibly it acted as a counterpoise when a cauldron of molten lead was suspended from the front of the building when lead pipes were being made. Another theory was that it acted as a retaining wall to counter the force of water- saturated soil against the building. Most likely, as Whelan, 2012, proposed, it was probably an afterthought which acted to protect the flared archway at the start of the tunnel inside the building as is illustrated by the top right-hand diagram.

COOMBE CONDUIT BUILDINGS – VIRTUAL TOUR
[NO. 1 ON THE PLAN]

Inside the lower building looking towards the open door. To the left and right hand sides of the door candle or lantern niches can be seen: more will be said about these soon. In the foreground, down some steps, is an oval-shaped, lead-lined cistern filled with spring water.

COOMBE CONDUIT BUILDINGS – VIRTUAL TOUR
[NO. 2 ON THE PLAN]

A close-up of a candle or lantern niche in the upper Tudor building. The arrow points to a section into which a candle or lantern was placed to protect it from draughts. It is possible that originally the whole of the inside surface of the niche was whitewashed to reflect the light.

COOMBE CONDUIT BUILDINGS – VIRTUAL TOUR
[NO. 1 ON THE PLAN]

The flared arch in the lower Tudor building that lies under the aforementioned *"buttress"* structure. The arch was designed to focus light from the door inwards. Note the fine brickwork and vestiges of plaster, which possibly once was whitewashed.

COOMBE CONDUIT BUILDINGS – VIRTUAL TOUR
[NO. 1 ON THE PLAN]

A decorative niche inside the lower Tudor building. Note the fine brickwork.

COOMBE CONDUIT BUILDINGS – VIRTUAL TOUR
[NO. 1 ON THE PLAN]

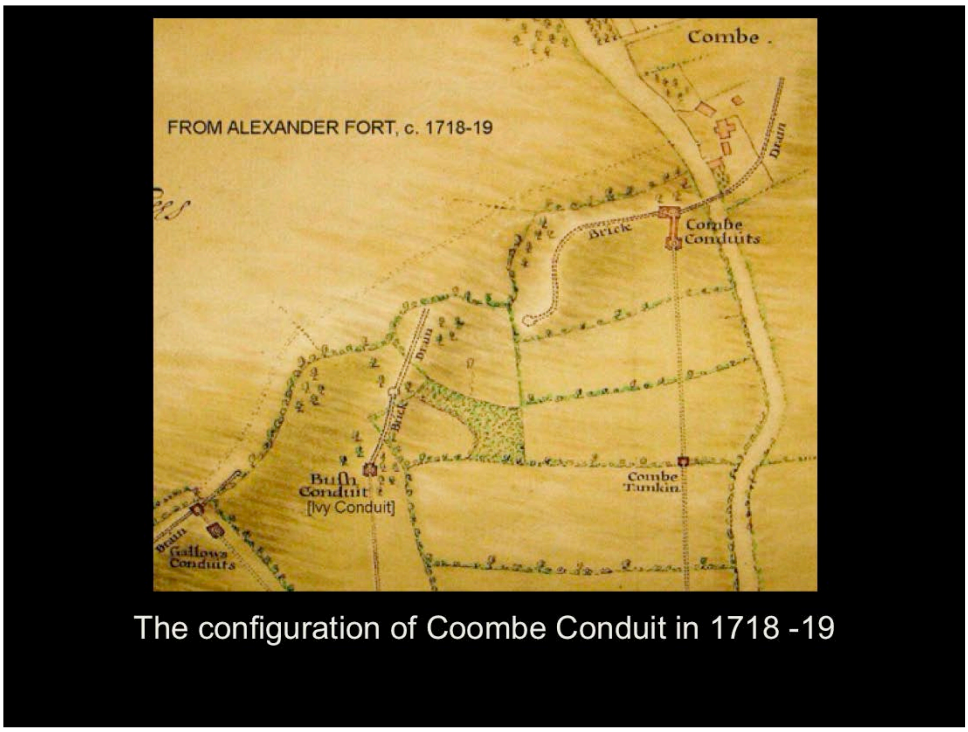
Looking up at the roof joists in the lower Tudor building. Under some joists, lines of nail holes can be seen. If these are original timbers, these may indicate where laths once were nailed. Possibly once the building had a lath and plaster ceiling. The construction suggests that perhaps there was another floor. While there is no evidence of joist holes below the window, possibly a mezzanine floor supported by upright timbers once was in place. It is conjectured that this would have provided somewhere for a guard or caretaker to sleep, being accessed by a ladder. Such might have been seen necessary to guard the royal water supply from attempts to introduce poison into the cistern.

COOMBE CONDUIT BUILDINGS – VIRTUAL TOUR
[No. 2 ON THE PLAN]

Looking down the sloped tunnel towards the open door. Plasterwork and a tiled floor can be seen. The cross section of the tunnel in places resembles typical Tudor arches to be seen in the older parts of Hampton Court Palace.

COOMBE CONDUIT BUILDINGS – VIRTUAL TOUR
[NO. 2 ON THE PLAN]

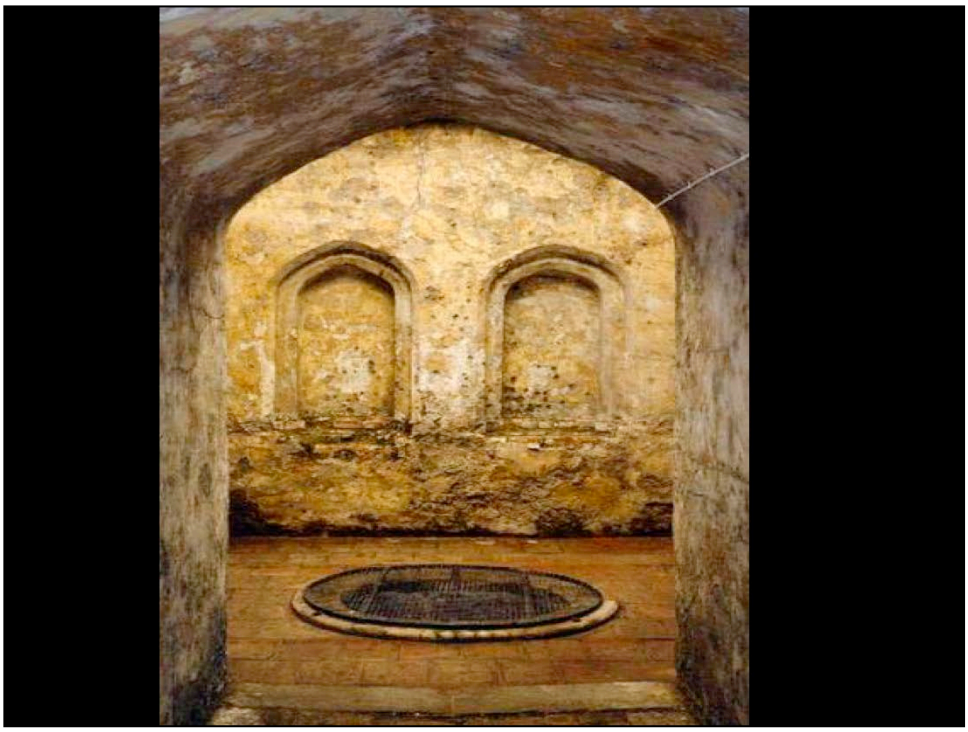
On a threshold stone of the upper chamber are symbols which have been identified as masons' marks. Such were the *"signatures"* of individual stonemasons who worked on a building and were associated with a payment system. The mark on the left may represent the Holy Trinity. The threshold stones may have been reused from another building; possibly the aforementioned Merton Priory. Possibly, the stones, with chisel work to prevent slipping, were once installed in a kitchen or cellar. Usually, mason's marks are not on the part of a piece of stonework that would be on public display. The broad arrow may denote a royal connection or it could have been made to indicate the direction it should be installed when the Conduit was constructed. Having said all this, it is possible that there are other explanations for these stone marks and this will be discussed later.



The configuration of Coombe Conduit in 1718 -19

COOMBE CONDUIT BUILDINGS – VIRTUAL TOUR
[NOS. 1 & 2 ON THE PLAN]

Alexander Fort's survey of 1718-19 shows two brick drains on either side of Coombe Conduit and only the northern extension.



COOMBE CONDUIT BUILDINGS – VIRTUAL TOUR
[NO. 2 ON THE PLAN]

In the foreground of the upper Tudor building is a lead-lined oval cistern, behind which are decorative niches with fine brickwork. Some bullet holes can be seen in the niches. When the Conduit was derelict and unprotected it was used illicitly as a firing range, probably for air rifles. The firing point was in the area by the door. The targets were placed in the niches.

COOMBE CONDUIT BUILDINGS – VIRTUAL TOUR
[NO. 3 ON THE PLAN]

Entrance to the 17th century extension to the upper Tudor building. It was formed by breaking through a decorative niche of the north wall. In this chamber some holes in opposite walls suggest that a shelf was once fitted here.

COOMBE CONDUIT BUILDINGS – VIRTUAL TOUR
[NO. 3 ON THE PLAN]

View through the entrance of the 17th century extension. In the rear can be seen the mouth of a square-section brick drain through which spring water continues to flow into the shallow rectangular-section cistern in the foreground. It is likely that the only water flowing into the Tudor buildings now comes from this source.

COOMBE CONDUIT BUILDINGS – VIRTUAL TOUR
[NO. 2 ON THE PLAN]

Close up of the oval cistern in the Tudor part of the upper building. In the centre spring water is flowing in. Gent, 1979, estimated the flow rate to be 20 gallon/hour [about 1.5 litres/minute].[1] Over the last ten years the flow has been visibly constant even after prolonged periods of drought and wet weather. This demonstrates the storage capacity of the catchment area. To the right can be seen the mouth of a wider bore pipe through which spring water once flowed. This suggests that in earlier times another spring supplied water to the cistern. The water from this cistern flows through pipes under the Tudor tunnel down into the cistern by the door of the Conduit house. The tunnel is roughly 80 ft [24 m] long with a gradual slope towards the door of the building.

1. L E Gent, 1979, The manor of Coombe or Coombe Nevill in Kingston upon Thames, Occasional Paper No. 3, Kingston upon Thames Archaeological Society

COOMBE CONDUIT BUILDINGS – VIRTUAL TOUR
[NO. 4 ON THE PLAN]

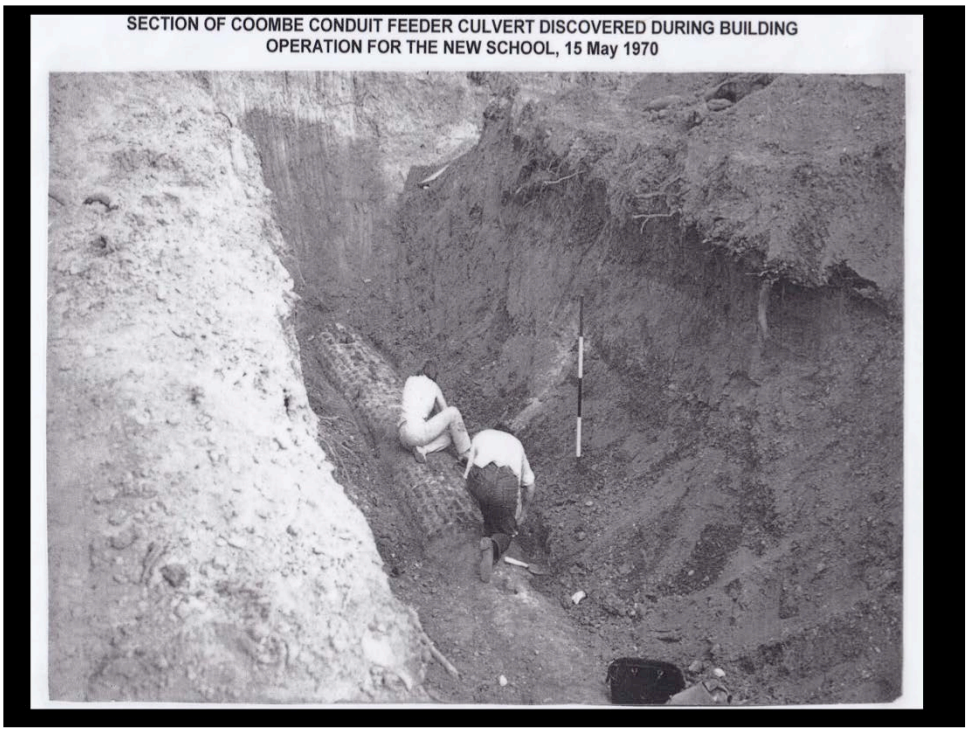
The entrance to the 18th century extension. It was formed by breaking through the south wall and filling the decorative niches on either side. On the right hand side of the entrance, the shape of what once was a decorative niche can just be made out. Stephen Hales, 1740, reported that this extension was constructed in 1733.

COOMBE CONDUIT BUILDINGS – VIRTUAL TOUR
[NO. 4 ON THE PLAN]

Looking down into the 18th century extension. Water trickles through a large tunnel at the rear into a shallow rectangular cistern. From there the water flowed independently downhill from the Conduit through pipes that met others from the water supply system. The tunnel extended under the road to what was then Coombe Manor to deliver water from a spring which once fed a deep well. Today, Coombe Junior and Infants' Schools are on the site and groups of children with teachers and adult helpers have visited Coombe Conduit in the summer. The size of the mouth of the tunnel suggest that once the flow of water from the source was considerably more than it is now.

COOMBE CONDUIT BUILDINGS – VIRTUAL TOUR
[NO. 4 ON THE PLAN]

The mouth of the tunnel that extends under Coombe Lane West. What appears to be a miniature waterfall is algal growth. Very little water flows through the tunnel today.



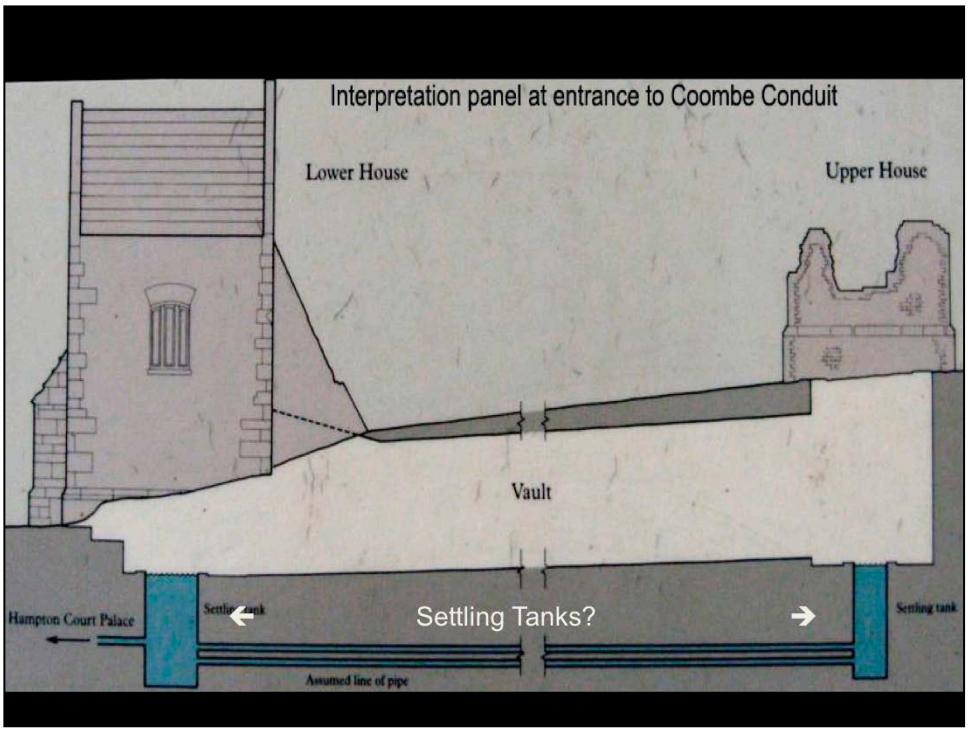
COOMBE CONDUIT BUILDINGS – VIRTUAL TOUR
[NO. 5 ON THE PLAN]

A section of the Coombe Conduit feeder culvert discovered during the building of the new Coombe Junior and Infants' Schools. The photograph, dated 15 May 1970, was kindly provided by Mrs. Anne Baker. It shows members of Kingston upon Thames Archaeological Society [KUTAS] recording the discovery. The culvert once delivered a considerable flow of spring water to the 18th century extension.

WATER IN NEWLY DISCOVERED FEEDER, 1970

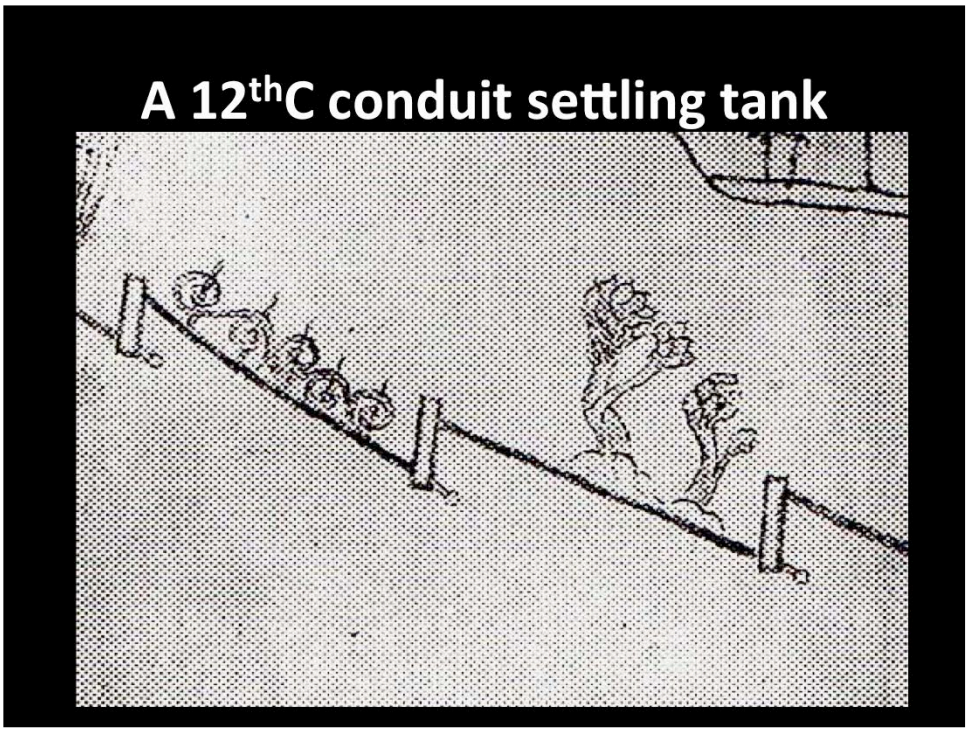
COOMBE CONDUIT BUILDINGS – VIRTUAL TOUR
[NO. 5 ON THE PLAN]

When the feeder culvert was accidently broken into by builders in 1970, spring water could be seen flowing through it. The photograph was kindly provided by Mrs. Anne Baker. The feeder culvert disappeared during the building work.



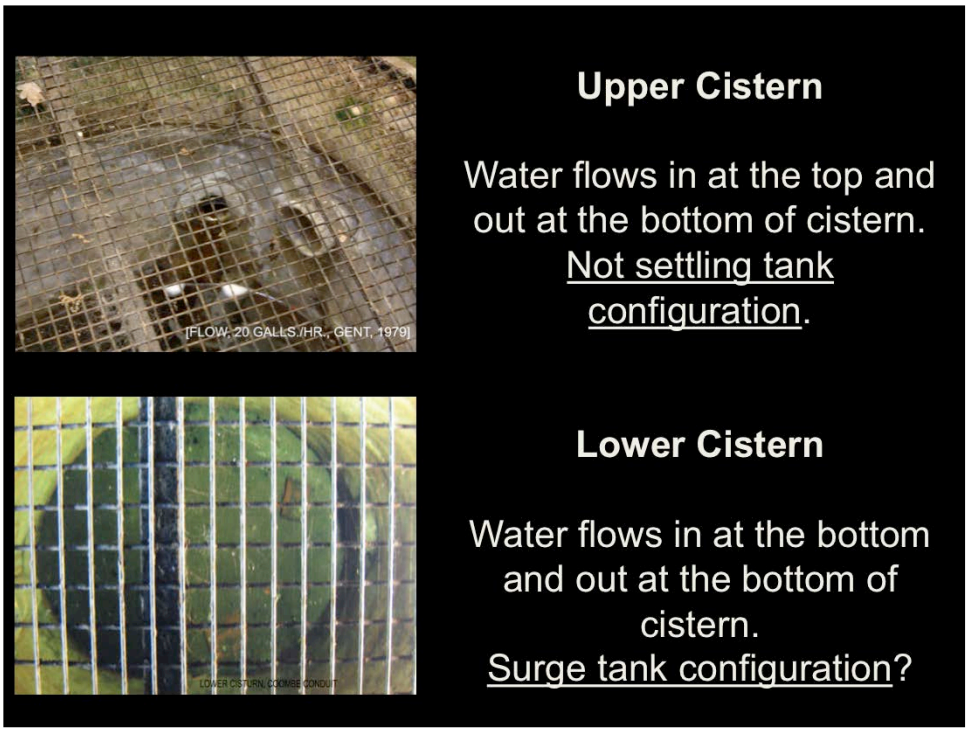
COOMBE CONDUIT BUILDINGS – VIRTUAL TOUR

English Heritage's interpretation panel at the entrance to the site denotes each of the two cisterns inside the building as a *"settling tank"*. But are they really *"settling tanks"*? This question will be addressed later.



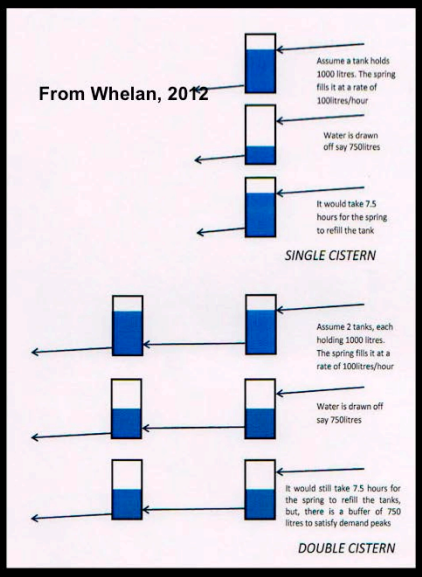
COOMBE CONDUIT BUILDINGS – VIRTUAL TOUR

This is a close-up of settling tanks which were part of the 12th century water supply system for St. Augustine's Abbey, Canterbury [Magnusson, 2001]. Water flowed into the bottom of a tank and flowed out at the top. At the bottom of a tank was a facility for removing sediment.



COOMBE CONDUIT BUILDINGS – VIRTUAL TOUR
[NOS. 1 & 2 ON THE PLAN]

The cisterns are another enigma. At the upper cistern of Coombe Conduit, water flows in at the top and out at the bottom of the cistern. This is not the configuration of a settling tank. At the lower cistern, water flows in at the bottom and as originally constructed it flowed out at the bottom. This is not the configuration of a settling tank. If the cisterns do not function as settling tanks, what was their original purpose? Possibly they functioned as surge tanks, i.e., they were intended to absorb sudden rises of pressure caused by variation in flow of the spring water as well as quickly providing extra water during a brief drop in pressure.

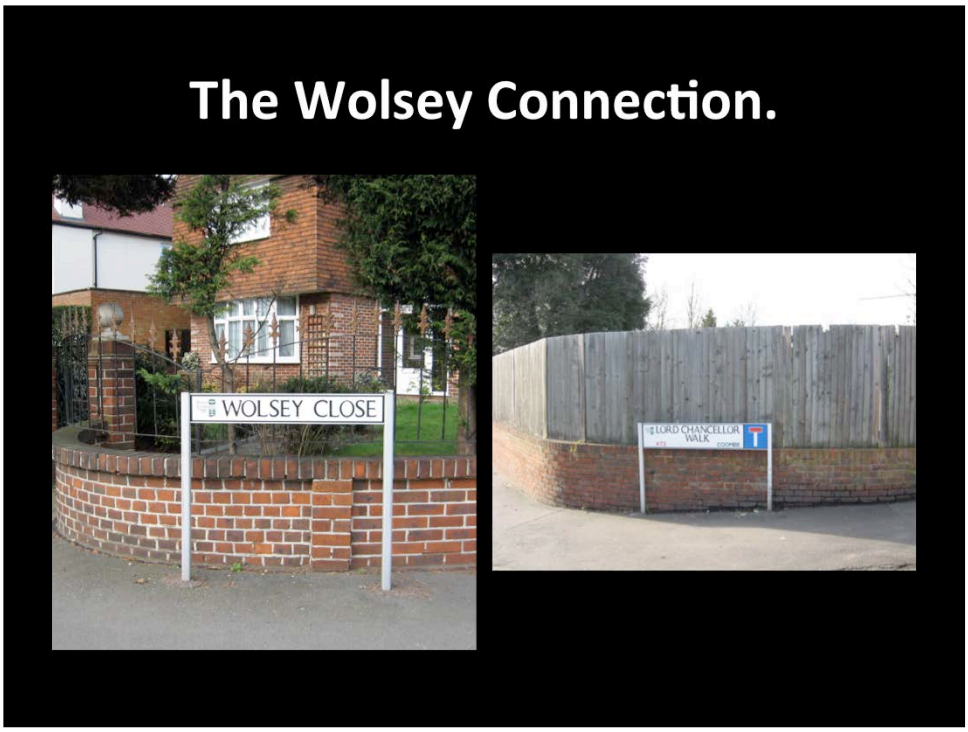


- At times the springs could not satisfy the demand for water.
- The increased storage capacity of two linked cisterns provided a back-up when demand increased.

[From Whelan, 2012]

COOMBE CONDUIT BUILDINGS – VIRTUAL TOUR
[NOS. 1 & 2 ON THE PLAN]

Why were there two cisterns in the original Tudor conduit buildings? Whelan, 2012, suggested that at times the springs could not satisfy the demand for water at Hampton Court Palace and that the increased storage capacity of two linked cisterns provided a back-up when the demand increased.

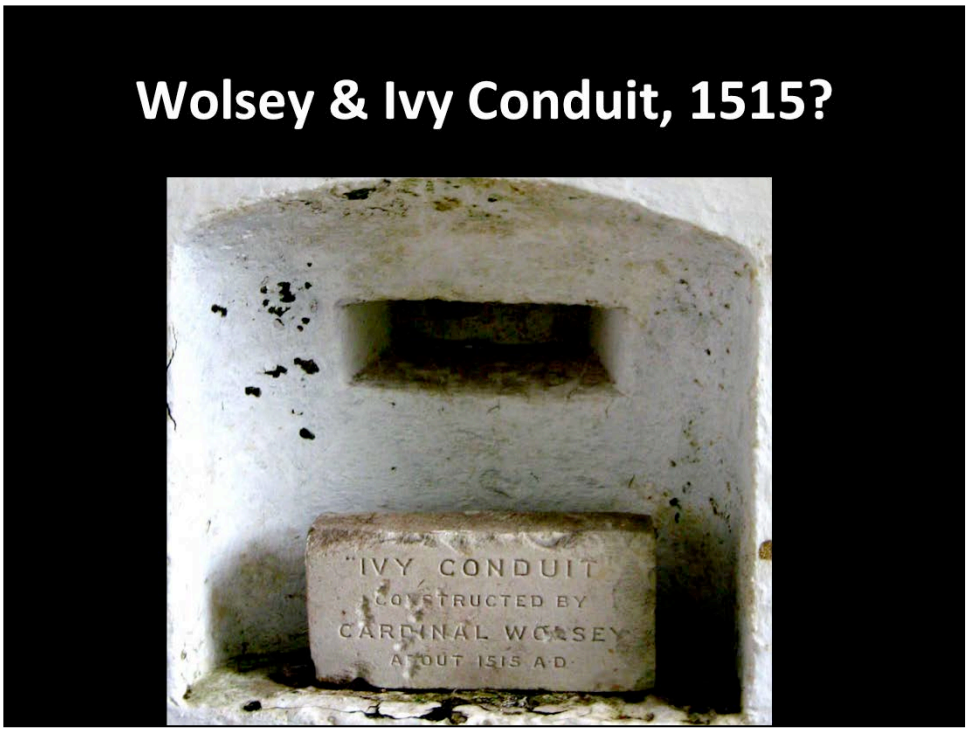


WHO BUILT THE WATERWORKS?

The nearby Wolsey Close [KT2 7ER] and Lord Chancellor Walk adjacent to Coombe Conduit [KT2 7HE] demonstrate a belief that the area had a connection with Cardinal Wolsey, once Lord Chancellor of England.

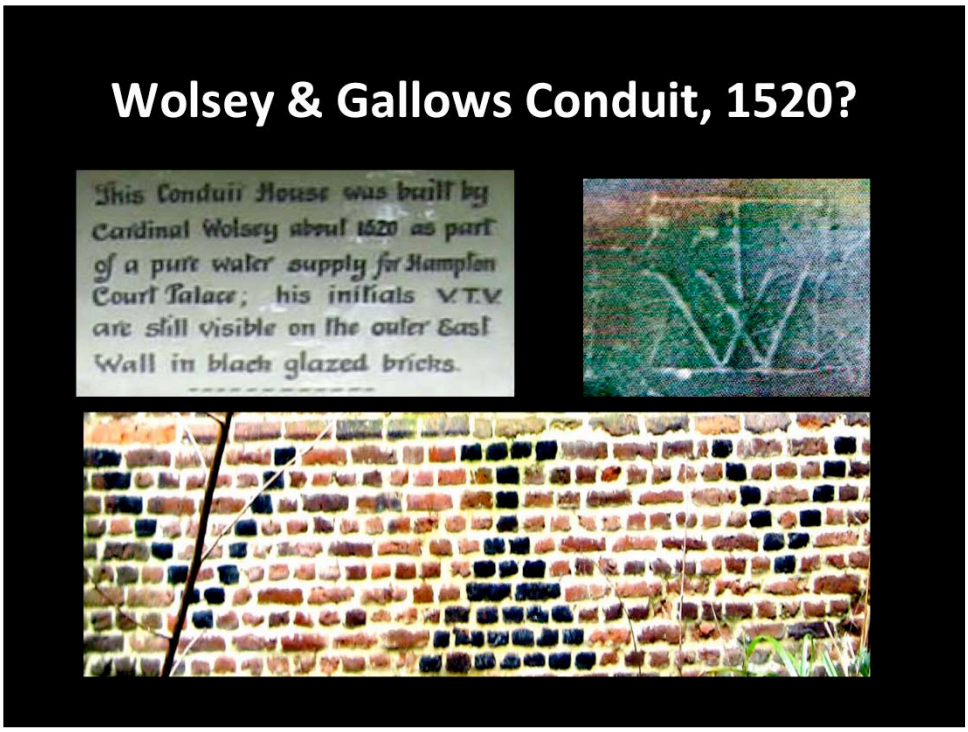
WHO BUILT THE WATERWORKS?

Cardinal Wolsey occupied the manor that became Hampton Court Palace from 1515-1529. According to Thurley, 2003, the manor once was the site of a monastic institution, that of the Knights Hospitallers, and the tenant before Wolsey was Lord Giles Daubeney who was the Lord Chancellor of England in the time of the first Tudor monarch, Henry VII. King Henry VIII took over the Palace from Cardinal Wolsey in 1529 and developed it further. He ruled from 1509 until he died in 1547.



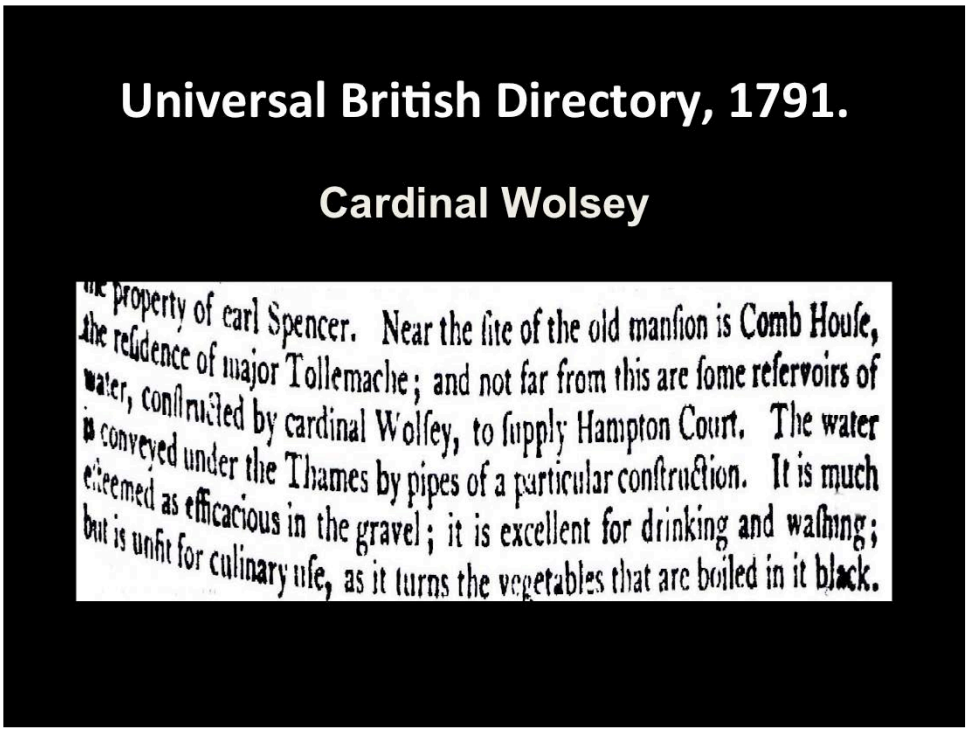
WHO BUILT THE WATERWORKS?

A tablet inside Ivy Conduit, once called Bush Conduit, states that it was constructed by Cardinal Wolsey about 1515. The tablet was installed an owner who clearly believed that Cardinal Wolsey built Ivy Conduit.



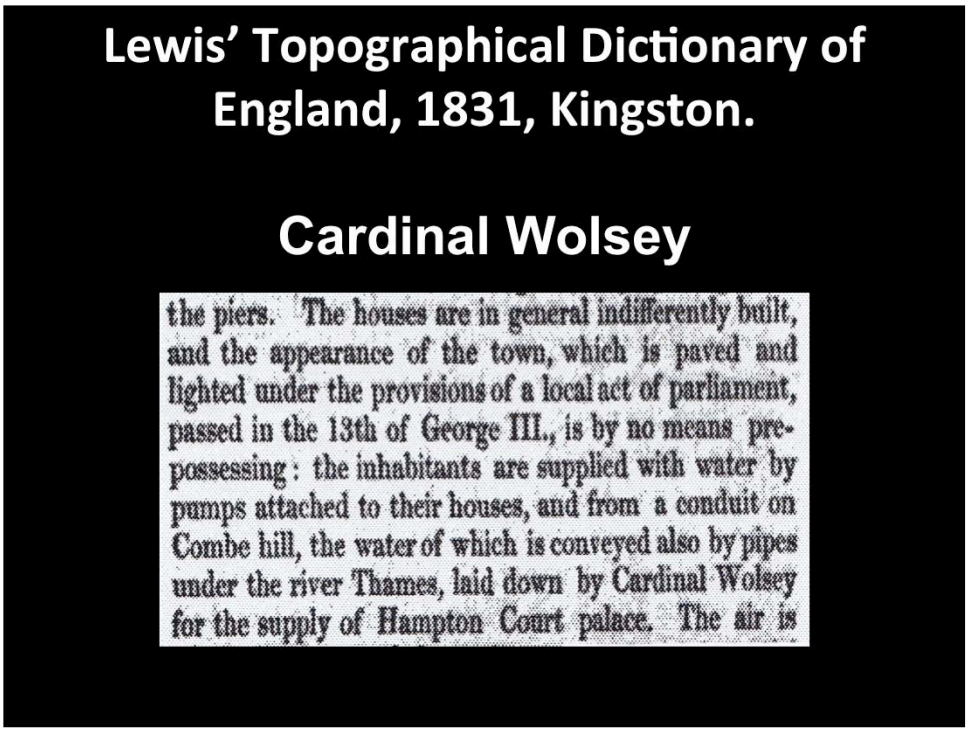
WHO BUILT THE WATERWORKS?

A notice on the door of Gallows Conduit stated *"This Conduit House was built by Cardinal Wolsey about 1520 as part of a pure water supply for Hampton Court Palace; his initials, V.T.V are still visible on the outer East Wall in black glazed bricks."* The notice was installed by an owner who clearly believed that Cardinal Wolsey built Gallows Conduit. At the bottom of the slide can be seen the *"initials"* referred to. At the top right hand corner of the slide can be seen Cardinal Wolsey's monograph that was photographed in his apartments at Hampton Court Palace. It appears as the letter *"T" [for Thomas]* superimposed on the letter *"W" [for Wolsey]*. The enigmatic *"initials"* on the side of Gallows Conduit may be an attempt to reproduce Wolsey's monograph within the constraints of brickwork.



WHO BUILT THE WATERWORKS?

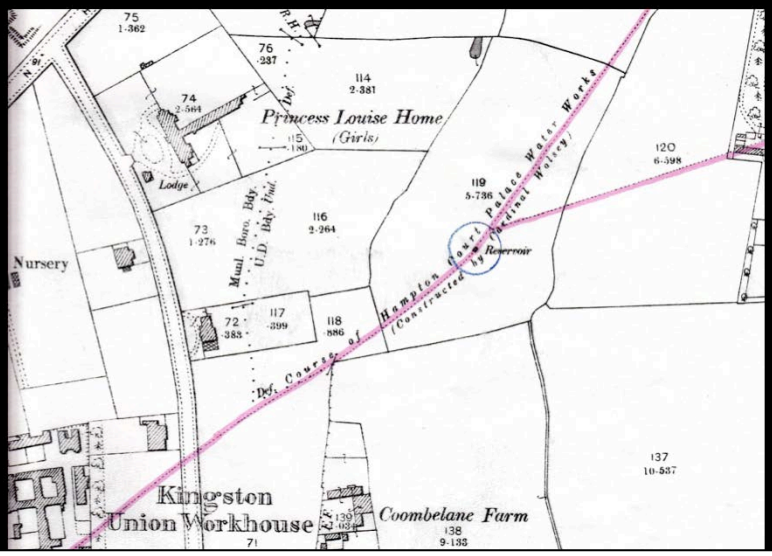
An entry referring to Kingston upon Thames in the Universal British Directory of 1791 stated *"Near the site of the old mansion is Comb House, the residence of major Tollemache; and not far from this are some reservoirs of water, constructed by Cardinal Wolsey, to supply Hampton Court. The water is conveyed under the Thames by pipes of a particular construction. It is much esteemed as efficacious in the gravel; it is excellent for drinking and washing; but is unfit for culinary use, as it turns vegetables that are boiled in it black".* Clearly, the author of this entry in The Universal British Directory believed that Cardinal Wolsey was responsible for the Hampton Court Palace waterworks. The properties of the water will be considered later.



WHO BUILT THE WATERWORKS?

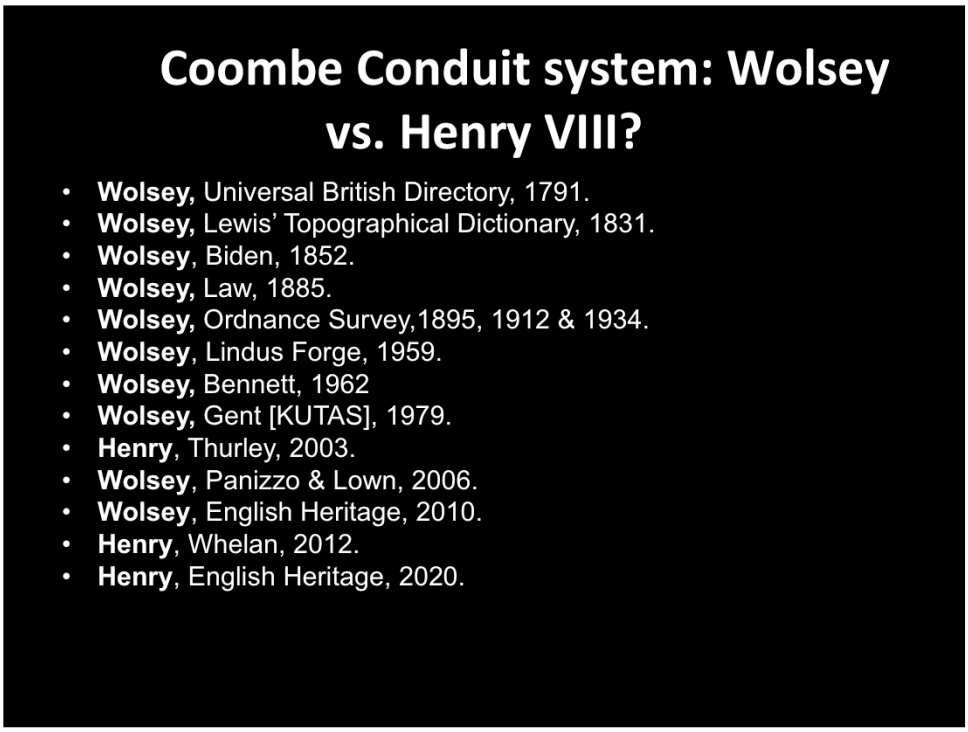
Lewis' Topographical Dictionary of England in 1831 said, among other things, of Kingston upon Thames *"…the inhabitants are supplied with water…from a conduit on Combe hill, the water of which is conveyed also by pipes under the river Thames, laid down by Cardinal Wolsey for the supply of Hampton Court palace.*" Clearly the author of this entry in Lewis' Topographical Dictionary believed that Cardinal Wolsey was responsible for the waterworks.

OS Map, 1895.



WHO BUILT THE WATERWORKS?

A copy of an Ordnance Survey map of 1895, in the collection of the Kingston upon Thames Society, indicated the course of Hampton Court Palace Water Works and attributed it to Cardinal Wolsey. Thus in 1895 the Ordnance Survey, an agency of Queen Victoria's government, believed that Cardinal Wolsey was responsible for the Hampton Court Palace water works. OS maps of 1912 and 1934 in the possession of the author reflected this. Modern OS maps, do not attribute the Hampton Court water supply to Cardinal Wolsey – see above, slide 3.

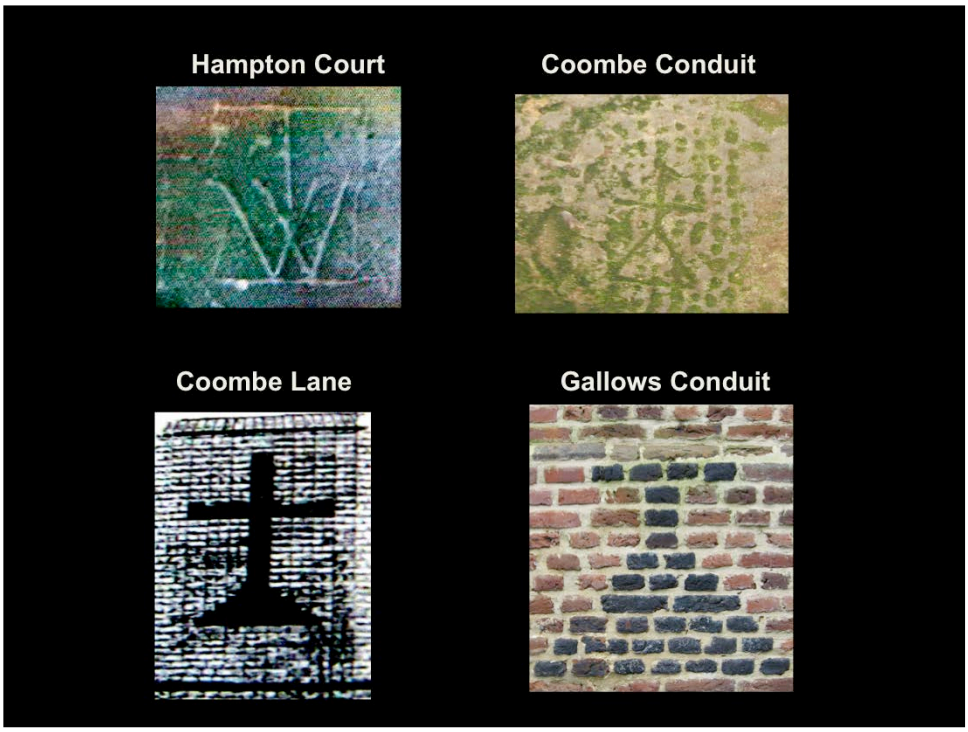


WHO BUILT THE WATERWORKS?

From 1791-1979, eight sources attributed the waterworks to Cardinal Wolsey. In 2003, Thurley attributed it to Henry VIII, while in 2006 Panizzo & Lown attributed it to the Cardinal. In 2010, English Heritage's website attributed the waterworks to Wolsey. In 2012, Whelan attributed it to Henry and at the time of writing this, 29 July 2020, English Heritage's websites gave Henry VIII the credit for the whole water supply system. Up to 1979, the consensus that Cardinal Wolsey built the Conduit system probably was based on local tradition. Thurley, 2003, mainly based his opinion on a discovery of an account of 1541 referring to the sum of £100 for *"Charges of the Condyte from Combhill"*. The inference was that the whole system cost £100 and was completed by 1541, i.e., when Henry VIII occupied the Palace. Panizzo & Lown, 2006, cited the account mentioned by Thurley and attributed the waterworks to Wolsey who because he was head of the Roman Catholic Church in England could requisition land on Coombe Hill, owned by Merton Priory, where the springs were situated. Whelan, 2012, concluded that Henry VIII was responsible for the waterworks on the basis of a detailed hydraulic and architectural analysis. English Heritage's view at different times probably reflected the prevailing theories of the time. More research is needed into this enigmatic area.

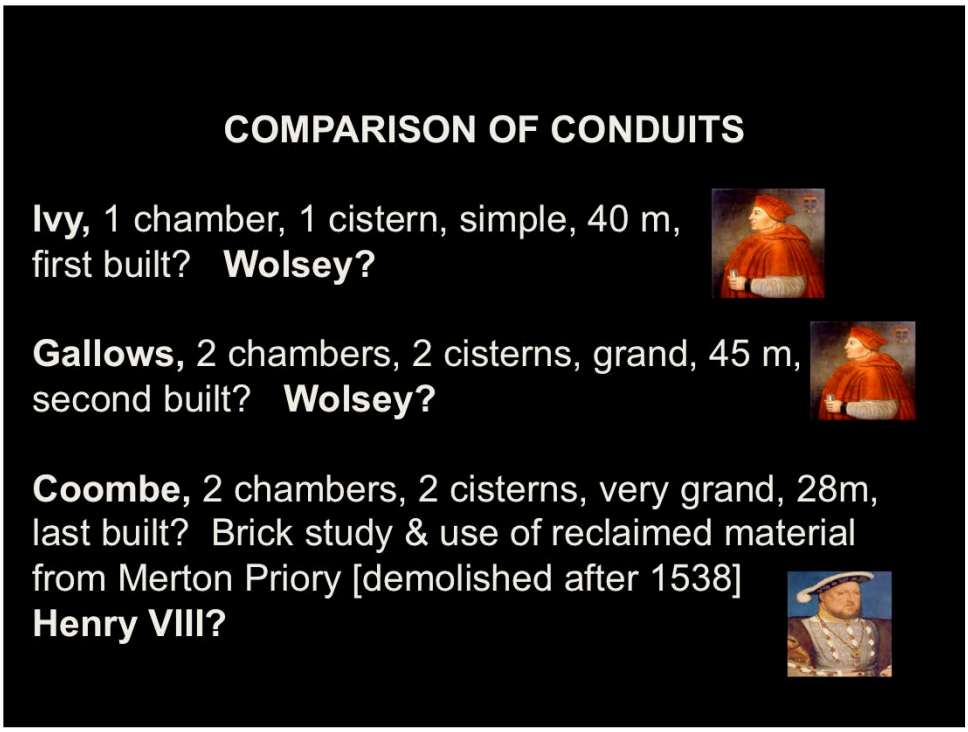
WHO BUILT THE WATERWORKS?

Does the mason's mark, the *"mark of the trinity",* on the threshold stone of Coombe Conduit provide a clue to the person who commissioned the building? This question is addressed next.



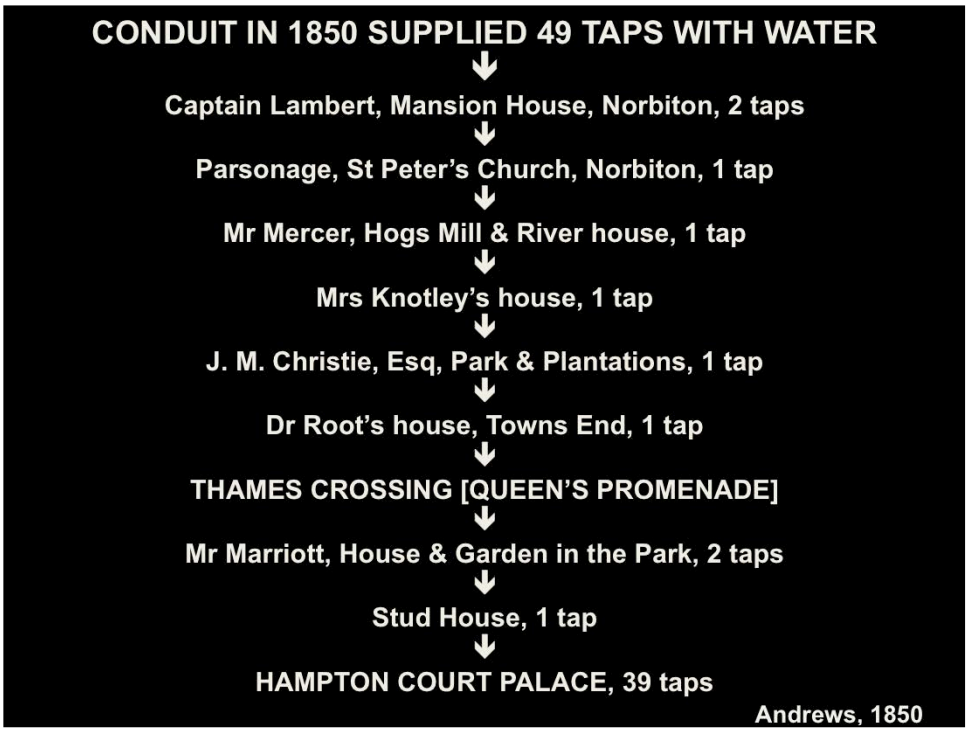
WHO BUILT THE WATERWORKS?

The *"mark of the Trinity"* at Coombe Conduit top right hand corner], a mark on a wall described by Law, 1885, as "*Cardinal Wolsey's cross of black bricks in a red brick wall on the Kingston Road"*, sadly now missing, and what was said by a one-time owner of Gallows Conduit to be part of Cardinal Wolsey's monograph, all look like *"Wolsey's crosses"*. And, if the imagination is stretched a bit, the Cardinal's monograph at Hampton Court also looks similar to the other devices. Additionally, Whelan, 2012, identified a *"mason's mark"*, similar to the "mark of the trinity" at Coombe Conduit. on the stonework surrounding the door of Gallows Conduit. Do all these apparent connections with Cardinal Wolsey identify him as the initiator of Coombe Conduit and Gallows Conduit? This is yet another enigma that needs research.



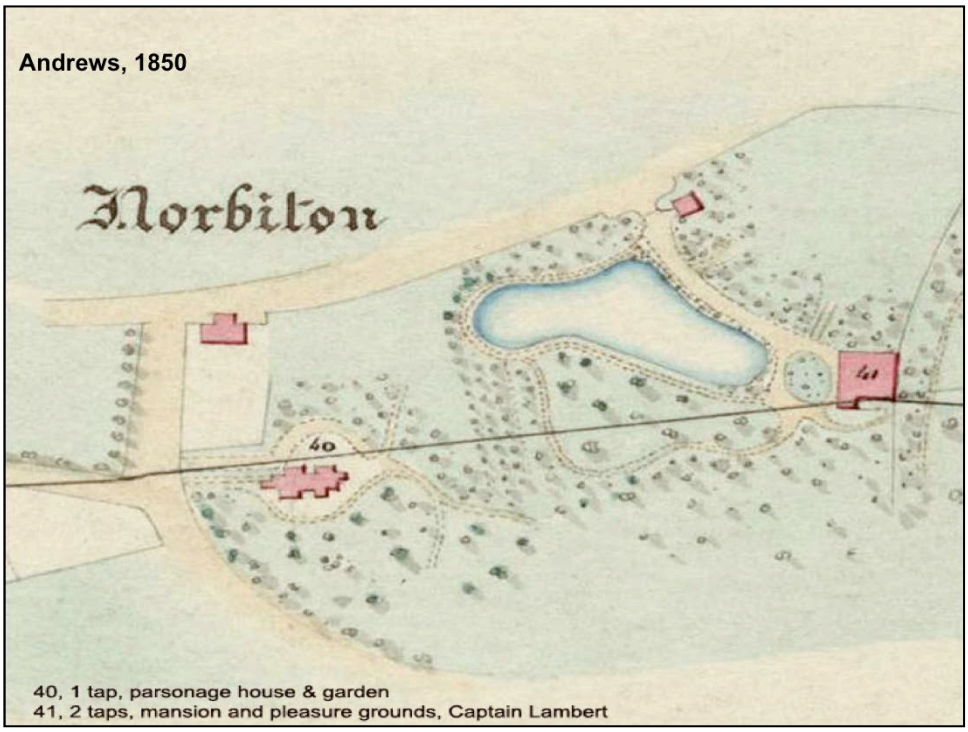
WHO BUILT THE WATERWORKS?

A comparison of the conduits might give an indication of when they were built and by whom. Ivy Conduit is a simple structure with one chamber and one cistern at an elevation of 40 m OD. Gallows Conduit has two chambers and two cisterns at an elevation of about 45 m OD. Compared with Ivy Conduit, it is a grand building. Whelan, 2012, praised the quality of its brickwork. Coombe Conduit has two chambers and two cisterns at an elevation of about 28 m OD. It incorporates reclaimed stonework which if it came from Merton Priory would not have been available until after its demolition, say after 1538. Compared with Ivy Conduit and Gallows Conduit, it is a very grand building. Given that Cardinal Wolsey and Henry VIII are the candidates for the system's initiation, are we seeing a sequence here? Did Wolsey build Ivy Conduit and Gallows Conduit in the time that he occupied Hampton Court Palace, i.e., from 1514-1529? Did Henry VIII build Coombe Conduit further to enhance the water supply system after he occupied the Palace in 1529? Or was Ivy Conduit built by an occupier of the Hampton Court site before Wolsey acquired it? It was concluded that more research is needed into this enigmatic area.



THE SPRING WATER

The survey undertaken by Andrews in about 1850 demonstrated that the Conduit system supplied 47 households with water, i.e., 49 taps in all; two households being entitled to two taps each. Of these, 39 households were *"grace and favour"* apartments in the Palace. Clearly, when the survey was undertaken the supply of water from the Springs on Coombe Hill was considerably more than is available today.

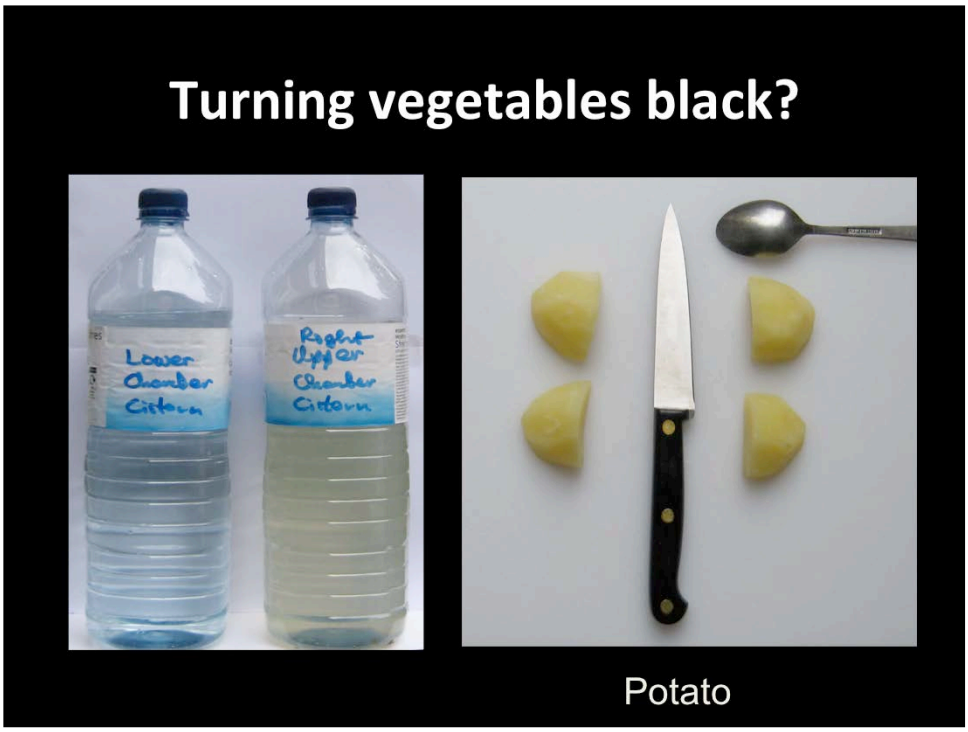


THE SPRING WATER

This section of the Andrews' survey shows the water supply to Captain Lambert, who was entitled to have two taps, and to the parsonage of St. Peter's Church, Norbiton.

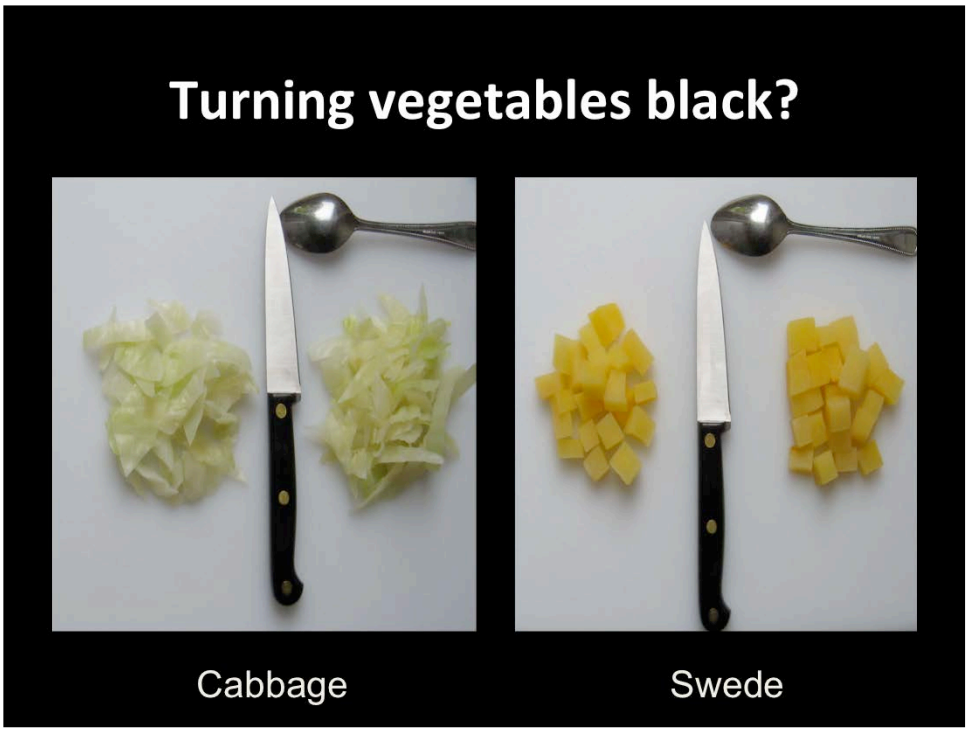
THE SPRING WATER

What is known about the quality of the spring water? Already you have heard a report that it could not be used for culinary purposes because it turned vegetables black when they were cooked in it. Furthermore, you have heard that once it was believed that the spring water was *"much esteemed as efficacious in the gravel",* i.e., the treatment of small concretions in the urinary tract.



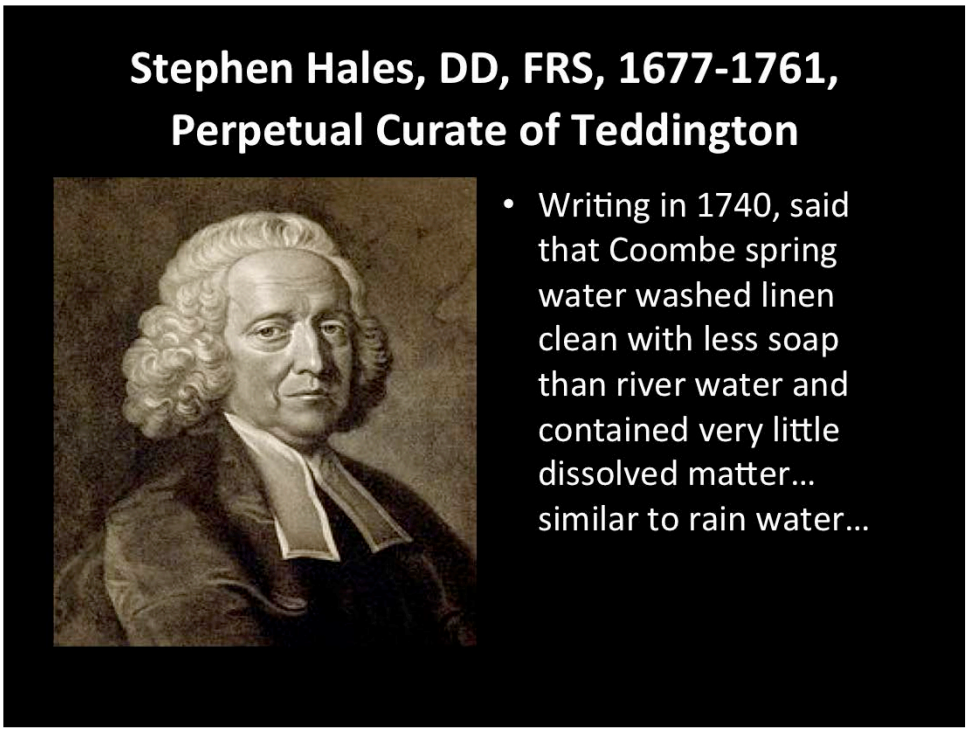
THE SPRING WATER

In 2012, experiments were carried out by the author to see whether Coombe Conduit water turned vegetables black when they were cooked in it. Samples of water were taken from the bottom cistern and from the cistern in the 18thC extension. The water from the bottom cistern was crystal-clear and remained so. The water from the other cistern was turbid with a greenish tinge and remained so, suggesting that it was colloidal in nature. Possibly, this was due to algal or microbial contamination. Portions of potato, cabbage and swede obtained from a local supermarket were boiled in each of the two water samples for up to one hour. They did not turn black. The cooked vegetables did not turn black upon cooling, storage in a refrigerator for one day at 4^{o}C or after storage at room temperature for one day. The potato samples on the left of the knife were cooked in the clear water from the bottom cistern. The potato samples on the right hand side were cooked in the turbid water from the top cistern.



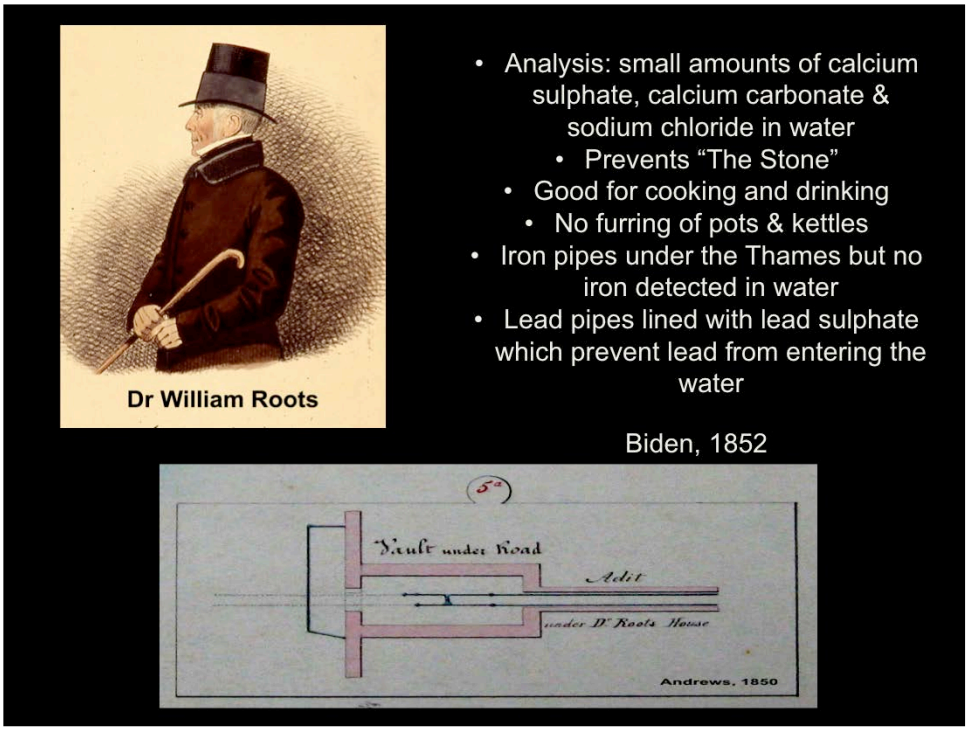
THE SPRING WATER

The cabbage sample on the left of the knife was cooked in water from the bottom cistern. The cabbage sample on the right hand side of the knife was cooked in water from the top cistern. The swede sample on the left hand side was cooked in water from the bottom cistern. The swede sample on the right hand side of the knife was cooked in water from the top cistern. As you can see, none of the vegetable samples turned black upon or after cooking in either of the spring water samples.



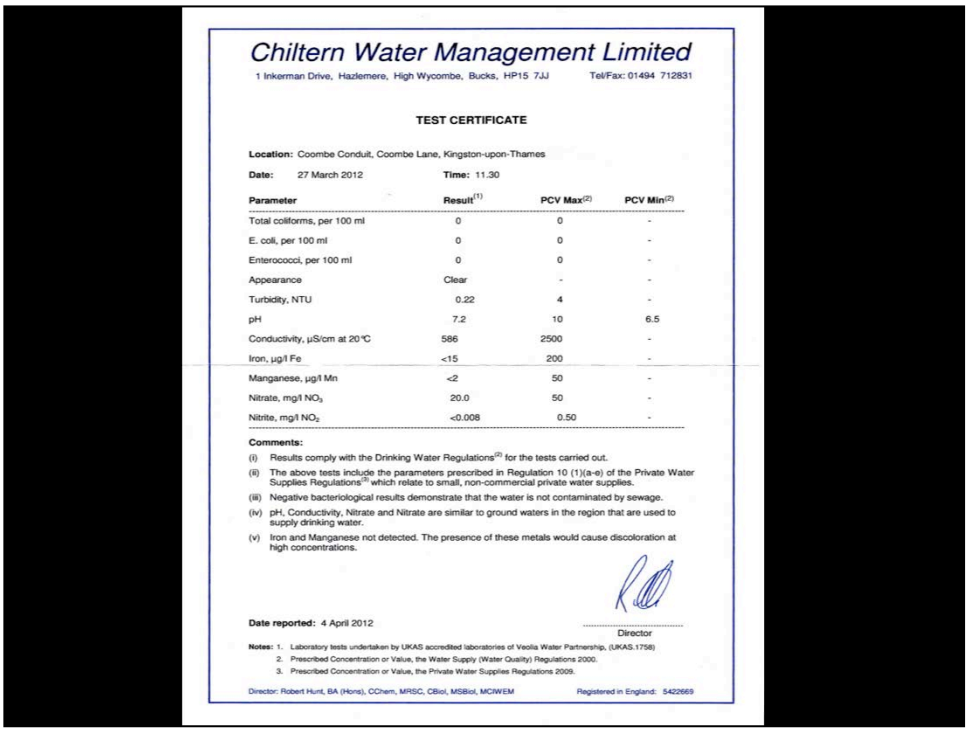
THE SPRING WATER

Writing in 1738, Dr. Stephen Hales, a Fellow of the Royal Society, and the Perpetual Curate of Teddington, said that Coombe Spring water washed linen clean with less soap than river water, contained very little dissolved matter and was similar to rain water. In 1852, Biden wrote that the springs selected by Cardinal Wolsey to supply Hampton Court Palace contained minute amounts of magnesium carbonate and magnesium sulphate.



THE SPRING WATER

Biden, 1852, in an appendix, reported the opinion of Dr. William Roots on the Coombe Hill spring water that he was allowed to take from the vault near his house. The water contained small amounts of calcium sulphate, calcium carbonate and sodium chloride. It prevented *"the stone"* [i.e., concretions in the urinary tract] was good for cooking and drinking, did not deposit fur on pots and kettles and contained no iron even though it had passed through some iron pipes. He pointed out that the inside of lead pipes through which the water passed became lined with insoluble lead sulphate, thus preventing harmful lead ions from entering the drinking water.



Chiltern Water Management Limited

1 Inkerman Drive, Hazlemere, High Wycombe, Bucks, HP15 7JJ Tel/Fax: 01494 712831

TEST CERTIFICATE

Location: Coombe Conduit, Coombe Lane, Kingston-upon-Thames

Date: 27 March 2012 **Time:** 11.30

Parameter	Result[1]	PCV Max[2]	PCV Min[2]
Total coliforms, per 100 ml	0	0	-
E. coli, per 100 ml	0	0	-
Enterococci, per 100 ml	0	0	-
Appearance	Clear	-	-
Turbidity, NTU	0.22	4	-
pH	7.2	10	6.5
Conductivity, µS/cm at 20°C	586	2500	-
Iron, µg/l Fe	<15	200	-
Manganese, µg/l Mn	<2	50	-
Nitrate, mg/l NO_3	20.0	50	-
Nitrite, mg/l NO_2	<0.008	0.50	-

Comments:

(i) Results comply with the Drinking Water Regulations[2] for the tests carried out.

(ii) The above tests include the parameters prescribed in Regulation 10 (1)(a-e) of the Private Water Supplies Regulations[3] which relate to small, non-commercial private water supplies.

(iii) Negative bacteriological results demonstrate that the water is not contaminated by sewage.

(iv) pH, Conductivity, Nitrate and Nitrate are similar to ground waters in the region that are used to supply drinking water.

(v) Iron and Manganese not detected. The presence of these metals would cause discoloration at high concentrations.

Date reported: 4 April 2012

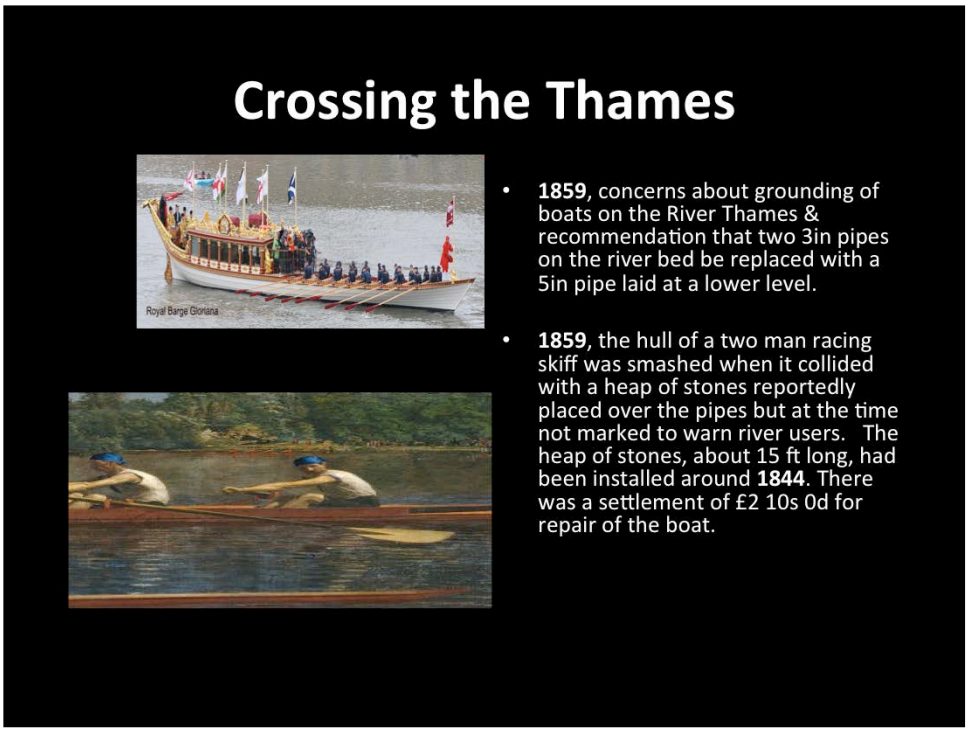
Director

Notes: 1. Laboratory tests undertaken by UKAS accredited laboratories of Veolia Water Partnership, (UKAS.1758)
2. Prescribed Concentration or Value, the Water Supply (Water Quality) Regulations 2000.
3. Prescribed Concentration or Value, the Private Water Supplies Regulations 2009.

Director: Robert Hunt, BA (Hons), CChem, MRSC, CBiol, MSBiol, MCIWEM Registered in England: 5422669

THE SPRING WATER

In 2012, an analysis was commissioned of the clear water taken from the bottom cistern of Coombe Conduit. The results were in compliance with the requirements of the prevailing Private Water Supply Regulations. There was no evidence of contamination by sewage. The pH result indicated that the water was close to being neutral in terms of acidity and alkalinity. The conductivity was low, indicating that the amount of dissolved matter, including nitrate and nitrite, was low. These results indicated that the Coombe Conduit water was similar in quality to ground water in the region that was chosen to supply drinking water. Iron and manganese, elements that in high concentration could possibly turn vegetables black when cooked in a water, were not detected. Overall, the results indicated that the water was fit for drinking.



THE LATTER DAYS

The pipes that crossed the Thames were a cause for concern, it was reported that anchors of barges fouled the submerged pipes despite the protection afforded by pebbles layered onto them. In 1859 there were concerns about the grounding of boats on the pebbles and the hull of a two-man racing skiff was smashed by collision with a heap of unmarked stones installed for the protection of the pipes. There was a settlement of £2 10s 0d for the damage caused to the boat.

Lifespan of Conduit system.

- Spring water supplied to Palace from 1540, perhaps earlier.
- Maintenance costs.
- 1876, concerns about water quality & the quantity available.
- Thereafter, Palace supplied from Hampton waterworks.

THE LATTER DAYS

In the nineteenth century concerns increased about the maintenance and repair costs of Conduit water supply system that had served Hampton Court from at least 1540. For example, when the new Kingston Workhouse infirmary was built in 1868 over the line of pipes from the conduits, it was necessary to install in the basement a drain to collect water that leaked out and there was evidence that the pipes had been repaired many times beforehand to address leakage. In addition, increased building works in the area meant that agreements had to be made with new landlords along the route of the pipes. Sewers and cesspits along the route brought fears of contamination. Eventually, a decision was made to obtain drinking water for the Palace from a commercial source. After 1876 the Palace was connected to a waterworks at Hampton.

Disposal of buildings and pipes

- **1895**, about 348 yd of 2in diameter lead pipe on Duke of Cambridge's estate. Older sections, 42 lbs/yard; newer sections, 27lbs/yard. Some lead pipes had been replaced with iron ones.
- **Dec. 1895**, HM Treasury approved an offer of £75 for the pipes and Conduit Houses on the Duke of Cambridge's estate.

THE LATTER DAYS

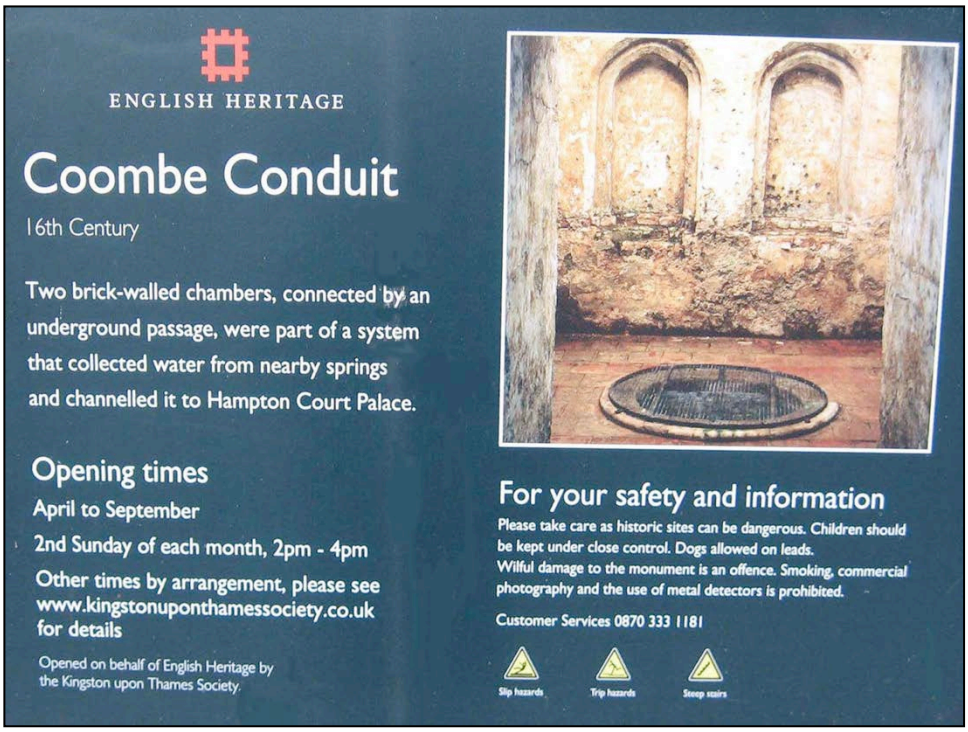
In 1895, about 348 yards of two inch diameter lead pipes were found to be on the Duke of Cambridge's estate. The older sections weighed 42 lbs/yard [about 21 kg/m] and the newer sections weighed 27 lbs/yard [about 13 kg/m]. Some sections had been replaced with iron pipes. After much negotiation, HM Treasury, in December 1895, accepted an offer of £75 for the pipes and conduit buildings on the Duke of Cambridge's estate and they became his property.

THE LATTER DAYS

After the Duke of Cambridge acquired the land around Coombe Conduit, it was sold and a house called *"Coombe Springs"* was built there. It is shown on the 1899, six in to one mile OS map, that was surveyed in 1893-1895. In the Census of 1901, the house was occupied by Mr. Hwfa Williams, his wife Florence, their daughter Gwnfra and seven servants. Hwfa Williams was a major shareholder in the Sandown Park Race Course and its manager. He was a friend of King Edward VII and his wife was a renowned society hostess. Panizzo & Lown reported that Mrs. Williams considered having the spring water bottled for sale but did not pursue this idea because when it was tested it showed evidence of pollution. Hwfa Williams died at Coombe Springs in 1926. Mrs. Williams fell on hard times, the Coombe Springs estate was neglected and she was reduced to living with only one maid. In 1941 the estate was taken over by The British Coal Utilisation Research Association [BCURA] for the duration of the war. BCURA's principal was John Godolphin Bennett and more will be said about him later. Mrs. Williams died in 1945, aged 91, in nearby Coombeland Cottage. On 1 September 1906, the Surrey Comet suggested that Coombe spring water, rather than going to waste, could be used in the creation of an open air swimming pool or to feed an existing swimming pool in Kingston. This idea came to nothing.

THE LATTER DAYS

In late 1945 John Bennett purchased the Coombe Springs estate and with his wife founded a residential college called *"The Institute for the Comparative Study of History, Philosophy and the Sciences."* In 1946 The old laboratories of BCURA were converted into bedrooms and remedial work was started on the neglected estate. The philosophy of the Institute was based on the teachings of the sage George Ivanovich Gurdjieff, who was born in Armenia. He had been influenced by eastern mysticism and believed that a higher level of consciousness could be attained through lectures, dance and physical labour. The picture is of Coombe Springs as it was in about 1959. In his autobiography *"Witness"* Bennett wrote that regularly he bathed in the spring water and how his pupils began their day with *"a pilgrimage to the Spring House for a plunge in the icy spring water".* In 1966, a decision was made to close the Institute and Coombe Springs was given to Idries Shah, a Sufi mystic. Thereafter, the estate was sold, the house was demolished and the present estate of 28 houses in Lord Chancellor's Walk was built. Coombe Conduit became a Listed Building on 30 May 1951 under the care of the Ministry of Public Buildings and Works. Restoration work started in 1956 and today Coombe Conduit is maintained by English Heritage. Sadly, the pure spring water still goes to waste.



PUBLIC OPENINGS OF COOMBE CONDUIT

At the time of writing this, 9 August 2020, Coombe Conduit, one of Kingston's most important ancient monuments, is closed because of the ongoing Covid-19 pandemic. It is hoped that it can be opened to the public as soon as HM Government's restrictions are lifted. Then again, in its atmospheric interior visitors will be able to see crystal-clear pure water still flowing into its cisterns.

ACKNOWLEDGEMENTS

ACKNOWLEDGEMENTS

Michael Davison and other volunteers from the Kingston upon Thames Society for their help and support.

Michael Davison also made helpful comments on an earlier draft

Anne Baker – images of KUTAS excavations in 1970

Patrick Whelan – research findings

Jon Cotton – Picture of Dr. William Roots

John McCarthy – computer enhancement of images and helpful comments on an earlier draft.

BIBLIOGRAPHY
INTERNET SOURCES

INTERNET SOURCES

Kingston upon Thames Society

http://www.kingstonuponthamessociety.co.uk

Friends of Kingston Museum & History Centre

https://www.kingston.gov.uk/info/200239/museum_and_history_centre/540/friends_of_kingston_museum_and_history_centre

English Heritage/Historic England websites, Coombe Conduit, Ivy Conduit & Gallows conduit

https://www.english-heritage.org.uk/visit/places/coombe-conduit/

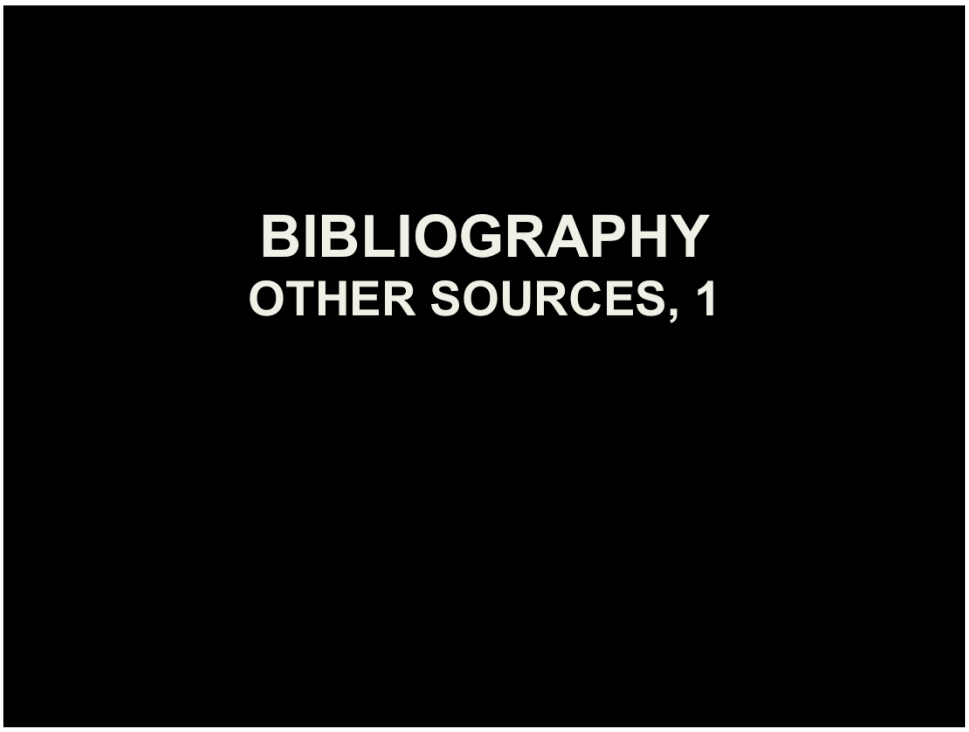
https://historicengland.org.uk/listing/the-list/list-entry/1080099

https://historicengland.org.uk/listing/the-list/list-entry/1080063

https://historicengland.org.uk/listing/the-list/list-entry/1080062

Geology of the Coombe Hill area

http://londongeopartnership.org.uk/wp/wp-content/uploads/2018/11/Richmond-Park-Geotrail-2017-web.pdf



OTHER SOURCES, 1

Hampton Court Palace water supply. Plan showing run of Cardinal Wolsey's water supply from Coombe to Hampton Court, about 1718-19, National Archives, WORK 34/104.

Coombe Conduit and new Kingston Infirmary, 1868, National Archives, WORK 9/5/7

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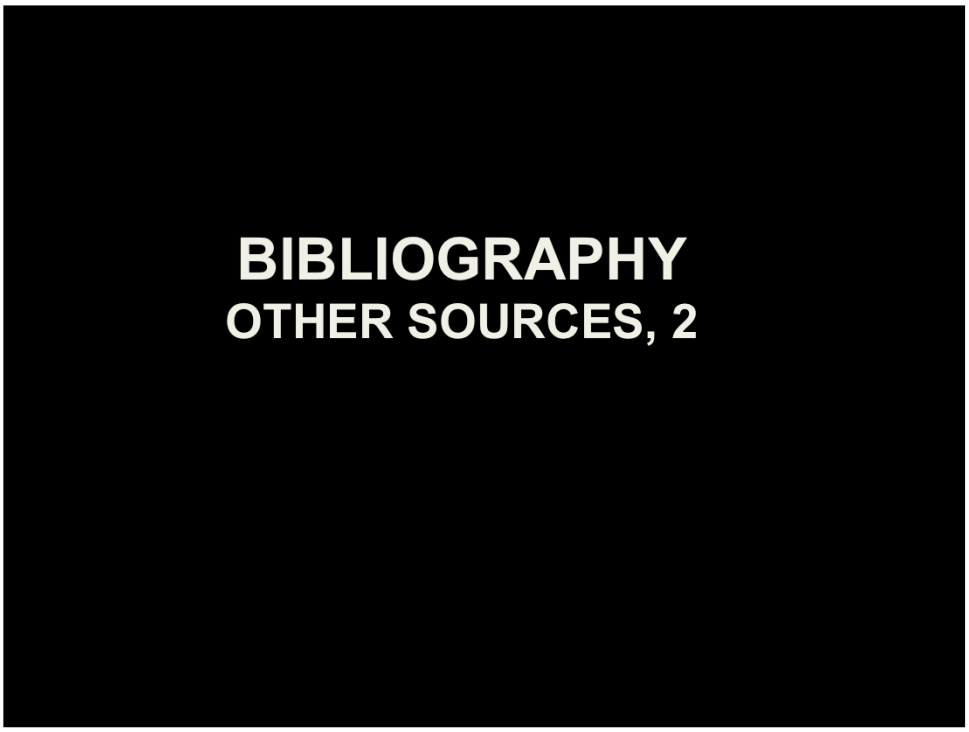

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