The Waterways of the Royal Gunpowder Mills

Though legend has it that Alfred the Great had channels dug to thwart the Danes in 895 and millstreams at Waltham Abbey are recorded in the Domesday Book in 1085 the earliest surviving map of the area is held in the archives of the Marquess of Salisbury at Hatfield House. This map shows the waterways at Waltham Abbey in 1590. A Fulling Mill is marked where Powder Mills are shown on Powder Mill River on the 1767 map. It was on this site that the present Gunpowder Mills started. In the early 17th century this Fulling Mill was converted to an oil mill. Then a deed of 1669 tells us that the "Oyle Mill... now lately converted into two powder mills...for the grindinge, boylinge, corninge and drying of powder". In 1735 Mr J. Farmer produced a detailed view of the Powder Mills and in 1770, Peter Muilman wrote of "several curious gunpowder mills, on a new design, worked by water (the old ones having been worked by horses)". The Mills were described in 1735 as "The largest and compleatest works in Great Britain".

Yet at the heart of this was a profoundly simple element — water. The Mills were reliant on the most complex and intensive use of waterways ever seen at a single British location. The system of canals, locks and aqueducts permitted not only an efficient internal conveyor system for raw materials and finished product — and a link to the ports, via the River Lea — but also segmented the site into separate zones to minimise casualties in the event of the inevitable unexpected detonation, exclusively utilising wooden barges to maximise levels of safety in the explosive atmosphere.

When canals were first built in England the use of puddling clay to line and waterproof the channel was almost universal. A cross-section of a typical canal showed a flat bottom which sloped up at either side to the banks.

When the canals in the Mills were dredged during the decontamination process in the early 1990s, it was revealed that the early channels, at least, were built with timber reinforced vertical sides.

Photo Richard Thomas

There were only two canals initially and both were in place by 1806. They gave access from the Millhead Stream, and thus the mills lining that waterway, to corning mills both built close to the River Lea. The Lea was six feet lower than the Millhead, which provided the head necessary to drive the waterwheels. Thus, some of the canals within the site were dual purpose; using the water flow to drive the machinery and the surface to move the purpose built boats which carried the gunpowder ingredients and compounds as they proceeded along the manufacturing flow line.

The third channel, built in 1806, was the Powdermill Stream which provided a connection between the Millhead Stream and the relatively new Lee Navigation. This had been built in 1770 and gave a wide modern pound-locked channel directly to the Thames, without the shallows, bends, mills, weirs and flashlocks of the old Barge River. The Navigation was 2 foot 6 inches lower than the Millhead so it was necessary to build Edmonsey Lock to overcome the difference.

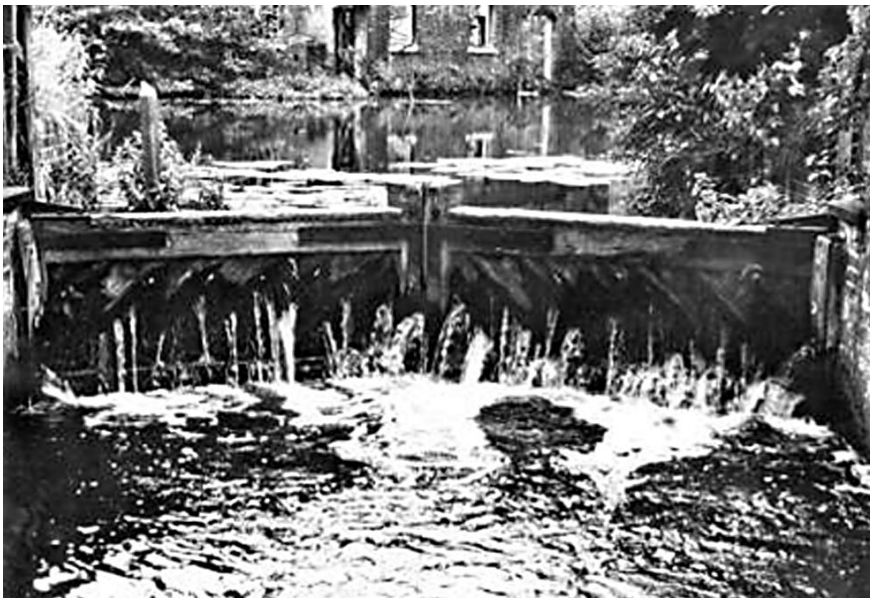
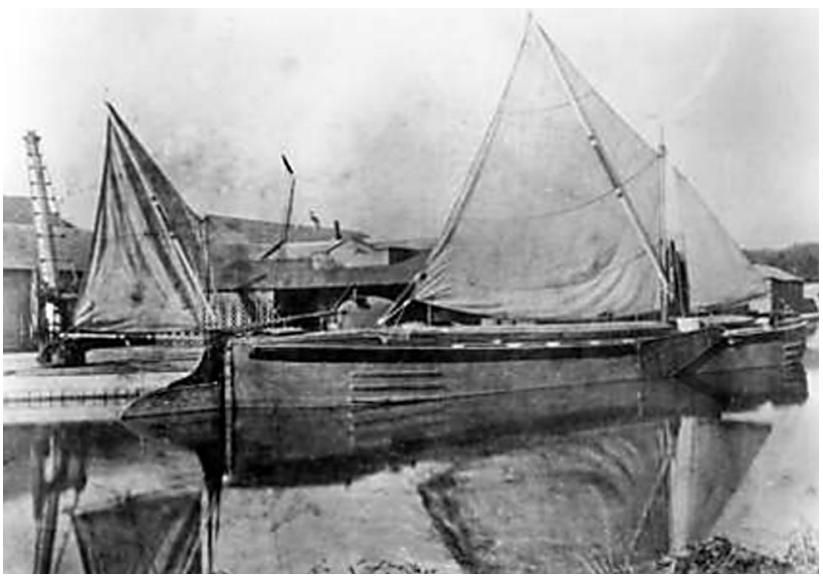


Photo Christine Richardson

There was now a direct waterway connection between the Grand Magazine holding the finished gunpowder and the magazines at Purfleet, without passing through the Mills. By 1806 there were already at least five barges carrying gunpowder between Waltham and Purfleet. One of the gunpowder sailing barges, Lady of the Lea built in 1933, still survives.



Lower Island was established, with its supporting waterways, to the south of Highbridge Street soon after 1806. By 1827, there were a number of small waterways serving the lower part of the Mills just to the north. A survey in 1814 included the information that there were “five barges, nine powder boats, two ballast barges and six punts

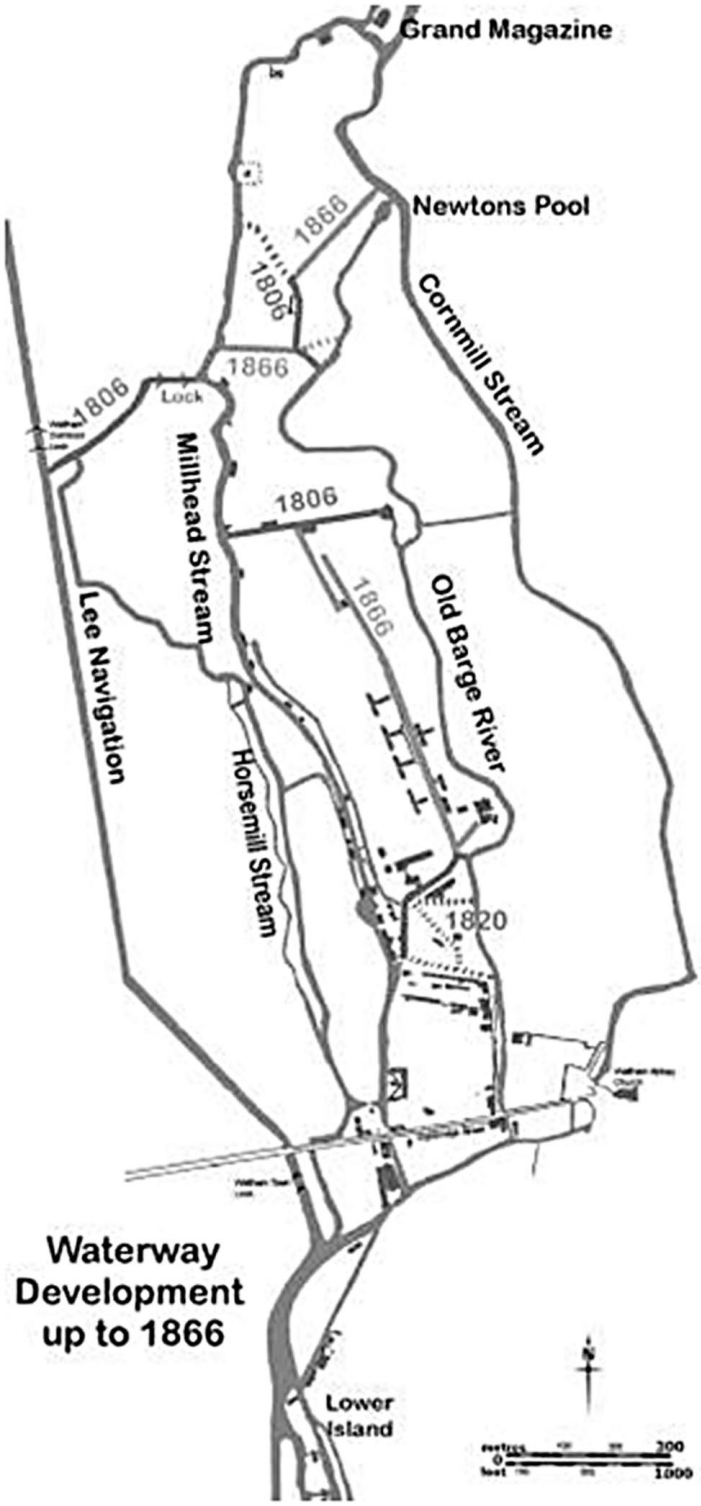
The coming of steam power signalled the end of the Mills’ dependence on water power with, in 1857, the building of the new Group A Mills with their associated boiler house and beam engine on a site to the south of Queens Mead, together with the provision of a number of carriage only channels.

These waterways were designed not to provide flowing water power to millwheels but solely to transport materials to and from the incorporating mills, although the northern part of the Queen Meads channel did act as a tail stream for the blank cutting house situated on a side cut from one of the original pre-1806 canals.

The Waterway Development map shows the three dates on which surveys were taken, 1806, 1820 and 1866. The application of a date to a waterway indicates only that it was in existence by that date; it is not the date the waterway was built.

Waterways within the Mills which later became extinct are shown as dotted lines.

The next surge of canal building came in 1878-9. The waterways were needed for access to the new nitro-glycerine, guncotton and cordite processing buildings. This expansion provided two cast iron aqueducts where the canals crossed the River Lea and a lock which connected the upper and lower levels of the canal system, as well as over a thousand yards of waterway. The aqueducts were probably floated into position on barges on the Lea, as they are both made of two side plates, each a solid casting, bolted to the base plates on site. One survives in very good condition and can be seen just south of the Burning Ground.


Grand Magazine
Newtons Pool
1868
1806
1866
Cornmill Stream
1806
Lock
Millhead Stream
1806
Lee Navigation
1806
Old Barge River
Horsemill Stream
1820
Waterway
Development
up to 1866
Lower
Island
200
1000

Aqueduct near the Burning Ground (Richard Thomas)

The 1878 lock was built to link the existing channel serving the Blank Cutting House (this building has been restored) and the canal connecting with the Incorporating Mills on Queen Meads. Although the lock appears to protrude above the surrounding landscape, it must be remembered that decontamination removed about two feet of topsoil. The original water level can be easily judged by the white lime staining on the abutments.

View of the 1878-9 lock chamber (Richard Thomas)

The paddle and sluice gear are of particular interest. The culverts are quite small and circular in section. The sluice gates are made of cast iron and are similarly circular in shape. The paddle gear is operated by a worm drive. These features would combine to make it impossible to fill the lock quickly. There would have been virtually no turbulence to throw the powder boats about, thus minimising the risk of banging the boat against the lock-side with possible catastrophic results. It also seems that the men who built the lock did not assume that the Mills' boatmen knew about lock operation; carved into the granite coping stones by the paddle gear at the top and bottom of the lock are the words "IN" and "OUT".

The footbridges over the canals were built to allow passage of the semi-cylindrical boats that carried the raw materials around the site. If a boat was passing through a bridge, men were forbidden to cross for fear that grit falling from their boots might contaminate the cargo.

In 1888, the acquisition of Quinton Hill Farm allowed the Royal Gunpowder Mills nearly to double in size. Nitro-glycerine, guncotton and cordite were all manufactured on this new South Site. There was an extensive waterway system accessing the cordite drying stoves. A lock was built at the southern end of Lower Island to allow waterway connection without using the Lee Navigation which would have attracted a toll. In 1896, the last of the four locks of the Royal Gunpowder Mills complex of waterways was built connecting the Millhead Stream to its tailstream level, six feet below. This enabled a more direct route from the South Site and Lower Island to the Grand Magazine on the North Site. By 1897, the increase in demand for cordite instigated the building of even more cordite drying stoves and the First World War created still further demand. The resultant extension of the waterways brought the canal system to its maximum extent of nearly 10 miles. The third cast-iron aqueduct was installed in 1904. This one was of a different design, supported on two girders and built in sections. The remains of the brackets which carried the towpath can still be seen. The bottom plate has fractured and fallen away, possibly as a result of two nearby explosions in 1940.

The canals were used up to the time of the Second World War, though with decreasing frequency. The last waterway to be built at the Royal Gunpowder Mills came about as a direct result of the massive nitro-glycerine explosion in 1940. The Court of Enquiry into the explosion recommended: “Transport. Quick boat transit can be facilitated by... connecting the high level canals between No 4 Mixing House and No 6 Mixing House...” The new canal was estimated to cost £2000. The relatively high price was no doubt due to the fact that the two houses were separated by the Old River Lea and an aqueduct would be required. Nonetheless, this structure was obviously a product of the austerity years. It consisted simply of concrete pipes laid side by side in the bed of the river with a concrete channel built over the top. No cast iron and royal insignia for this one, just the date cast in the concrete!

Since the Royal Gunpowder Mills closed in 1945 no use has been made of the canal system. Many of the waterways at the north end drained or choked with weed. Even where they remained, they became part of a secret nature reserve. This was rudely disturbed when the site was decontaminated in the early 1990s but it has not taken long for nature to reassert itself. The South Site has disappeared, partly under a housing estate, partly under Sainsbury's Distribution Depot and partly under the re-landscaping of Gunpowder Park, managed by the Lee Valley Regional Park Authority. Parts of Lower Island are under the M25 and the Lee Flood Relief Channel. The surviving waterways and the ruins and restored buildings on their banks bear witness to a sometimes explosive but always fascinating past.

The march of progress... the Lower Island Lock. disappears under the embankment for the M25

Richard Thomas

An abridged version by Chris Bushill originally published in "Meridian Cuttings" from Richard Thomas' booklet.