The Well at East Hanningfield Rectory

The well at East Hanningfield Rectory was part of the story of my childhood, and a fascination for friends and visitors, although its original function had ceased many years before my time. The unusual story of its construction, as a parish project to provide clean water for the whole community, 100 years ahead of any piped supply, deserves retelling. It still exists, as built, just under the surface of the redeveloped rectory site, and could still, with modern technology, fulfil something of its original purpose.

At 475 feet deep, this well is reputed to be the deepest hand-dug well in Essex. Sunk inside one year, between June 1790 and May 1791, it was the brainchild of the then rector, the Reverend John Nottidge. Three generations of Nottidges had held the living at East Hanningfield, (all called John….) and this incumbent wished to change things that had affected his forebears, and more especially his parishioners, of whom he was very supportive. Rev. Nottidge was determined that East Hanningfield should have a clean and reliable source of drinking water, and that if he dug a well at the rectory, then all his parishioners could have access to it. (He also made major improvements to the *old* All Saints Church, a mile from the rectory, to increase the comfort of his parishioners during services).

East Hanningfield was a large rural parish of around 700 souls, and John Nottidge was very concerned that on this relatively high ground in Essex, there were a few seasonal streams, and field ponds, but no really reliable sources of drinking water. All water for drinking had to be boiled, and at his rectory there was evidence for this, in the shape of a dedicated brewery/ bakehouse, and a cellar beneath the rectory, with an external staircase into it, opposite the brewery, wide enough to take barrels of beer, which was the only safe drink at this time. After the rebuilding of the rectory in the 1860's, this building became the laundry of the rectory.

My father said that John Nottidge recorded details of the project in what he described as his 'Commonplace Book', but I have never seen this document, which doesn't appear to be held with other parish records in the Essex Records office in Chelmsford. The project is however recorded in a letter, published I believe in the July edition of the 'Gentleman's Magazine' for 1791.

I think it is worth reproducing here in its entirety, and with its original spelling.

"Mr Urban, 1791 Essex July 8th.

Unacquainted as I am with the measurement of the deepest wells in this kingdom, I conjecture *that*, at length fortunately completed by the Rev. Mr Nottidge, at East Hanningfield parsonage, near Chelmsford, to be sufficiently extraordinary to merit your notice. It was begun June 21, 1790; and water, when the workmen, from such tedious labour, were at the moment of despair, was found May 7th, 1791. Thirty-

nine thousand and five hundred bricks were used, without cement, in lining this well; the soil of which, for the first thirty feet, was a fine, light brown, imperfect marle: and although fossils may ingeniously chuse to discriminate the different strata, yet, except from shades of a deeper colour and firmer texture, occasionally, but slightly, mixed with a little sand and a few shells, the same soil, to a common eye without more material variation, continued to four hundred and sixty feet; where it was consolidated into so rocky a substance, as to required to be broken through with the mattock. A borer then of three inches diameter, and fifteen feet in length, was tried; which soon, through a soft soil, slipped from the workmans's hands, and fell up to the handle. Water instantly appeared, and rose within the first hour one hundred and fifty feet; and after a very gradual rise now stands at three hundred and fifty feet; extremely soft and well-flavoured. This source is supposed to supply the well at Battle's Bridge, about six miles further, and lower than Hanningfield, which is three hundred and forty seven feet in depth, and the water overflows the brim. At Bicknacre Priory, and mile and half in descent from Hanningfield, is a well (nearly, from neglect, choaked up) only four feet in depth.

The price of labour at Hanningfield well was, on a diameter of five feet three inches, four shillings *per* foot for the first forty feet, and one shilling advance at each successive forty feet.

Yours, &c. PHILUDROS

John Nottidge did not record the building cost for his record, but allegedly concluded his account with the words ***"I, John Nottidge, paid the piper."*** Based on the rates given in the letter, he may have had to fork out over £200 in digging costs alone, which was a significant sum at a time when a servant might be working for £12 per year. We are given to believe that the workmen who 'broke through' were apparently the third team to try to hit water……surely there must have been some significant financial incentive for that last team to restart the dig.

Mark out a circle 63 inches across, and imagine working inside that space, in almost total darkness (probably just one or two candles) with a shovel, having been lowered 400 foot down the narrow shaft by the winchman, with your feet and your shovel in the bucket, clinging to the winch cable for dear life. That's like been lowered from the top of the cross on St. Pauls Cathedral, and then some more – an interesting way to start a day's work. Over a shift, working in stale air, and almost no light, the well sinker would be digging out clay from around the elm and iron frame on which the bricks, lining the shaft, rested. Digging out the clay evenly around and under the frame allowed the weight of the brick lining to drive the cutting edge of the frame deeper and deeper into the clay. Failure to remove the clay systematically would mean that the shaft would not sink straight. (We don't think the well went straight down, but rippled slightly side to side as it went down, so perhaps this ***was*** a problem….) He then had to load the spoil into the bucket he came down in, for it then to be hauled to the surface, time and again. He would be hoping, of course, that the winch cable would not snap, or that he would always dodge the bucket as it

came back down, or that the team dry-laying the bricks at the top of the shaft did not dislodge one down the shaft onto him. In that cramped space, 63 inches across, (less the thickness of the brick lining, say around 54 inches in total), there was little room to dodge buckets or bricks. Clearly it would not be a job for the claustrophobic!

If we look in quantitative terms at the task that faced the well sinking teams (the volume of material removed in constructing the shaft), the basic figures are indicated by the letter of 1791.

The shaft diameter is stated as 63 inches. I assume that this is the excavated diameter, not the inside diameter of the brick-lined shaft (about 54 inches)**.** Digging stopped at 460 feet.

Working on the ***excavated*** diameter, 63 inches (**or 1.6 metres**), and a total depth to that diameter of 460 feet (**140.2 metres**) then the volume that had to be removed was:

3.142 x 0.8 x 0.8 x 140.2 = **281.9 cubic metres**.

Density of the London Clay is between **1.9 to 2.2 Mg/cubic metre**, or around 1900 – 2200 kg per cubic metre. ('Characteristics and engineering properties of natural soils' Tan et al, 2003, Swets and Zeitlinger, Lisse, ISBN 90 5809 537 1)

On the basis of the above data, then the total weight of clay spoil removed was between **540 tonnes** and **620 tonnes**. Given the dates for the project, this suggests an extraction rate of at least 1.7 tonnes per day, but since it is unlikely that the project ran 24/7 for the 330 days it took to strike water, then the actual daily extraction rates must have significantly exceeded this figure.

It is not recorded what an average working day would dig out, or how many working days were needed to complete the shaft. Every scrap of soil had to be loosened and dug out by hand, before being loaded into the winch bucket. We assume that horse power may have been used to raise the spoil, but there is no record that that was in fact the way it was done. Even barrowing that material away from the shaft head would be no mean task.

After an unknown time spent at the base of the work each day, the well sinker, the skilled digger of the team, would call down an empty bucket once more, get himself and his tools into the bucket and signal the banksman to be hauled back up to the surface. If a cable broke, or something went wrong 'up stairs', there was no way out. It's no wonder earlier teams gave up when they failed to hit water.

On top of the initial construction costs, there must have been extra costly issues due to the construction of the substantial well head winding gear, which would have been required to shift the spoil out of the shaft for the 11 months of work, before they broke through into the chalk aquifer under the London Clay. It's likely that the same winding gear was used to draw water from the new well, as the initial water level was 110 foot below ground level.

We have no existing description for what was actually used for the well sinking operation, or how it might have been adapted subsequently, although we have a pretty good idea of what it ***might*** have looked like from the surviving remains of horse gear from the early coal mines. (I have attached a sketch of a very basic' horse gin', which was a fairly simple piece of winding gear, easily constructed by any competent millwright). As a relatively impoverished country parson, he might have had some difficulty raising enough capital to install anything very elaborate, but it's possible other landowners in the parish may have assisted in paying for a system that would benefit the wider population of the parish.

An additional cost must have been the 39,500 bricks lining the well. It is possible that they were made on site, as the field pond between the two rectory fields west of the rectory was believed to have been a brick clay pit, possibly first used to make the bricks for the beer cellar of the old rectory (the original part of the rectory cellar was an arched brick vault, with an extension into a wine cellar, under the east end of the rectory and, in my time, directly under the front hall). However, from the evidence of the task of digging the well, it was 'clay all the way down', and by the time they had reached the 460 foot mark, they would have removed over 280 cubic meters of clay spoil. Some of that, at least, may have been recycled as bricks.

We have no record of the shaft head / well head arrangements, but they must have been substantial, with at the very least, towards the end of the work, a windlass with a capacity of 500 foot of cable, simply to winch out the tonnes of spoil. A common system seen elsewhere, used animal power in a treadmill or in some form of 'horse gear' where the animal walked in a fixed circle, driving the windless, to operate the buckets. With larger diameter shafts, as in some of the coal mines, a 'two bucket' system was used, with counterbalanced buckets on each end of one length of cable wrapped around the gin drum; once one bucket had been raised to the surface, the direction of rotation of the winding drum would be reversed to lower that bucket and raise the second bucket. It appears that at each reversal, it would have been necessary to brake the winding drum, and reverse the coupling of the horse (or horses) to the beam turning the winding drum, which sounds quite a procedure. However, it is known that something like this was done at many mines that did not have steam engines or a water wheel to drive the winding equipment. I'm not sure whether it would be practical to work two buckets in a shaft only 54 inches in diameter.

It is possible some form of horse gear was used at Hanningfield from the beginning, as the remains of the 'walking track' used by such a system could be seen during my childhood, in the form of a big circle of blue engineering brick set into the yard, where the horse or donkey walked round and round – engineering brick would resist the wear and tear of hooves on brickwork.

We understand that parishioners could collect water free of charge before 10 o'clock, so there was probably some form of cistern at ground level that the buckets were emptied into, and from which smaller buckets could be filled.

It must have been interesting to operate a winch and bucket system, as not only is there quite a long way down to the water, but as I've said it seemed to ripple slightly on the way down; however, the system worked for more than fifty years, until the rectory, a Jacobean timber house, (shown in John Walker's map of the Ingatestone Hall estate, drawn in 1610) and known by generations of incumbents, was replaced by a completely new brick built building in 1863 – 65. (***I can only give my own observations about the alignment of the shaft from childhood memories; if you dropped a stone into the well in the hope of hearing a splash you were disappointed. All you could heard was the echoes from the stone bouncing off the brickwork, which seemed to go on for ever. I never heard a splash, ever).***

Once the new rectory was completed, the yard around the well was now almost completely enclosed. The old kitchen bakehouse building (originally separate from the timber rectory) was incorporated as a wing of the new build. The well had been dug not more than fifteen feet from the original outside door of the kitchen block, and in the new configuration of the rebuild, the well head was immediately outside a lean-to passageway built onto the wall of the old kitchen. The new outside door at the end of the passageway was no more than five foot or so from the edge of the shaft.

The old brewery building was converted into a laundry (with the addition of a new soft water supply, an early example of rainwater harvesting) and a stable for the animal used to work the water raising. The arrangements for raising water were completely revised. Out went the windlass and bucket system, and instead a force pump system was installed, with pumps on staging at intervals down the shaft. The pumps were driven by moving rods in bearings attached to the wall of the well. (we think that the rods rotated rather than reciprocated, to drive the pumps, but again there are no surviving written records of how the system operated). These rods were driven by gears powered by the horse gear in the rectory yard.

We think at least two pumps must have been installed although there may have been three all told. The lowest pump would have had to have been within 30 feet of the water, and as we think the level varied from time to time, the lowest pump may have been quite close to the water, around 100 foot down. The water was pumped to the roof of the new rectory, where it was stored in tanks made of sheets of slate. Gravity supplied water to the kitchens, (and to the bathroom on the nursery on the third floor). There appear to have been flush toilets on all three floors from the beginning, so the roof tank supplied these as well. We assume that there was a standpipe in the yard to supply the parishioners, also from the tank, so the horse gear only worked when needed, to fill the tank, and not every time someone needed a bucketful of water. I suspect the Victorian slate water tanks are still there, up the roof space above the nursery floor (now divided into the upper floors of two separate apartments).

The maintenance of the new system would not have been straightforward. The rod drive would need regular lubrication, as would the linkage to each pump. The effort

in turning the combined system, as well as pumping the water, must have been significant. To service the pumps in the well shaft, someone would have had to climb nearly 100 foot into a dark, dripping, dank narrow shaft, by candle or oil lamp light, it could never have been a popular or frequent job (to say nothing about it being downright dangerous). Even in our time it was possible to see iron rungs set into the brickwork of the shaft (as well as those driving rods) and my brother Martin can remember being told that the 'backhouse boy' (whoever he was) had the unenviable job of descending into the depths with lantern and bucket to prime the pumps and get the system working. It is not surprising that the system was abandoned no more than forty years later.

By that time, the existing railway branch line, in the Crouch Valley, required a piped water supply to its halt above Battles Bridge. This supply apparently came from a reservoir near Danbury. The pipeline ran through East Hanningfield village, so was then available as a drinking water supply for the village, 'on tap', at last.

The laborious water raising system, and the well itself, were abandoned after around one hundred years of use, and the horse gear was dismantled, leaving only the 'walking path' for the horse as a circle of blue brick in the surface of the yard, that I remember from my childhood. I assume that the pumps in the shaft were simply abandoned, although it is possible they were removed from the shaft, and not simply left to fall into the depths when the platforms supporting them rotted away. The only trace of their presence were the driving rods, still running down the wall of the shaft, that I saw when I looked down the well during the fifties and sixties. The well itself continued to be occasionally used (according to my father) to measure the height of the water table in the chalk aquifer under London (as the well went right through the London Clay - the 'light brown imperfect marle' described in the letter of 1791), although I don't personally remember seeing a Water Board visitation.

When my father took over the living in 1944, the shaft was marked by a low brick wall about a foot high, topped with decaying wooden covers. One of his first acts as the new rector was to have the well capped off with a reinforced concrete cover, flush with the ground. The only access then was through a bolted down manhole cover, so his children were totally protected from this particular hazard in his new home.

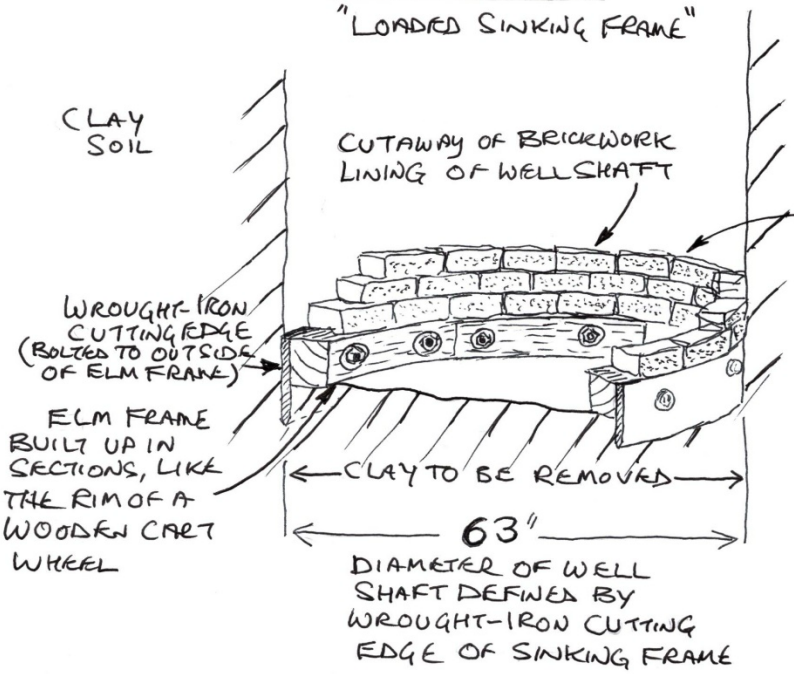
When I asked why the well had been abandoned, my father said that there had been concerns about contamination entering the well from the new graveyard established around the church, built in 1888. I must admit to being unconvinced, as there was rather more risk, I thought, from a very large Victorian cess pit no more than 60 feet from the well shaft, on the far side of the rectory yard……..

Pat Ost Newhaven October 2018

1) Illustration of likely method of sinking well at East Hanningfield Rectory
2) Sketch illustrating a 'horse gin' winding gear

SECTIONAL SKETCH ILLUSTRATING THE PRINCIPAL OF SINKING A WELL SHAFT THROUGH CLAY SOIL

(BASED ON THE DESCRIPTION OF THE WELL AT EAST HANNINGFIELD RECTORY)



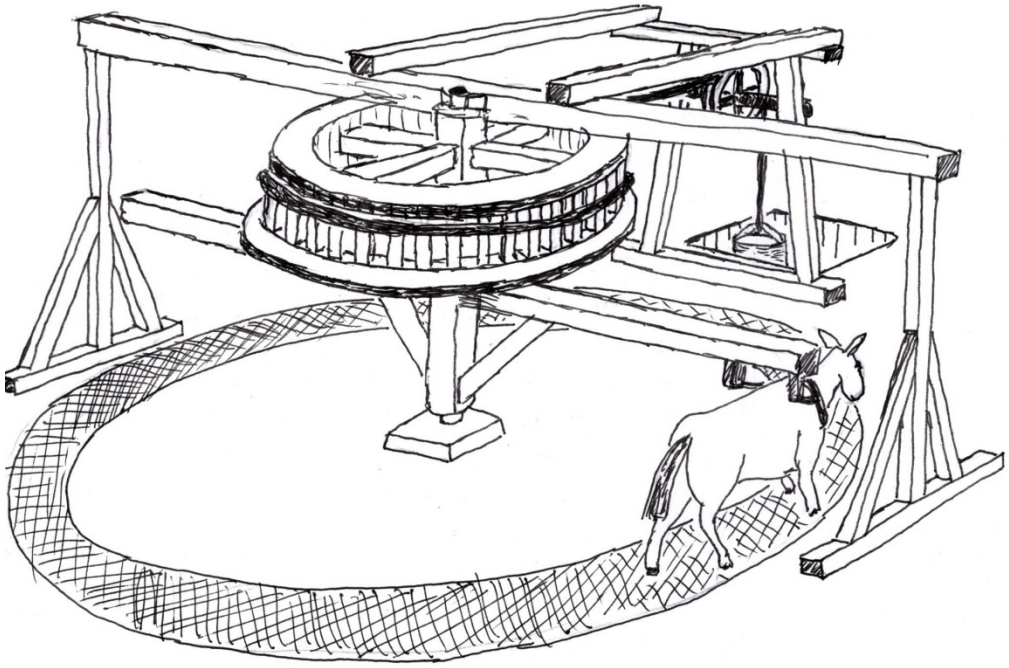
1) IRON EDGE OF SINKING FRAME DRIVEN INTO SOIL BY THE WEIGHT OF THE BRICKWORK STACKED ON THE ELM FRAME.
2) THE WELL SINKER DIGS CLAY AWAY FROM THE UNDERSIDE OF THE FRAME, TO ALLOW THE FRAME AND THE BRICKWORK TO SETTLE EVENLY. (THIS IS THE SKILLED PART OF THIS TECHNIQUE)
3) THE CLAY INSIDE THE FRAME WOULD BE DUG AWAY ONCE THE FRAME HAD STOPPED MOVING; (THE DRAWING ILLUSTRATES THIS STAGE, BEFORE THE NEXT ROUND OF CLAY REMOVAL FROM UNDER THE ELM FRAME)

7TH OCTOBER 2018

SKETCH OF HORSE-DRIVEN WINDING GEAR
"A HORSE GIN", AS USED IN SHALLOW MINES.

(THIS FORM OF "HORSE GEAR" MAY HAVE BEEN USED AT EAST HANNINGFIELD DURING THE SINKING OF THE RECTORY WELL, AND LATER FOR RAISING WATER)

W



ONLY ONE HORSE IS SHOWN, ALTHOUGH TWO ANIMALS COULD BE HITCHED TO THE WINDING DRUM. IT IS POSSIBLE THAT SOMETHING AS SIMPLE AS THIS COULD HAVE BEEN USED TO RAISE AND LOWER TWO COUNTERPOISED BUCKETS, IT IS NOT CLEAR IF THE RELATIVELY NARROW SHAFT AT EAST HANNINGFIELD WOULD BE WIDE ENOUGH TO ACCOMODATE A "TWO BUCKET SYSTEM".

IT IS NOT KNOWN HOW A TWO BUCKET SYSTEM WOULD BE WORKED WITHOUT UNHITCHING THE ANIMALS TO CHANGE WINDING DIRECTION.

12TH OCTOBER 2018