Cherry Hinton and Coldham's Brooks:
A Portrait of a Much-abused Suburban Chalk Stream

CONTENTS

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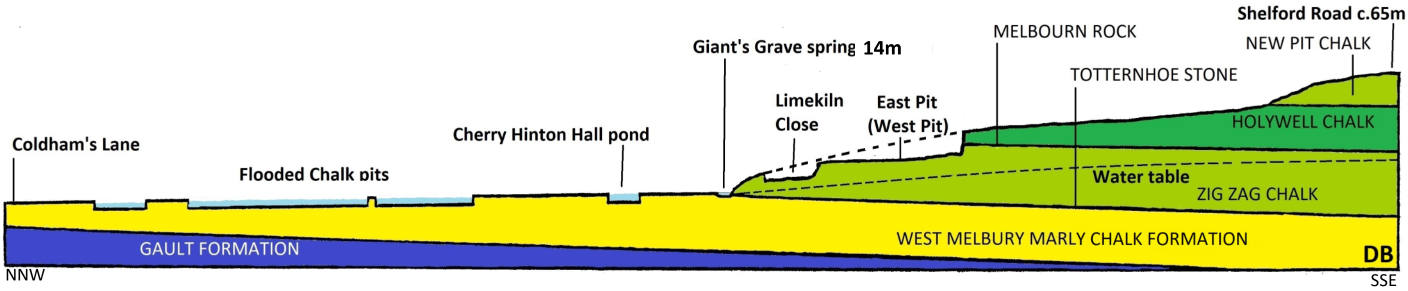


Fig. 1 *The schematic sketch-section shows the relationships between geological structure, hydrology, and surface morphology north and south of the spring at Giant's Grave. The Cherry Hinton Brook flows from Giant's Grave, through the pond in the grounds of Cherry Hinton Hall, alongside the flooded Chalk pits (Fig.2), and then as Coldham's Brook towards the Cam. The length of the section represents 4kms and its vertical exaggeration is x6.*

The Chalk springs at Giant's Grave are the source of the Cherry Hinton Brook. In Fig. 1 they lie at the point where three lines intersect: the land surface, the boundary between the Zig Zag Chalk and the West Melbury Marly Chalk Formation, and the water table. The lower the curve of the water table, the lower the hydraulic gradient, the lower the rate of spring flow, and the less the 'discharge' of water in the brook. This 'portrait' is, in part, the story of the rapacious human quest for water and its effect on the water table and the natural hydrology and ecology.

It is also, in part, the story of the human, voracious appetite for land; for land to exploit, and to cover with tarmac and concrete for our convenience and prosperity. A comparison of the maps on pages 2, 3, and 4 shows the historical transformation of an agricultural valley criss-crossed by field boundaries, brought about by the inexorable advance of suburbia. This urban growth was partly fuelled by, and the brook blighted by, industrialisation and extensive mineral excavation. For 'growth' to occur around 'X' in Fig. 2 the land had to be drained. From here, the resulting artificial channel system (Figs. 3, and 4) followed the valley to the Cam, and eventually destroyed Coldham's Brook. Its associated abandoned leat (Figs. 34 and 36) stands as an ironic symbol of human progress.

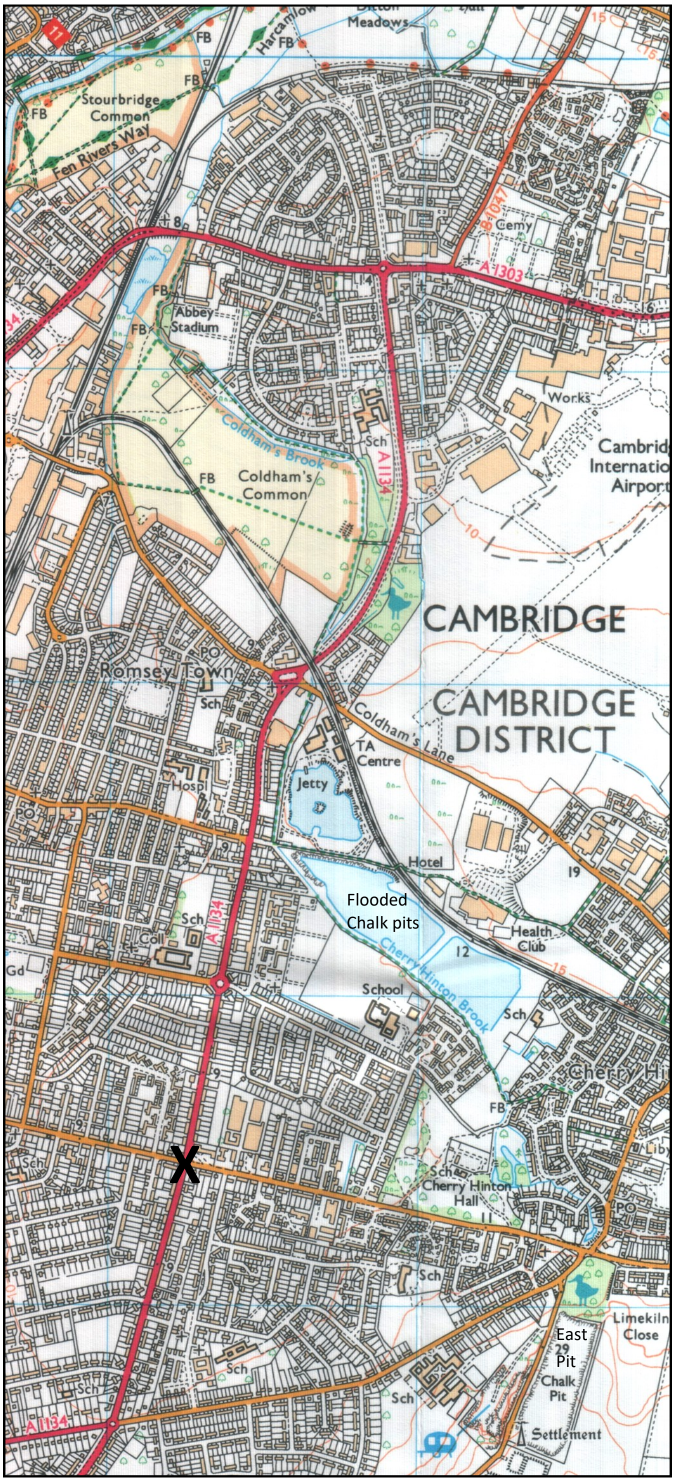
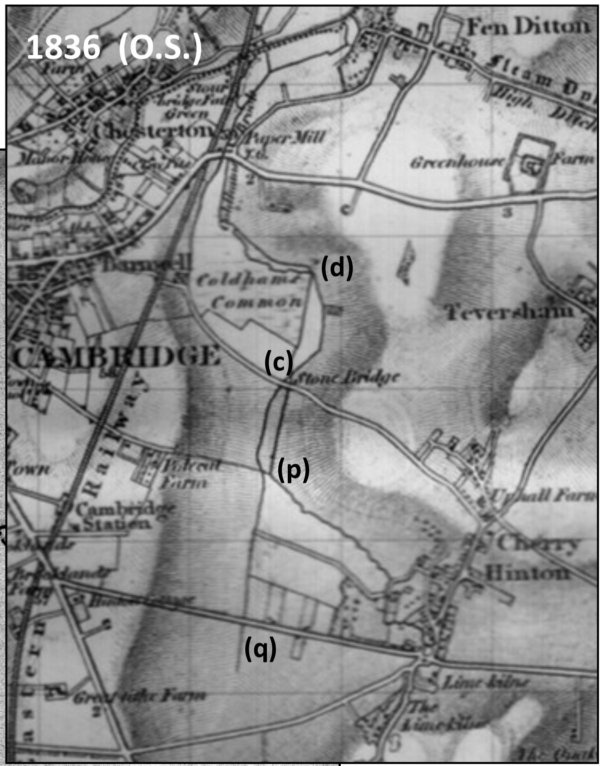
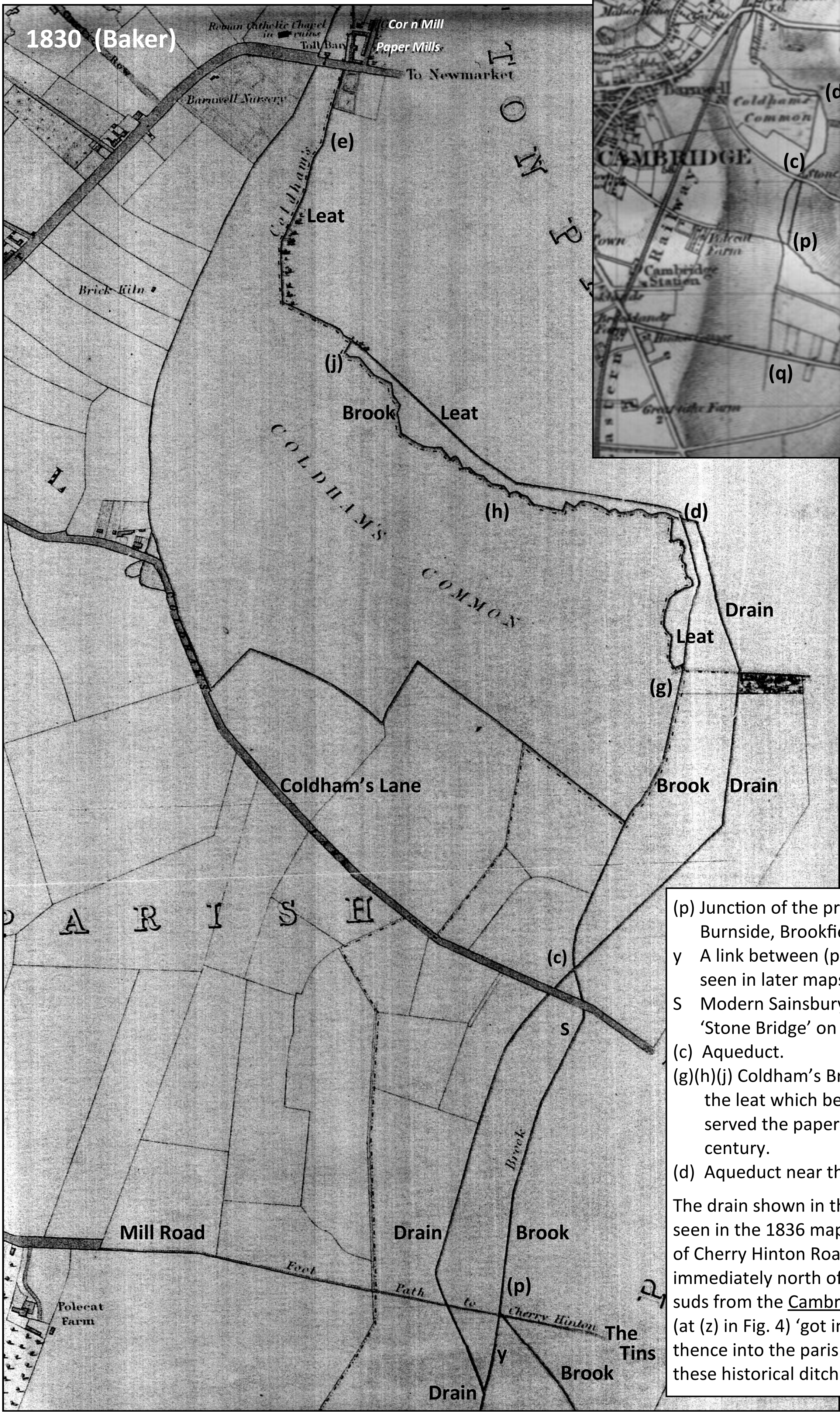


Fig. 2 The 2014 *OS map, scale 1:25,000, shows the course of the Cherry Hinton Brook starting at the Giant's Grave pond at the crossroads at the end of Cherry Hinton High Street, on the north side of the Limekiln Close Nature Reserve. Beyond the roundabout on Coldham's Lane its name changes to Coldham's Brook. This OS map incorrectly names East Cambridge's Main Drain as Coldham's Brook (see Figs. 3 and 34). Furthermore, the channel downstream from (d) in Fig.34 is the abandoned man-made leat (it is not Coldham's Brook) which served the old mills. It is the Main Drain which flows into the Cam on the north edge of the map near footbridge (FB) (Coldham's Brook has been subsumed into it). The map from south to north represents c.5kms.*

Fig. 3 *Compare Baker's 1830 map with the 1836 OS map, and both with Figs. 2 & 34. The 1830 map covers part of what had been Cambridge's medieval East Field. Its strip cultivation extended eastwards to the 'water-logged Fenland' of the brook, already being drained.*





(p) Junction of the present Burnside, Brookfields, and The Tins.
y A link between (p) and the drain, not seen in later maps or present landscape.
S Modern Sainsbury's at the former 'Stone Bridge' on Coldham's Lane.
(c) Aqueduct.
(g)(h)(j) Coldham's Brook running beside the leat which began at (g) and which served the paper mill(s) in the 16th century.
(d) Aqueduct near the present Galfrid Rd.

The drain shown in the 1830 map can be seen in the 1836 map to start at (q), south of Cherry Hinton Road. In 1882, immediately north of the this road, soap suds from the Cambridge Steam Laundry (at (z) in Fig. 4) 'got into an open ditch and thence into the parish drain'. Remnants of these historical ditches can be seen today.

Fig. 4 shows that by 1927 the Cambridge residential suburbs had reached the Cherry Hinton Brook only at Burnside, this locality then being dominated by marl pits and the heavy industry of cement manufacture with their devastating environmental consequences. Already by 1906 the brook had been described as a 'dirty ditch with tins and fragments of pottery amongst its weeds'. The impact of this and later development can be gauged from John McGill's history of the area.

The site of the Atlas Concrete Works is now occupied by the Coldham's Lane Sainsbury's; and the marl pit with tramway by the Norman Way Business Park. The Cambridge to Newmarket railway opened in 1851. By 1927 this 'Old Railway' which crossed the Cherry Hinton Brook at the south end of Burnside had closed. Excavation of the two largest modern 'Flooded Chalk pits' (Fig.2) had not yet begun.

A comparison of Figs. 3 and 4 shows that the essential features of the artificial drainage system remained unchanged over a century. The directional (water flow) arrow near the south west corner of Fig. 4 shows the 'parish drain' trending north-north-eastwards, crossing the Cherry Hinton Road and following the Municipal Boundary (west of the 'Laundry') until it meets the 'Old Railway' after which it turns through two angles before running between the Isolation Hospital and the Allotment Gardens (former coprolite workings). There appears to be the representation of a ditch running hard by the Laundry to the parish drain.

Just as the course of the drain is straight and angular, the Cherry Hinton Brook also turns through what is unlikely to be a 'natural' angle at the footbridge (F.B.) where The Tins footpath (F.P.) meets Burnside. Incidentally, there is no convincing alignment in Fig. 4 to correspond with link 'y' in Fig. 3.

The modern East Cambridge Main Drain (Fig. 34) follows Daws Lane, beginning at its distinct angular bend (seen in Fig. 4), then turning through a small angle before heading straight to the Municipal Boundary and 'parish drain', seemingly following the line of yet another old drainage ditch.

Intriguing is the drainage pattern on the north side of the pre-WWI rifle range, especially if Figs. 3 and 4 be compared. The 1830 map shows the unmistakeable pattern of a naturally meandering stream from (g) through (h) to (j). At (g) part of its flow had been diverted into a straight and angular leat which (unusually) rejoins the meandering course at (j). By 1927 (Fig. 4) the meandering stream had been severely 'straightened', being then fed by water exclusively from the 'drain' which crossed the leat (confusingly named 'Coldham's Brook').

Fig. 4 *1927 O.S. map, Sheet XLVII. N.E. 6 inches to 1 mile.*

Both brooks were surely 'straightened' or re-aligned *before* 1830, at least downstream from the south end of Burnside. It seems that before the excavation for Burnside (road) damaged the channel of the brook it was already dead straight. Modern (hillshade)LIDAR maps show no clear traces of earlier meanders.

Fig. 5 *Massive joint pattern in the Totternhoe Stone Giant's Grave pond.*

A Chalk stream?

However, to begin again at the beginning: the Giant's Grave pond (Figs. 13 and 15) is fed by Chalk springs. Water emerges through joints in the Totternhoe Stone (Fig. 1, a hard grey silty calcareous sand) where it overlies the Marly Chalk Formation. The massive (widely spaced) pattern of joints can be seen in the bed of the pond (Fig.5). So, after leaving the pond, the brook has some of the features characteristic of 'Chalk streams'. For example crystal clear water flowing over flint gravel can be observed from the bridge in Forest Road (at A in Fig.13) though the gravel is not 'natural' being so near to man-made constructions.

Initially, this water will have fallen on the agricultural Chalkland to the south and east as very weak carbonic acid rain which infiltrated into, and reacted with the Chalk (calcium carbonate) to produce soluble calcium bicarbonate. So the spring water is mildly alkaline with a pH range of approximately 7.4 - 8.5 (Fig. 8); and is said to be 'mineral-rich and nutrient-poor'. However, the Chalk aquifer has been polluted by the prevalent nitrate levels due to the past and present agricultural

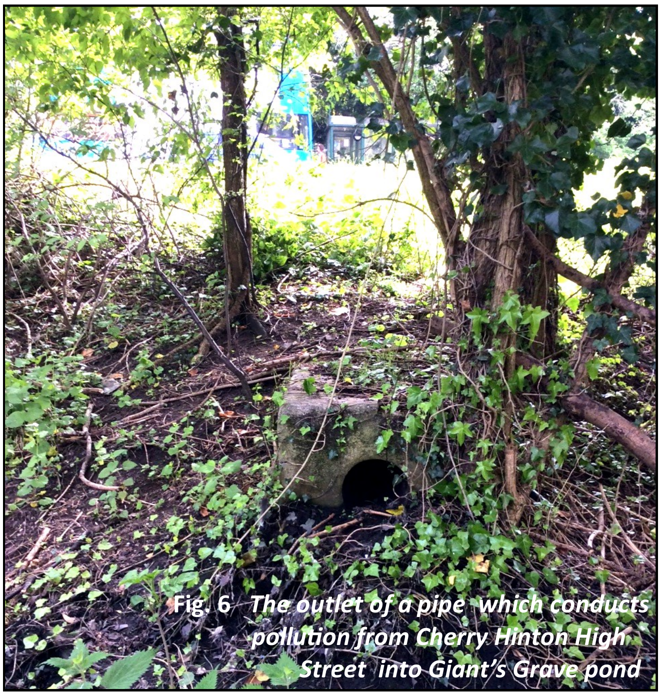


Fig. 6 *The outlet of a pipe which conducts pollution from Cherry Hinton High Street into Giant's Grave pond*

use of fertiliser. This pollution will persist for decades to come. The steady temperature of the spring water ranges between about 10.2° and 10.4°C.

The 'Chalk stream' properties are lost or diluted downstream (Fig. 8), for example by change of temperature, by the rain wash of disturbed surface material into the channel, by decayed vegetation falling into the stream, together with other pollutants. Where the brook reaches the ornamental 'fish' ponds in the grounds of Cherry Hinton Hall, ducks alone change the chemistry of the water.

Fig. 7 *Three pipes and New Zealand pygmyweed at Giant's Grave*

Apart from the obvious contaminants such as oil, salt, tyre and brake-lining dust, a very wide range of chemicals are washed into the brook. Fig. 6 shows a pipe which carries pollutants from Cherry Hinton High Street directly into the pond at Giant's Grave. Notice the fan of detritus in front of the pipe, and the bus and bus stop in the background.

Fig. 7 shows three of four other pipes which lead into the south end of the pond. Technically they are said to be 'washouts' for water-supply mains which feed Cherry Hinton. They are needed in order to reduce pressure for repairs to the system. Some informal inspection during rainfall has not found water flowing out of these four pipes.

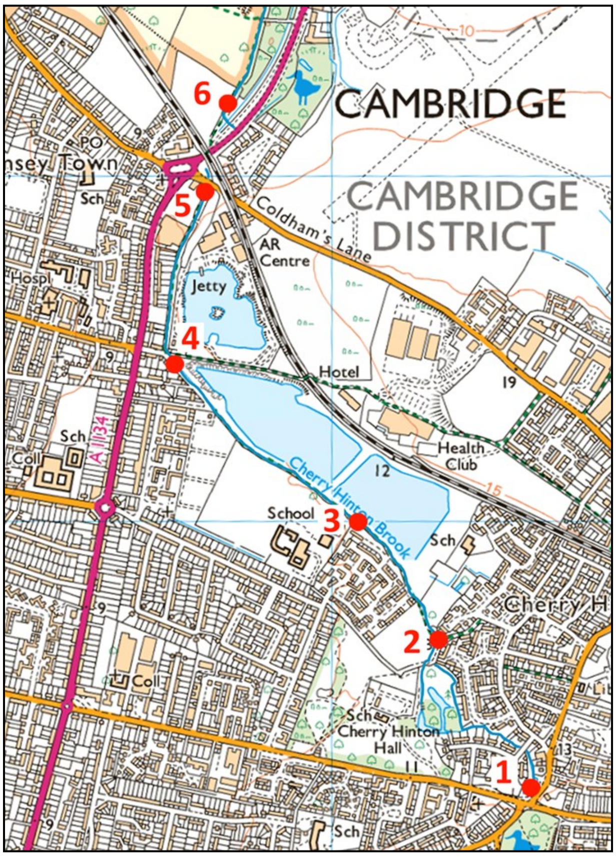
Flora and fauna

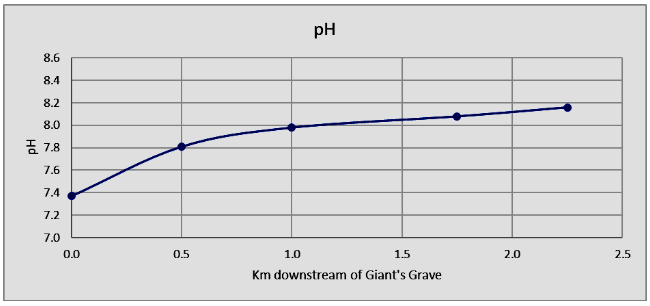
In 1990 Dr. Steve Boreham found (page 67) that the Giant's Grave pond supported a very pollution-sensitive macro-invertebrate community but one of limited diversity. He also described the fauna downstream, and flora in less detail. At and beyond Coldham's Common he thought that the influx of urban drainage does not necessarily cause serious

Fig. 8 *Water quality in the Cherry Hinton Brook, 12 August 2024.*

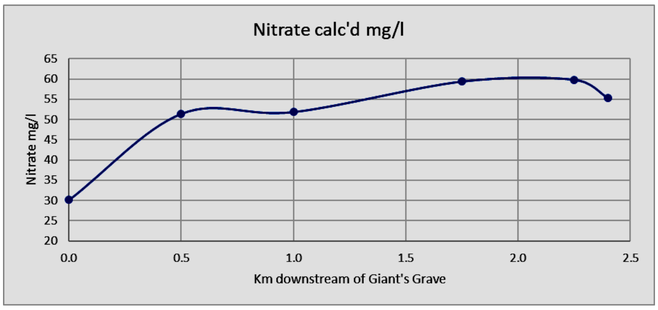
Dr. Steve Boreham prepared the following graphs to provide both a snapshot of water quality on 12 August 2024 and a baseline for future comparisons, but also to illustrate what can be achieved in a total time of 3 or 4 hours using relatively simple 'citizen science' (Newsletter 91) equipment, at moderate cost.

Measurements were taken at the 6 points shown in the OS map on the right. They were taken during dry weather flow conditions which showed the brook in the best circumstances, qualifying as 'High Quality' under the Water Framework Directive parameters. However, following rainfall it is most likely that there would be a deterioration in water quality due to urban run-off (e.g. Fig. 6).





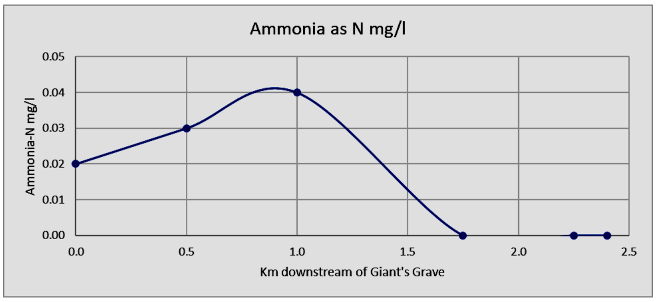
Unsurprisingly, the pH at Giant's Grave was 7.4 (see page 4). The pH value increases downstream as the water becomes more alkaline. This is due to the loss of dissolved carbon dioxide and therefore the lowering of carbonic acid levels.



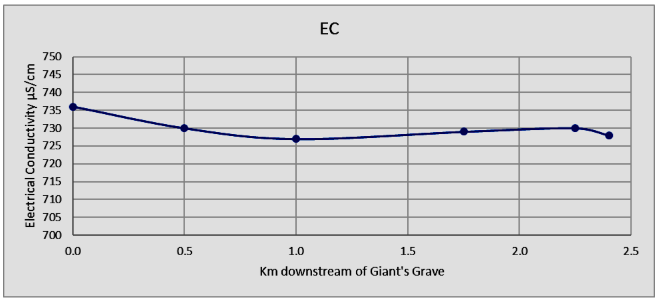
The nitrate level at Giant's Grave was perhaps lower than expected (see page 4) at c. 30 mg/l but increased markedly downstream especially between sampling points 1 and 2. So inputs were occurring as the brook was flowing between residential gardens and through the grounds and pond system of Cherry Hinton Hall.

Nitrate is of potential concern as a cause of eutrophication which can be responsible for excessive algal growth. On the other hand Phosphate-P, another major nutrient implicated in eutrophication, was not detected in any of the samples.

It is interesting that Ammonia-N was detected at very low



levels (<0.05 mg/l) at Giant's Grave and at St. Bedes. This hints at some level of leakage from the sewage system in the Cherry Hinton area. It is perhaps worth noting that in 1908 concerns were expressed about the primitive sewage system of Cherry Hinton and the safety of the water supply. So, could this be an historical legacy?

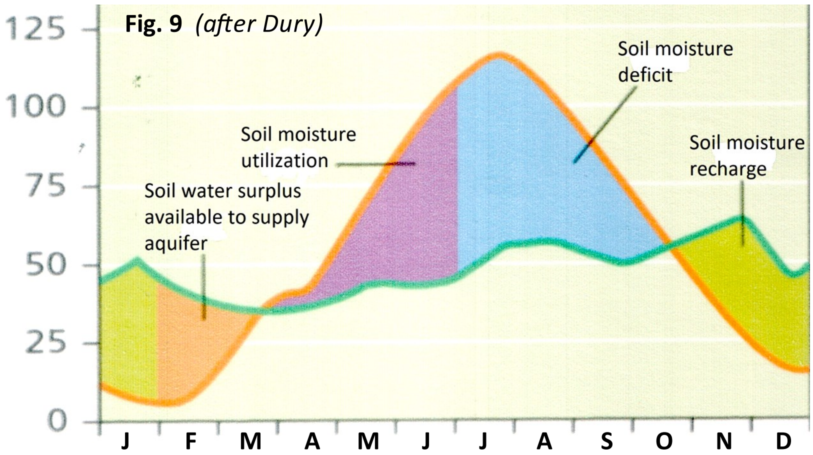


Electrical Conductivity (EC) is a proxy for a variety of chemicals contained in the water, derived from the Chalk bedrock and overlying soils as well as from pollution.

Turbidity was also measured, but this is a more erratic parameter. The water is often clear, but the deep silt layer is easily disturbed by ducks and dogs, for example.

harm if it is sufficiently diluted. Also, his Fig. 1 shows the watershed or catchment boundary of the brook system. The dark green vegetation in the water in Fig. 7 is the more recent invasive New Zealand pygmyweed (*Crassula helmsii*). The Cambridge Natural History Society Report for 2009 describes the flora of Giant's Grave, and the Cherry Hinton Brook including the grounds of Cherry Hinton Hall.

Before the water of the brook manages to reach the River Cam it has lost its identity entirely, of course, having been absorbed into the turbid, polluted East Cambridge Main Drain (p.20). See the Chalk Streams Project Report and the Advisory Visit for overviews.



A schematic 'water balance' graph for a particularly dry year in a location typical of the Cambridge region. *The vertical scale is in mm for both the green rainfall line and the brown line which shows the pattern of potential evapotranspiration. This is the theoretical maximum amount of evaporation from soil plus transpiration from plants.*

Variations in discharge

When compared with streams such as the Bourn Brook, which flows over the Gault (clay) Formation, there is little or no risk of flooding. The Bourn Brook is flashy. The Cherry Hinton Brook is not. Snakey Path is unlikely ever to be flooded by water issuing from the springs at Giant's Grave. Vulnerability to flooding was assessed (p.41) in 2005.

Increase in discharge (leading to an increase in depth of the stream by a few inches) immediately following periods of heavy rain are at least partly due to soil moisture flow. Rain falls onto neighbouring gardens, lawns, allotments, school playing field, and common land, and seeps into the soil. The moisture infiltrates down through the soil until it reaches (at no great depth) the largely impermeable West Melbury Marly (clayey) Chalk Formation (which underlies the brook's catchment area and which is the rock which was quarried from the neighbouring pits now occupied by the three lakes). The soil moisture then seeps laterally into the channel of the brook.

There is probably little or no surface flow over soil in this catchment of such low relief despite the Marly Chalk's clay content. However, soil moisture in the vicinity of the steep banks of the stream is likely to drain relatively quickly into the channel. Surface runoff on tarmac and concrete, including street runoff, is even more rapid of course. This would help explain the slight but rapid increase in depth of the brook during the wet November following the dry summer of 2022. A few years ago part of the site of the Cambridge Folk Festival was flooded following thunderstorms.

Meanwhile the height of the water table within the Chalk aquifer makes a delayed and slower response to winter rainfall. The reasons for this and why Cambridgeshire Chalk streams are so fundamentally vulnerable to over-abstraction or a shortage of rain are explained in Fig. 9. Rainfall in East Anglia is so low and summer evapotranspiratioin is potentially so high that, often, depending on local conditions and the weather, soil moisture and aquifer recharge only occur between October and March when, in relation to rainfall, temperatures and potential evapotranspiration are at their lowest. In general terms soil moisture has to become saturated before the water infiltrates down to the water table.

The brook and the lakes

There are no raw data available to reveal the relative altitudes of the two main lakes nor their levels in relation to the Cherry Hinton Brook. Nevertheless it can be observed from Snakey Path that the level of the southern lake varies, particularly with rainfall, sometimes being lower than the Brook, sometimes higher. Available LIDAR data has suggested that the water surface of the lakes is 7-8m OD as compared with the brook at c. 9.5m OD. However, near lamp post 14 on Snakey Path there is an overspill pipe through which water spills periodically from the southern lake into the brook. Water, that has the potential to be polluted, drains into the lake from the industrial estate north of the railway line. In 2024 the planning application for the development of the former landfill sites in this area raised the possibility that more pollutants will enter the lakes (p. 7), before passing into the brook.

Stream discharge in the longer term

Unlike the Hobson's Brook and the Little Wilbraham River, the Cherry Hinton and Coldham's Brooks do not have gauging stations; so there is no historical

Fig. 10 ***Coldham's Brook in the dry summer of 2022, at the (rifle) Butts Bridge, showing gravel and logs at an early stage of channel restoration***

record of change. (See p. 14 for reference to some temporary stream 'gauges' c. 1871.)

As a one-off, it may still be possible for someone to vouch that the Cherry Hinton Brook did or did not dry up in the exceptionally dry summer of 1976. This would afford an absolute comparison with the flow of Hobson's Brook from Nine Wells, near Addenbrooke's. Here the springs did dry up, and they lost their SSSI status as their flatworms (*Crenobia alpina*) and cased-caddisflies (*Agapetus fuscipes*) did not survive. In the dry summer of 2022 the low flow of the Cherry Hinton Brook more or less dried up before reaching Coldham's Lane and before it should have become Coldham's Brook.

Fig. 10 shows the appearance of Coldham's Brook at that time, the photograph having been taken from the (rifle) Butts Bridge leading to the Common from Barnwell Road. Incidentally, the low water level reveals the gravel and logs installed earlier (under water) as part of the ongoing channel-restoration project (see p. 19).

The reason for the 'drying up' was not obvious. The brook perhaps infiltrated through disturbed surface material in this historical zone of drastic human interference, construction work of various kinds, and the historic coprolite works on the left bank of the brook between Sainsbury's and Brookfields. On the other hand it may have seeped through the Marly Chalk Formation into the East Cambridge Main Drain (p. 20).

The brooks and the Cambridge Water Company

Changes in the discharge of water from Giant's Grave, over decades, have depended on changes in the height of the water table in the Chalk, but also on the patterns of movement of ground water below the water table within the Chalk. These latter are complex and not necessarily predictable. They depend on the structural arrangement (p.16) of contrasting Chalk strata together with micro-structural features and their relationships to surface relief. Springs are sometimes found at unexpected locations.

When water is extracted from a bore-hole a cone of depression is created in the water table around it. So ground-water flow converges on the bore-hole. Fig. 11 shows patterns of flow caused by the extraction of water from the aquifer, through bore-holes, by the Cambridge Water Company.

The map portrays so-called 'Source Protection Zones' within the Chalk in relation to the Cherry Hinton Brook and neighbouring streams. Boreholes are located within the areas shaded faintly in red. Though compiled in order to analyse the risk of water contamination, the map in fact reveals the pattern of flow of ground water through the permeable Chalk towards the boreholes. Zone 1 is defined as the area within which the travel time of ground water through

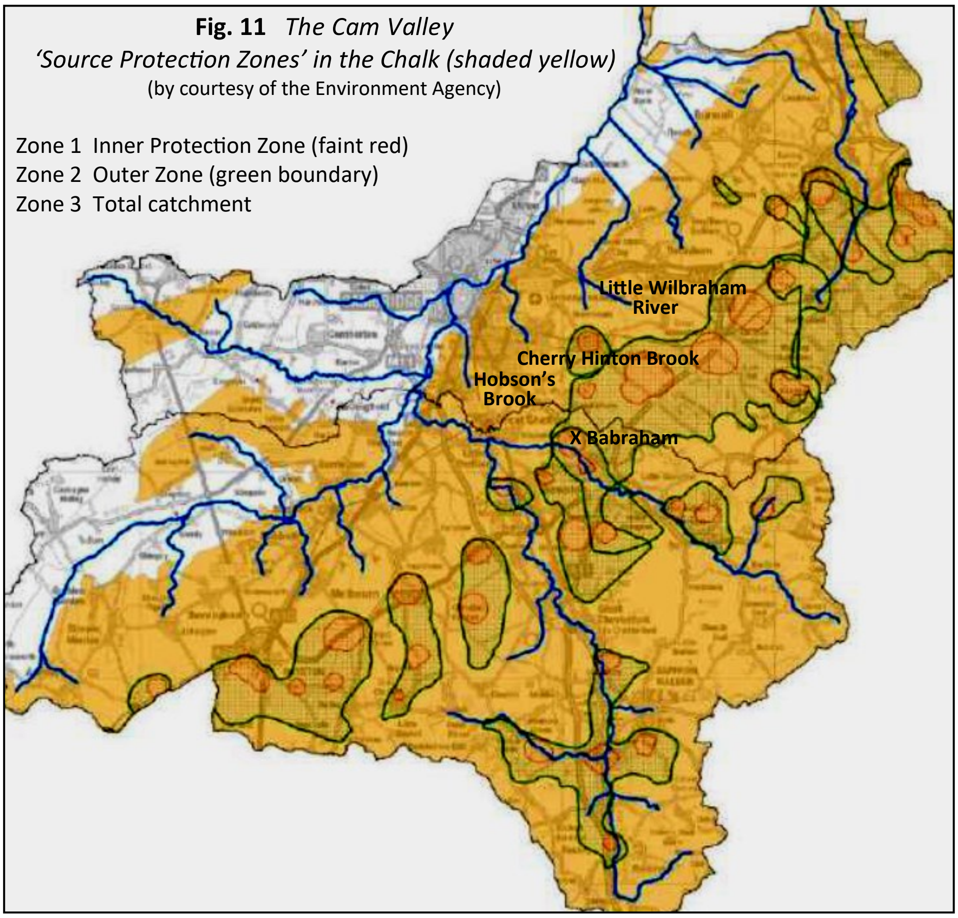


Fig. 11 *The Cam Valley*
'Source Protection Zones' in the Chalk (shaded yellow)
(by courtesy of the Environment Agency)

the Chalk to a borehole is 50 days or fewer. For Zone 2 the travel time is 400 days or fewer.

The proximity of rapidly-seeping groundwater so close to the Little Wilbraham River does nothing to discourage the understanding that over-abstraction has been directly responsible for the sad history of that stream. It so happens that the Cherry Hinton Brook itself is, also, not so very far from the same zone.

Cambridge Water's own investigations (pp. 78 and 70-71) confirmed in 2018 that pumping at the Babraham station, some 8kms away from the springs at Nine Wells, had a direct and adverse affect on the flow rates of those springs. At the time, this frank admission made the Company's claim that such pumping at Fleam Dyke (Dungate Farm, Fig.12) had no comparable affect on the flow at Giant's Grave, implausible. However, as the result of more recent investigations specifically into the impact of Fleam Dyke pumping station on Cherry Hinton Brook, it is proposed that abstraction licences will be reduced by c.0.53 million litres per day with effect from 2025. The EA are seeking further reductions at Fleam Dyke by 2030 based on cumulative impacts across the aquifer, not specifically Cherry Hinton Brook. This would be a further reduction equivalent to 20-30% of the existing deployable output/licence.

In any case, it is a truth more or less universally acknowledged that, year by year, the total rate at which water is lost from the Cam Valley Chalk (through pumping and through natural springs) is greater than that replenished by rainfall. In other words groundwater is being depleted due to human rapaciousness. The water table has been falling for decades due to over-abstraction, and Chalk streams have been suffering.

In recent years their fate has become a national issue exercising the concerns of a vast range of organisations and individuals. The Fens Reservoir, planned to relieve pressure on the Chalk aquifer, is a step in the right direction but it is too small and the earliest it will come on tap is 2035. A plan to transfer water from Graffham Water to Cambridgeshire from 2032 also seems like action being taken too late to deal with the water-supply crisis. Time will tell how universal metering, reductions in customer consumption and leakages, and innovative tariffs will bridge the gap between 2024 and 2032.

Extraordinary augmentation

Evidence for the awareness of impending crisis came, in fact, some decades ago from an unexpected quarter. This was in the shape of the extraordinary Lodes Granta and Rhee Groundwater Support (ie augmentation) Schemes developed by the Environment Agency and Cambridge Water since the 1990s (Fig. 12).

The map shows two of the five (summer) stream augmentation schemes south and east of Cambridge. For example, water pumped up from the borehole at Dungate Farm (Fleam Dyke) is fed by pipes into the Little Wilbraham River at two discharge points (shown in green). Just to the west, the Cherry Hinton Brook is, of course, without augmentation. A little further west, off the map, are the springs at Nine Wells. Their

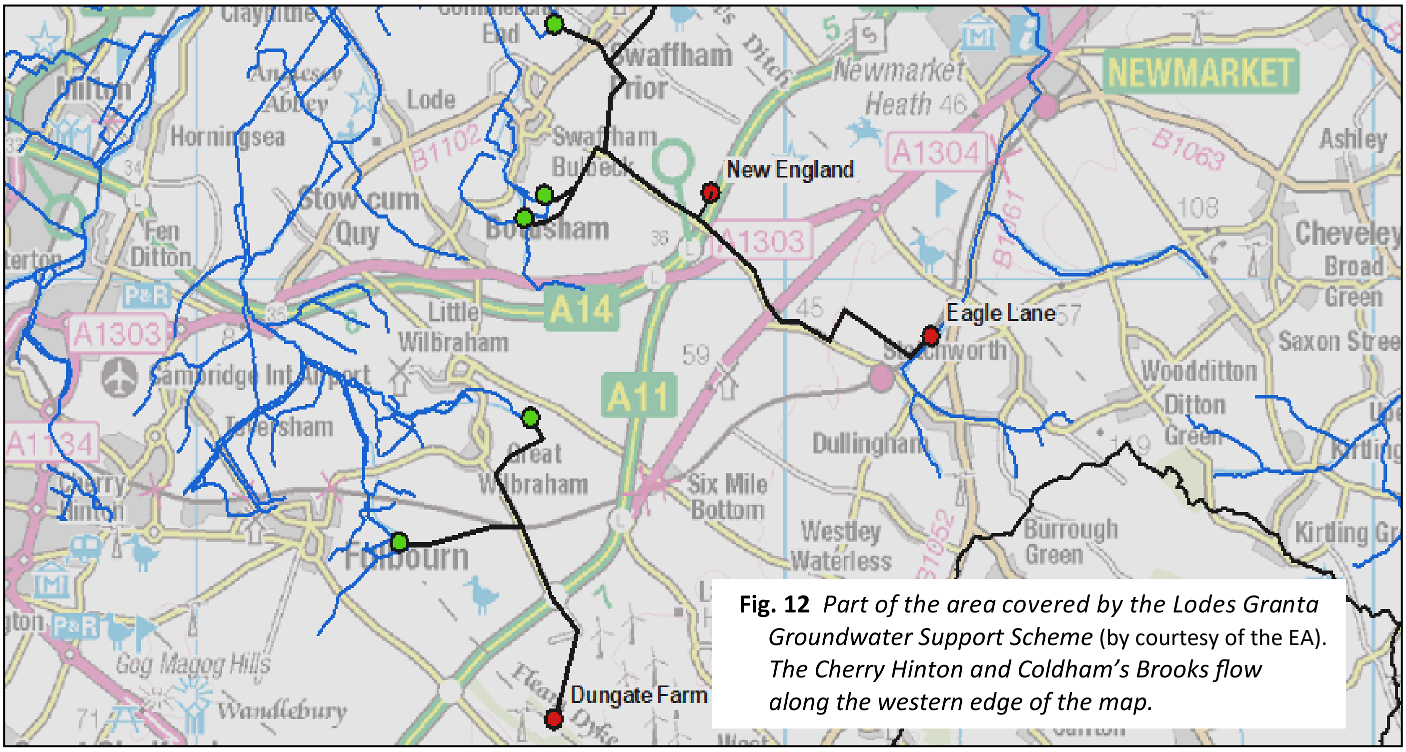


Fig. 12 *Part of the area covered by the Lodes Granta Groundwater Support Scheme* (by courtesy of the EA). *The Cherry Hinton and Coldham's Brooks flow along the western edge of the map.*

augmentation by water piped from Babraham began as recently as 2020. Eight more of the Rhee Groundwater Support schemes lie south and west of Cambridge stretching beyond Royston to Ashwell.

Only a moment's thought is needed to realise that water being pumped from the aquifer in this way, for the short-term benefit of the streams, is in itself making a major contribution to the long-term, inexorable lowering of the water table. This exacerbates the underlying problem. Is there a trace of irony in the name 'Groundwater Support Scheme'? In reality the groundwater is being whittled away. Peter is being robbed to pay Paul. Chalk stream ecologists view augmentation, at best, as a necessary evil.

Giant's Grave

The source of the Cherry Hinton Brook at Giant's Grave (south east corner of Fig.13) has been much tampered with. Fig. 15 is the oldest known

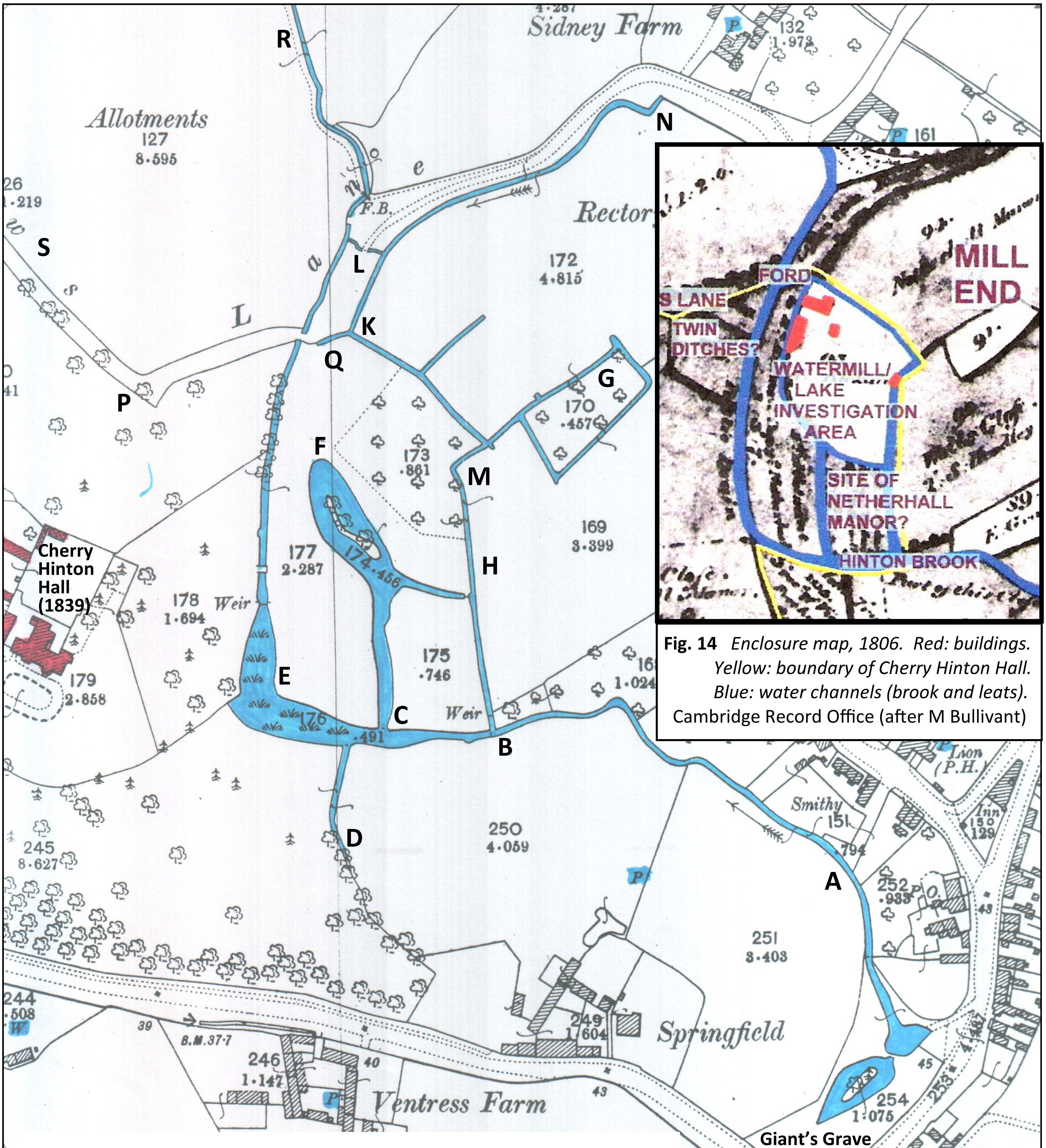


Fig. 14 *Enclosure map, 1806. Red: buildings. Yellow: boundary of Cherry Hinton Hall. Blue: water channels (brook and leats).* Cambridge Record Office (after M Bullivant)

Fig. 13 OS Map of headwaters of the Cherry Hinton Brook, c. 1905
Water surfaces in blue. Pumps (P) and well (W) are highlighted in blue.

photograph of it, taken from a vantage point now shrouded in mature trees. ('Grave' refers to the island in the pond.)

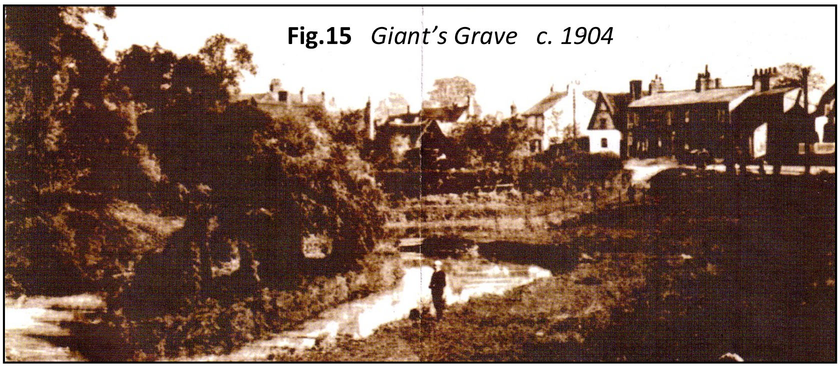


Fig.15 *Giant's Grave c. 1904*

A spring naturally creates a 'spring hollow' or 'springhead' for itself by the process of 'spring sapping'. The creation of a pond is not part of this process. This particular depression bears no resemblance to a natural spring hollow. It must have been shaped by quarrying. An incidental or deliberate creation of a village pond would have been for the benefit of villagers.

In 2003 the local historian Michelle Bullivant excavated three sites beside the pond. Domestic refuse, pottery, bones, and building materials confirmed human activity in the 19th and 20th centuries and the inevitable human proclivity to dump rubbish. When excavated, of course, such artefacts, including a medieval brick and worked stone, in the context of multiple soil layers, tell a fascinating, if tantalizing and incomplete story.

The most recent change in the shape of the hollow came about in the 1960s when the road above was widened and the slope down to the pond was 'landscaped' in a manner which took no account of local history or of any rock which may have been exposed by quarrying.

The Cherry Hinton Hall vanity project

Fig. 13, an OS map dated 1905, shows, in the area BGKE, the main features of the vanity project of one John Okes who had built Cherry Hinton Hall in 1839. This consisted of two fish ponds E and F and two leats or distributaries of the brook, one from C feeding pond F and the other, BHK, also feeding the channel enclosing the plot of land G.

Flowing towards this area were two 'natural' tributaries of the brook, D and N. There is no trace in the present undergrowth of the one flowing from N along the south side of (Da)ws Lane (named on the map at S). This lane was a prehistoric routeway and undoubtedly served as a drove-road in more recent times. The much-modified ephemeral tributary D runs along the boundary between the Cherry Hinton Hall grounds and the gardens of houses on Forest Road. There is said to be a culverted stream running through the cellar of Cherry Hinton Hall.

Domesday 1086 and watermills

Mr. Okes was much influenced and encouraged by the pattern of water channels which he found when he purchased the land and which is portrayed in the Enclosure map of 1806 (Fig. 14). The overall patterns in Figs. 13 and 14 can be compared. The creation of pond F would have required merely the blocking of the channel which previously ran from F through Q; and some digging.

It seems likely that elements of the 1806 pattern of water channels probably had their origins even before 1086 when the Domesday Book recorded '4 mills' in Cherry Hinton. These are assumed to have been at this 'mill end' of the village though perhaps one was located on the stream which existed at the 'church end'.

Fig. 14 shows that in 1806 two buildings stood adjacent to a water channel or leat at the location labelled Q in Fig. 13 and that a building at M in Fig. 13 stood astride the leat. One might ask what the sites of these buildings suggests about their functions.

In 2004 Michelle Bullivant excavated the remains of one of the buildings at Q. Multiple floor layers overlying a culvert offered convincing evidence that this was once the site of a mill. This small area was probably an industrial site occupied continuously for perhaps more than 500 years until at least the 16th century when wind mills at the 'church end' of Cherry Hinton became more important. The mill stone unearthed and now on display beside pond E has been dated c.1500 and has been observed to be not very well worn. All the buildings highlighted in Fig. 14 were demolished by Mr. Okes.

So there is little doubt that the mill(s) at Q was driven by a stream running from F through Q in a channel which was filled in by Mr. Okes. An early map of the Cambridge Waterworks Company suggests that the main channel of the brook ran from just north and east of B through F to Q. This would confirm site Q as the obvious choice for a mill(s). If this were the case then Okes diverted the original course of the brook from F to E creating pond E with one of his four weirs.

The 1806 Enclosure map also shows another likely location of a mill at Forest Road, at A in Fig. 13, but just south east of Fig. 14. A millstone embedded at the bottom of a brick wall in Gladstone Way may have been transported from that site.

So, how can a 'gently flowing' stream such as the Cherry Hinton Brook provide a head of water sufficient to turn a heavy mill stone of the kind now on display beside pond E? Stream discharge was greater in those days but it was shared among distributaries.

The dammed pond E helps one to visualise the drop in altitude (below the horizontal surface of the pond) of the flooded channel, from the 'top' end of the pond (near point C) to the weir, a distance of about 100 metres. The weir is almost 1 metre in height. A railway line with a gradient of 1 in 100 is not steep. From B past H to K the channel covers a greater distance. At K the channel is held up at present by a weir which has a drop of nearly two metres. Anyway, in 1086 the combination of natural relief and a stream discharge much larger than at present evidently made possible the engineering of three or four Domesday mills, all at once.

The moated plot of land G is an anomaly. Michelle Bullivant believes it was a medieval moated garden associated with Netherhall Manor which might have occupied the 'rectangle' in Fig. 13 containing the letter C. In any case the ditch around plot G has been obliterated by the modern demand for housing, on Malvern Road. The distributary BHK now feeds, through an underground pipe, the starting point of the Cambridge East Main Drain in Daws Lane, at P in Fig. 13 (see p. 19). The Drain was excavated after 1905.

A modern view of surviving water mills is one of picturesque, romantic serenity. An alternative view is that their construction, and that of mills which have not survived, together with the diversions of streams away from their natural courses and the construction of mill ponds, have damaging consequences for the hydrological and ecological systems to which they belong. This view may well be most persuasive in the case of sensitive Chalk stream systems.

In any case, the UK Environment Agency has been seriously considering the removal of the mill weir at Hauxton, and even the weir at Byron's Pool. The least that could be done to lessen the impact of Mr. Oke's legacy (forgetting water mills) is to install fish passes at the weir which holds back pond E and at the weir which is immediately upstream from B.

The 1850s: Tanks at Giant's Grave

The 1850s brought uncharted changes to the discharges of the Cherry Hinton and Coldham's Brooks. The Cambridge University and Town Waterworks Company was formed in 1852/3 to supply water to the whole of Cambridge. Within a year or so two 'collecting tanks' had been sunk into the floor of (or on the edge of) the Giant's Grave pond at locations shown in Figs. 16 and 17. They were, presumably, simple pits (sumps) excavated in the Totternhoe Stone and perhaps in the underlying West Melbury Marly Chalk. One source (p.27) described them as 'underground chambers of open brickwork'. If the two red rectangles in Fig. 16 were drawn to scale then the tanks were each approximately 10 by 5 yards. Fig. 17 appears to show only one (square) tank.

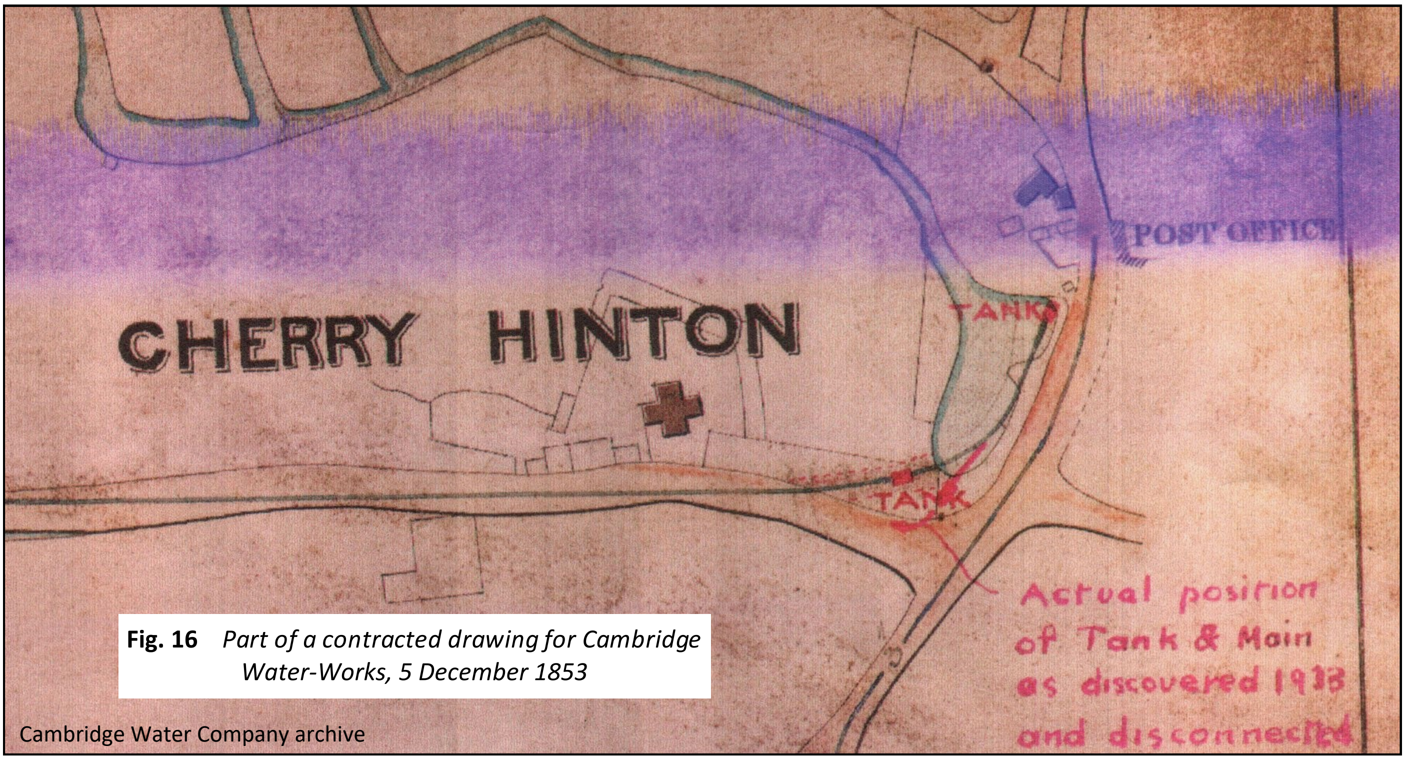


Fig. 16 *Part of a contracted drawing for Cambridge Water-Works, 5 December 1853*

Cambridge Water Company archive

The plan was to transfer water from the tanks, by pipe, along the Cherry Hinton Road to a pumping station ('Disused' in Fig. 4) at what is now No. 406, where only the engineer's house remains. From here the water was pumped to the reservoirs at the top of Lime Kiln (Hill) Road whence it was distributed to the town and university. One can only guess at the impact this had on the discharge of the Cherry Hinton Brook.

Fig. 16 shows a pipeline connecting the two tanks and gently curving towards Cherry Hinton Road. Fig. 17 shows two straight lines joined at an angle, labelled 'Line of intended works'. This latter alignment seems to be more in keeping with the alignment in Fig. 16 as corrected in 1913 (or 1933) than it does with the original black curve drawn in 1853. There are no signs of the tanks now, but sensitive excavation might reveal them.

By 1855 a well 48 feet deep, a third tank, and a lower reservoir under the pumping station had all been constructed at 406 Cherry Hinton Road, thus engineering the transfer of water to the top of Lime Kiln Hill.

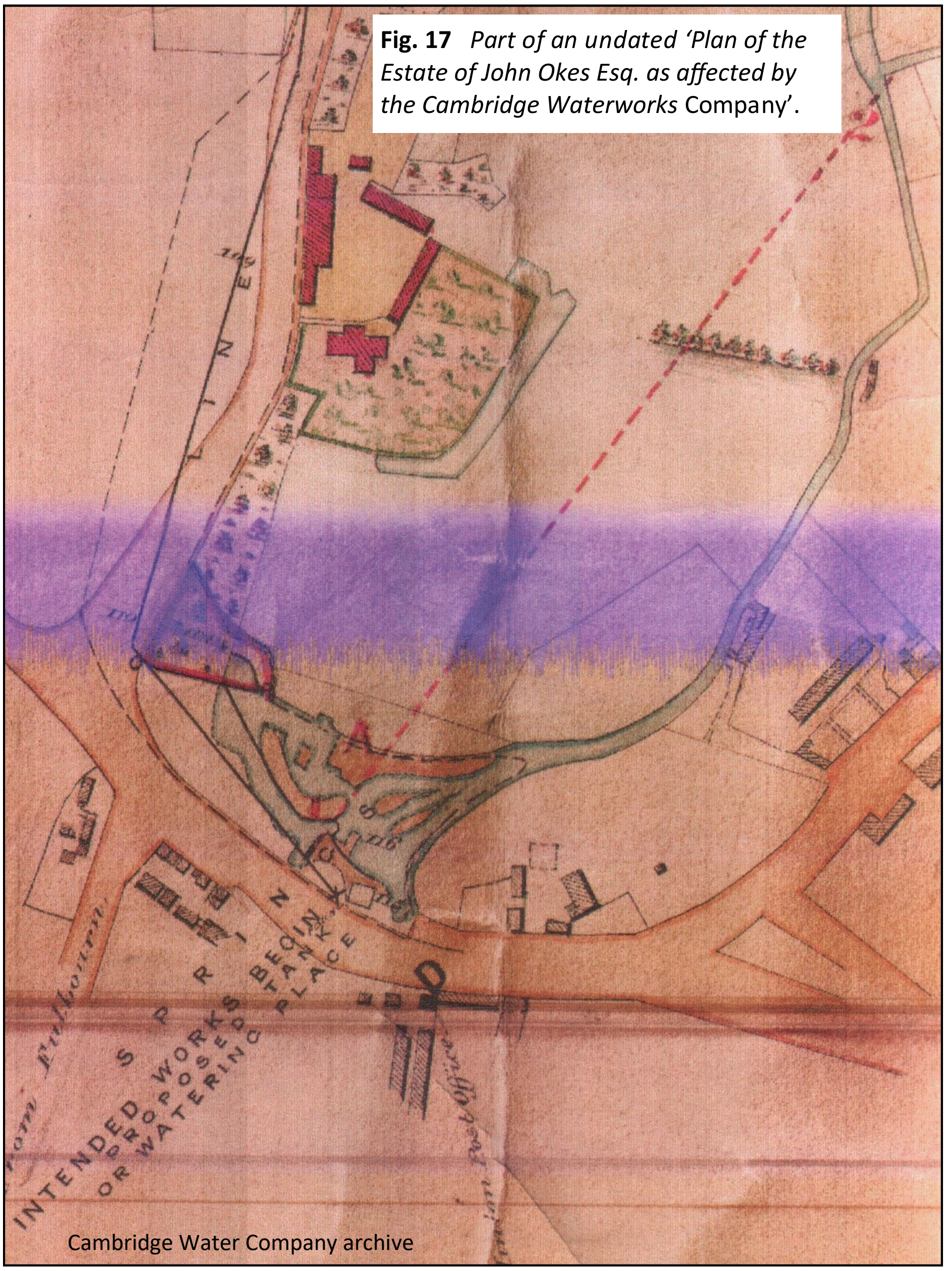


Fig. 17 *Part of an undated 'Plan of the Estate of John Okes Esq. as affected by the Cambridge Waterworks* Company'.

Cambridge Water Company archive

The Cambridge Chronicle described the official opening of the system in the following terms:

On a Tuesday in 1855 Directors and Shareholders of the Waterworks Company left their office in St. Andrew's Street, and, forming a procession of carriages, proceeded to the Engine House on Cherry Hinton Road. The Vice-Chancellor pointed out to the company the various parts of the engines and pumps which were working with beautiful regularity and freedom from vibration.

The carriages toiled up Lime Kiln Hill above the lime kilns to the large reservoirs. One was charged with water, the other being dry was soon honoured with the presence of many distinguished personages; the vaulted roof, the arched sides, and character of the workmanship appeared in noble effect by candle-light.

In a brief but pithy speech the Master of Trinity quoted well-known lines of Schiller, asked God's blessing, and expressed the fervent hope that this work would be of great benefit to the working men of Cambridge. He turned the tap and said, 'And so the water goes to Cambridge'. Champagne corks flew.

Descending the hill, the springs at Giant's Grave were attentively examined much to the annoyance of the Cherry Hinton laundresses, who were drawn up in battle array, and with their tongues assailed the Directors volubly for interfering with their water. They had traditionally taken in washing from the colleges delivered by donkey cart service.

The procession reformed and witnessed the play of jets in the town, being quite as high as King's College Chapel.

So, what was the effect of water abstraction on the pond that should have so riled the laundresses? And what were the concerns of Mr. Okes who had presumably commissioned the map in Fig. 17?

An 1871 agreement, and later

By 1871, Okes had come to an agreement with the Waterworks Company that the discharge of the Cherry Hinton Brook entering his estate should never fall below 100 gallons per minute. He installed stream gauges to check that all was as it should be. It so happened that his brother Richard was a director of the Waterworks Company; but this could be an irrelevance. It can only be that his motive was to maintain the success of his water project rather than to show concern for an adequate supply of water for the citizens of Cambridge. These were the days, of course, when water tables and the ecologies of Chalk streams were not generally pondered over. On the face of it, 100 gallons per minute suggest that Okes struck a very good deal, perhaps so good as to jeopardize municipal water supply? More importantly, in the absence of historical discharge data this seems to be a high minimum benchmark against which supposed modern lower flows (see pages 7 and 8) could be compared.

So, 'modern' flow was measured in November 2023 at Forest Road, and found to be 26 litres per second, a figure comparable with measurements taken at Nine Wells. However, it transpires that Mr. Okes's modest requirement of 100 gallons per minute is the equivalent of a mere 7.5 litres per sec. So, to learn that discharge in the 1870s never fell below that low figure does nothing to support the argument that average flow then was greater than average flow now.

1883 and later

In 1883 two additional wells were sunk in the Lower Chalk and a 12-inch bore-hole sunk 200 feet to tap the Greensand underneath. At about this time it was reported that almost 50% of water being 'supplied' was going to waste. From 1891 boreholes in Fulbourn supplied additional water. In 1907 the Fulbourn pumping station replaced Cherry Hinton Road. In <u>1908 (p.40)</u> the primitive sewage arrangements of Cherry Hinton village and the safety of the water supply were of some concern.

By 1921 the modern era had begun with the sinking of the 162 feet well at Fleam Dyke. Two horizontal adits, 18 feet above the bottom of the well, intercepted water-bearing fissures. So this sometime marshy corner of the Cam Valley was drying out.

Chalk streams: canalisation

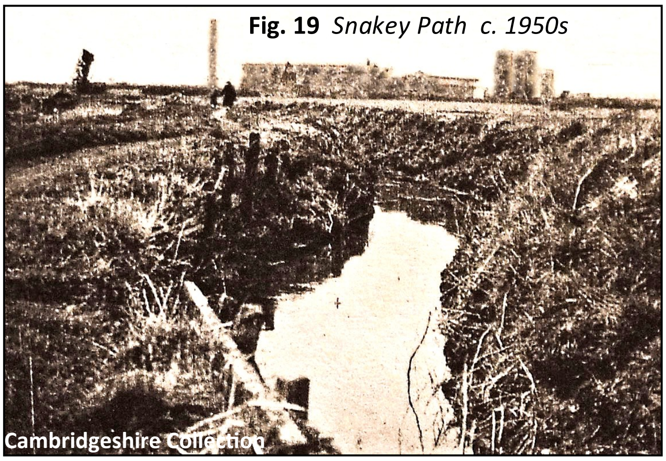
Further change was afoot. Fig.18 shows what a proper Chalk stream might look like: a gravel bed, shoals of fish in crystal-clear water, strands of water-crowfoot and water-starwort, with a unique community of aquatic insects and invertebrates and a wide range of wildlife attracted to the water's edge. Now compare with the Cherry Hinton Brook in Figs. 19 and 20 which were both taken at the same bend in Snakey Path (near lamp post 25).

The apocalyptic desolation of Fig. 19 may be partly due to the monochrome photographic paper used. It

Fig.18 *A Chalk stream exemplar*

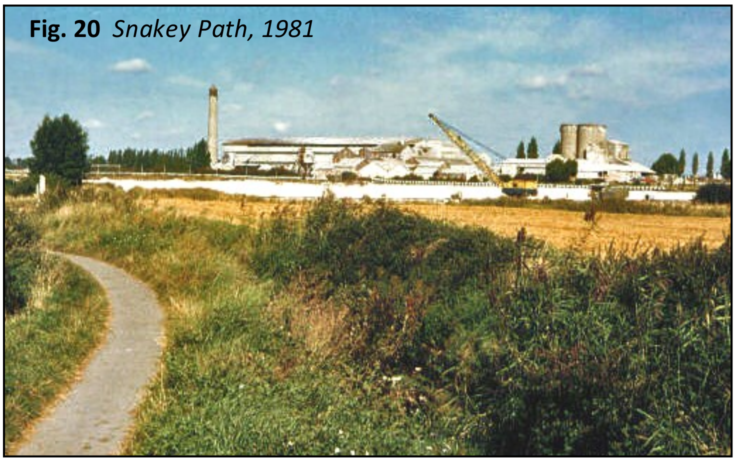
Charles Rangeley-Wilson

Fig. 19 *Snakey Path c. 1950s*



Cambridgeshire Collection

Fig. 20 *Snakey Path, 1981*



is possible that the trench-like channel represents the spate of deep dredging which took place as an over-reaction to the disastrous 1953 floods. This was soon after the Norman cement works had been rebuilt. The photograph in Fig.20 was taken in 1981 shortly before the works were finally demolished.

Fig.21 shows clear evidence of dredging. A JCB took its place on the tarmac of Snakey Path which is just visible in the bottom right hand corner of the photograph. It bodily scooped out the sides and bed of the channel and deposited the spoil on the directly opposite side of the channel forming the regular bank or artificial levée. An analysis of the material in the bank might reveal characteristics of the banks and bed of the original channel. They appear to have contained little or no gravel. The West Melbury Marly Chalk and other local Chalk strata contain little or no flint. A count of tree rings in the three mature trees planted on the levée would provide the latest possible date for the event.

Fig. 21 Snakey Path, 2022, with lake in the background

In summary, this unwelcome process widened, deepened, and straightened the channel, and steepened its banks. All flora and fauna were destroyed. Above all, fine material has been washed in from the banks, so the channel bed of the entire lengths of the Cherry Hinton and Coldham's Brooks became covered with a deep layer of silt, the least favourable environment for the spawning of fish.

The lakes beside the brook (background of Fig. 21), excavated in the Marly Chalk for the cement works, are, of course, an abuse of landscape on an industrial scale in themselves. Before the cement works closed the disposal of waste into the brook caused it to flow sludgey grey and must have contributed to the deposition of silt on the bed of the channel.

Other historical influences

At first sight the fields on both sides of the channel in Figs. 19 and 20 appear to represent a floodplain, created over geological time by the lateral erosion, to and fro, of its meanders; this surface being periodically flooded by increased stream discharge after rainfall. Typically, silt is deposited on such a floodplain by the flood water. If this were a floodplain having this origin then the natural relationship between this meandering stream and its floodplain has been destroyed by the overdeepening of the channel brought about by dredging.

However, this is not the story here. Some 500,000 years ago the surface of the area represented in Fig. 1 was eroded by the south-moving kilometre-thick Anglian ice sheet. This had the effect of reducing the slope of the Chalk scarp and causing it to retreat southwards. Subsequently the Cam Valley took shape during extended periods of fluvial erosion and the associated periodic formation of gravel terraces. The nearest of the latter are just outside the immediate catchments of the Cherry Hinton and Coldham's Brooks.

Dr. Steve Boreham has emphasized the importance of periglacial processes in the formation of the Cam Valley. These are processes which operate under tundra conditions, in the soil and in unconsolidated material lying on top of permafrost, on the periphery of an ice sheet. Periglaciation finally ceased about 11,700 years ago after the last glacial (Devensian) ice finally left the British Isles (which had not reached as far south as Cambridge).

More locally he has drawn attention to periglacial landforms (p. 16 and Fig. 3) within the catchment of our two brooks. A near-circular, very shallow depression, about 1.5km in diameter, is centred near the junction of Cherry Hinton and Perne Roads at point X in Fig. 2, and bounded by the 10 metre contour. The latter is difficult to follow but is clearly seen close to Snakey Path. A narrow outlet channel from this depression drained north in the vicinity of Sainsbury's. This outlet led across Coldham's Common, at 8-9 metres OD., towards a second outlet near the Abbey Stadium, thence to the Cam.

This circular landform is interpreted as a thermokarst depression once containing a thaw lake during the

Devensian period, before those 11,700 years ago.

Incidentally, this depression explains the former marshy nature of the terrain and the flooding in 2002 of the Birdwood and Walpole Roads area. This map shows the modern open drains in the locality (though it incorrectly shows an open channel near the spot labelled Q in Fig. 13).

So, the headwater of the Cherry Hinton Brook ran across the 'flat' land surface seen in Figs. 19 and 20, just before reaching and then following the perimeter of the thaw lake depression without, it seems, 'spilling' into it, but eventually occupying the outlet onto Coldham's Common before finding the second outlet down to the Cam. So the tiny brook is a misfit stream flowing through what is known as an 'alas' valley (Photo C, p.120).

Therefore, the Cherry Hinton Brook has done little more (geomorphologically speaking) than establish its route across the 'recently'-created, very gentle slopes, formed by periglacial processes. At first the relatively small stream channel was perhaps braided, spreading through alder and willow carr. In any case those level-looking slopes in Figs. 19 and 20 do not technically constitute a (fluvial) floodplain. Nevertheless, the single channel eventually formed was destroyed by dredging.

Channel restoration

In recent decades it has perhaps been fisherfolk who have been most sensitive to the desecration of Chalk streams. Individual enthusiasts have done much to try to repair damage done. Given that true restoration of that which has been removed is impossible, some well-established techniques have been developed which do succeed in attracting a diverse and authentic Chalk stream ecology.

The simple channel restoration undertaken in the two brooks can be seen as the construction of channels within a channels. The photographs in Figs. 22-25 were taken alongside the Blacklands allotments, Daws Lane. Brushwood fascines were staked in the channel to make it narrower (Fig. 22) and more naturally sinuous thus increasing the rate of flow and helping to flush out silt. Fascines are often made on the spot using bankside branches cleared to open the channel to more light to encourage, for example, colonisation by water voles. Logs,

Fig. 22 *Daws Lane*

Fig. 23 *Daws Lane*

Fig. 24 *Daws Lane*

Fig. 25 *Daws Lane*

staked in position Fig. 26) are used as flow-deflectors and to help create a patchwork of water habitats of contrasting depths and speeds and directions of flow, thus encouraging ecological diversity, and abundance.

Flint gravel, ideally ranging in grain size from coarse sand to small cobbles, has been spread on the channel bed, often by voluntary labour (Fig. 27) with professional guidance by the Wildlife Trust, the Wild Trout Trust, and the City Council. Sometimes there is mechanical help (Fig. 23). The gravel is fashioned to resemble the bed of a natural stream (Fig. 25) so that the depth of water varies both laterally across the channel and along its length creating pools and riffles (shallows). This in turn creates water currents which vary in speed and direction resulting in the natural processes of erosion and deposition.

Unfortunately, although gravel has now been laid in the channel from the pond in the grounds of Cherry Hinton Hall to the allotments bridge in the bottom right-hand corner of Fig. 25, twenty or thirty tons of gravel delivered by lorry covers very few yards of channel. Furthermore, downstream, gravel has only been applied at conveniently accessible points such as at the upstream end of Burnside and at St. Bedes Crescent (Fig. 26). Unhappily, some of the flow deflectors and gravel at these locations have sunk out of sight into the underlying silt. The stretch beside Sainsbury's (Fig. 27) was more successful. Here, silt was sent downstream by vigorous trampling before the gravel was laid.

The beneficial effects of restoration are being monitored at monthly intervals by taking kick samples of invertebrates in the gravel visible in Fig. 25. Within living memory, at this very spot where the bank slopes gently down to the water's edge, the local farmer used to dip his sheep by blocking the entrance to the brick bridge and pouring arsenic into the pond which formed.

Uncaring humankind

Humankind is divided into those who care and those who don't. For decades the stream channel has been treated as a convenient and favoured dumping ground for the detritus of suburban civilisation: metal cans and bottles, clothes, bicycles, supermarket trolleys, garden furniture, car tyres and wheels, not to mention stolen portable safes and miscellaneous plastic and metal objects of all kinds. If all of these had not been painstakingly removed over the years the channel would now surely appear as a long, narrow landfill strip.

Fig. 26 *St. Bede's*

Fig. 27 *Sainsbury's*

Fig. 28 *Snakey Path*

Young summer trespassers attracted by the lakes have done much to degrade the brook and, especially, the southern lake, with litter and rubbish. Attempts by Peterhouse to keep out trespassers with insensitive and ineffective fencing, steel pillars, and even a plate-steel barrier did not prevent a death by drowning in 2024.

It is astonishing that such a maltreated stream should form the axis of a green corridor of such ecological richness and diversity, crowned, for example, by water voles, herons, little egrets, and kingfishers (Fig. 28).

Greater heights of desecration

In Fig. 34 the Cherry Hinton and Coldham's Brooks are represented by a thin black line, the East Cambridge Main Drain by a thick black line, dashed where buried.

After all the abuse outlined above, the level of desecration reaches new heights once the Cherry Hinton Brook has passed the roundabout at Sainsbury's.

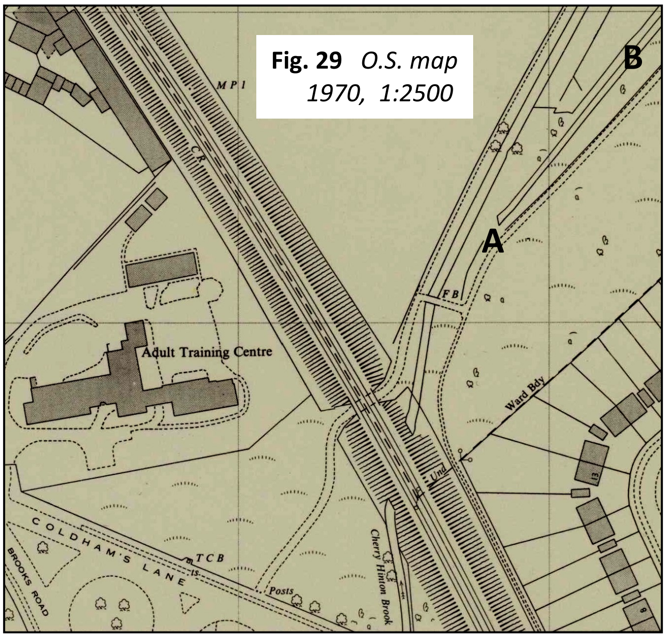


Fig. 29 *O.S. map 1970, 1:2500*

Fig. 29 shows the precursor to the 'Sainsbury's' roundabout at the junction of Coldham's Lane and Brooks Road in 1970, before the construction of the Barnwell Road which now enters the roundabout from under the railway. The general alignment of the Cherry Hinton Brook (and its direction of flow) is clearly shown and, perhaps, doesn't differ significantly from its 'natural' position. However, a comparison of Figs. 4 and 29 shows that between 1927 and 1970 the alignment of the Drain was shifted laterally from alongside the Smallpox Hospital in 1927 (along what was the 'Ward Boundary' in Fig. 29) towards the north west, and, partly buried, emerging at point A in Figs. 29 and 30 where it emerges today.

After 1970 the pushing through of Barnwell Road (for our convenience and benefit) from the roundabout, dipping into the depression under the modern railway bridge to an altitude lower than that of the brook, and then cutting a swathe north-eastwards across the rough grassland in Fig. 29, brought disastrous change to the brook.

After flowing under Coldhams Lane (at the exit to the Sainsbury's car park) the Cherry Hinton Brook now disappeared into 100 metres of miserable tunnel before turning left under Barnwell Road and emerging into the light at K in Fig. 30, before having to turn right at J to regain its earlier course. So the channel of the brook with its 'natural' alignment between Sainsbury's car park and J in Fig. 30 were plucked from the surface of the earth. The resulting tunnel and two bends (at (c) in Fig. 34) must have seemed at the time to be a good engineering solution to a traffic problem.

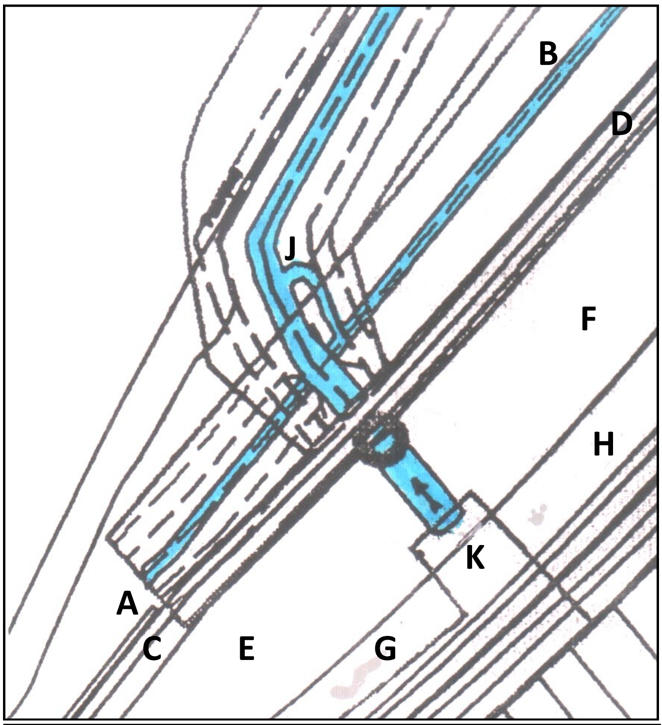


Fig. 30 *The underground East Cambridge Main Drain emerges at A in this map and in Fig. 29 and flows towards B. Coldhams Brook emerges from under Barnwell Road at K and crosses the Main Drain through a covered aqueduct before turning right at J. CD is a footpath/cycle track. EF is a grass verge and GH is Barnwell Road. It is not known if the spillway at J down to the Drain still exists as the area is thoroughly obscured by brambles.*

The photograph in Fig. 31 was taken from K in Fig. 30 where the Coldham's Brook emerges from under the Barnwell Road and flows towards the covered Aqueduct 1 over the Main Drain. The photograph of the Main Drain in Fig. 32 was taken from B in Fig. 30 looking upstream towards the aqueduct. The pipes on the left, now blocked, presumably formerly drained Barnwell Road.

Fig. 31 *Coldham's Brook between Barnwell Road and the aqueduct.*

Fig. 32 *East Cambridge Main Drain. View towards aqueduct from B in Fig. 30*

As we have seen (pp. 3 and 4) the abandoned channel between (d) and (e) (in Fig. 34) is in fact the historical leat, hardly ever with a continuous flow of water. However, the channel between (c) and (d), almost always with flowing water, is being 'restored' (Figs. 10 and 33). Here the channel is relatively straight and deeply cut (artificially) into the Marly Chalk Formation. The silt is deep and flint gravel is naturally absent.

In recent years considerable effort, time, and money have been spent on restoration largely by volunteers and contractors organised by the City Council and the local group Abbey People.

The photograph on the home page of the latter's website is of just such a group taken on the (rifle) 'Butts' bridge (F.B. in Figs. 4 and 37). This is the only convenient access point for lorry-transported gravel. The photograph in Fig. 10, taken from that bridge, shows unwelcome silt, the strategic use of logs, fashioned gravel forms, and the use of brushwood (on right hand side, near camera) to narrow the channel, all revealed by the exceptional low flow at the time.

Because of the difficulty of carrying gravel, restoration without gravel has concentrated on narrowing the channel with marginal brushwood or fascines staked in position. Fig. 33 shows holey buckets being used to scoop up silt from the bed of the channel and poured into brushwood. The vegetation associated with this length of stream channel was described in detail in the 2007 Cambridge Natural History Society Report.

Fig. 33 *Holey buckets*

Between (c) and (d) (Fig. 34) the Main Drain is joined by a tributary which drains part of the airport to the east and runs through a pond in the Barnwell East Local Nature Reserve. It was once reported that an 'incident' at the airport resulted in significant ecological damage to the pond.

The death knell

Excavated for our benefit, to clear the streets of rainwater and to reduce the chance of flooding, the East Cambridge Main Drain rang the death knell for Coldham's Brook. By the time it has reached the second aqueduct at (d) in Fig. 34 it has 'captured' or absorbed the brook which has filtered down and laterally into the lower (polluted) drain. Together the two water bodies enter the Cam as one, as the Main Drain. Beyond the aqueduct the leat is left, more or less, high and dry (Fig. 36).

The story begins back in the grounds of Cherry Hinton Hall. Here an underground pipe conducts water from the north (downstream) end of the distributary at K in Fig. 13 and at (a) in Fig. 34, under the brook to the start of the East Cambridge Main Drain where it can now be seen as an open ditch at P in Fig. 13 and at (b) in Fig. 34 where Daws Lane turns through a sharp angle near one of the entrances to the grounds of Cherry Hinton Hall. This ditch was excavated some time after the 1927 date of Fig. 4. The earlier history of drainage in this area was discussed on page 4.

At that corner in Daws Lane water can always be seen emerging and flowing northwards along the ditch. The discharge of the Cherry Hinton Brook is permanently reduced by this amount of water; the first instance of piracy. Note that the altitude of the Drain here, at (b), is presumably lower than the point at which the underground pipe passes under the channel of the brook between (a) and (b) (unless the water is forced through under hydrostatic pressure).

From Daws Lane the alinement of the modern East Cambridge Main Drain follows the historical ditches shown in Fig. 4. Although the Drain upstream from the Sainsbury's roundabout is mainly buried it is exposed along part of the boundary of St. Bede's School.

Where the brook crosses the Main Drain at (c) the altitude difference mentioned above is maintained or, more likely, increased. Between (c) and (d) the two water courses are approximately parallel, the Main Drain always being at a lower level than the brook. Throughout this length, along the edge of Coldham's Common, the water of the brook seeps down through the lowest strata of the West Melbury Marly Chalk Formation and laterally into the Main Drain, especially as it approaches the aqueduct at (d) near Galfrid Road.

Fig. 35 *View through collapsed roof of a swallet (underground stream)*

Just upstream from the aqueduct there is an underground stream or swallet (Fig. 35) which runs directly from the bank or bed of the brook channel, under a concrete wall at a depth of about 2 feet, then some 10 yards down into the Main Drain. The collapsed roof of the swallet revealed the abundant free flow of water throughout 2024. Its what3words location is care.sugars.neck.

With reference to the geological section (Fig.1), where the water in East Cambridge Main Drain has reached (f) (in Fig. 34) the Marly Chalk Formation has feathered out due to the general dip (downwards) from left to right. So the Gault (clay) Formation reaches the surface. Clay from the Gault used to be extracted from Gray's clay pit (Fig. 34), now a deep pond.

So, at (d) the bed of the Main Drain rests on the Gault

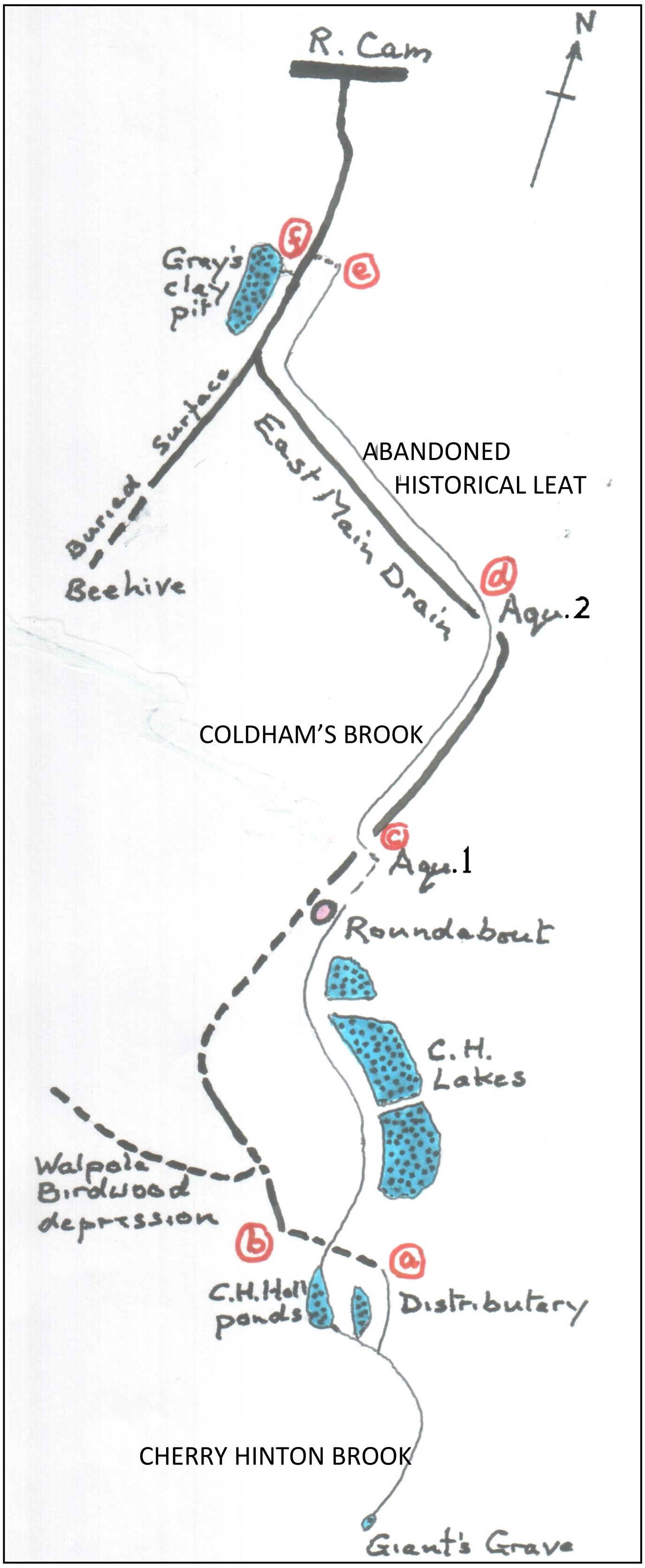


Fig. 34 *A schematic sketch map (not to scale) of the drainage of east Cambridge. The distance as the crow flies from Giant's Grave to the River Cam is c. 2½ miles. The fluvial channel between the two aqueducts holds Coldham's Brook which is normally absorbed by the East Cambridge Main Drain before reaching point (d). The normally dry channel between (d) and (e) is an artificial leat.*

(clay) Formation. The general leakage described above could be aided in part by the presence of a thin

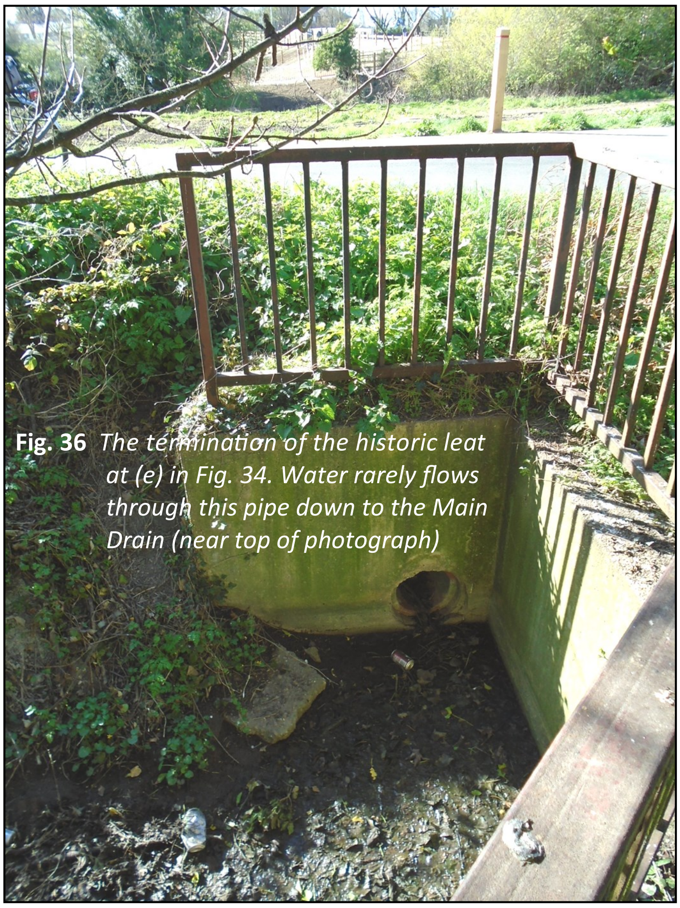


Fig. 36 *The termination of the historic leat at (e) in Fig. 34. Water rarely flows through this pipe down to the Main Drain (near top of photograph)*

stratum of Cambridge Greensand which sometimes lies between the Gault and the Marly Chalk Formation.

The lining of the leaking channel is repaired periodically by the City of Cambridge Drainage Department. Evidence for the seepage can often be seen in the channel of the Main Drain, by looking upstream from the bridge formed by Aqueduct 2, for example, in the colour and pattern of sediment on the bed of the channel or in the pattern of water flow.

So, the Main Drain more or less completely captures the brook. It seems that expensive waterproofing of the channel bed of the brook would be required in perpetuity in order to maintain this most unsatisfactory state of affairs.

Just occasionally water trickles through Aqueduct 2 into the leat. However, it should be noted that the channel entrance to the aqueduct pipe is plugged (as in November 2024) by an enormous mass of silt covered with common reed (*Phragmites).* This has the effect of damning back a long and very narrow lake whose water is lost through its banks and bed, balanced, in a kind of equilibrium, by the supply from the Cherry Hinton Brook. If the silt plug were removed the lake's water level would presumably drop as water flowed through the aqueduct pipe into the leat.

As it is, the clearly-defined channel of the leat between (d) and (e) normally holds, at best, a string of puddles. The wettest stretch lies between the Abbey Pool and the Abbey Stadium. On 31 October 2024 there was a very shallow puddle, or sequence of puddles, over perhaps 50 yards, of stagnant, heavily polluted, smelly, motionless water which was clearly of local but unknown origin.

The photograph, Fig. 36, shows where this channel terminates, ignominiously at (e), without quite reaching the Newmarket Road where the 16th century channel (once known as the Paper Mills Stream, all the way from Giant's Grave) continued in its alignment across the road (as shown in the much later 1830 map, Fig. 3) supplying water to the paper mill (linked to the history of the Cambridge University Press).

During the wet winter of 2023/2024 dribbles in the leat reached (e) in Fig. 34 though the flow may not have been continuous from (c) to (e). Anyway, some water flowed down to the Main Drain through the buried pipe (Fig. 36) represented by the dashed line between (e) and (f). From Fig. 36 it can be understood that this small pipe runs down into the (significant) shallow valley, occupied by trees near the top of the photograph, which is now followed by the Main Drain

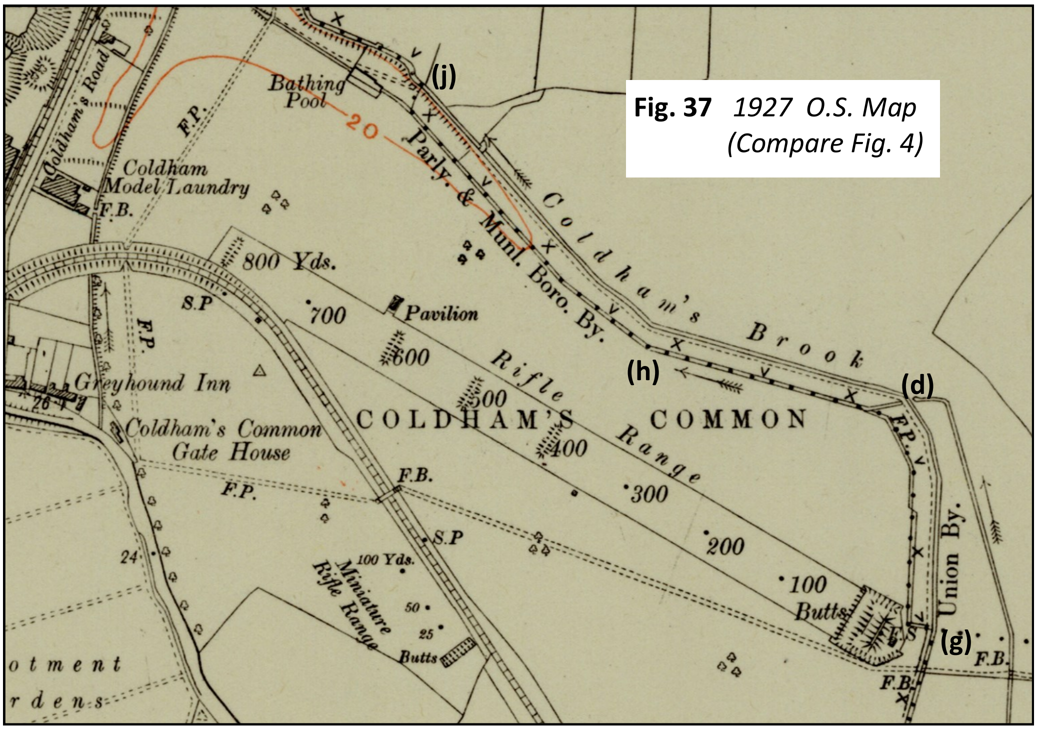


Fig. 37 *1927 O.S. Map (Compare Fig. 4)*

which flows from left to right.

When is a brook not a brook?

In summary, with reference to Figs. 3 and 34:

(1) At least until 1830 (Fig.3), a section of Coldham's Brook meandered freely across a floodplain between (g) and (j).

(2) It is more than likely that in earlier centuries, both upstream and downstream from these two points, the brook also meandered freely on the floor of its shallow valley.

(3) Before 1830 (presumably in the 16th century) a straight/angular leat was dug to extract water from the brook at (g) close to the WW1 (rifle) Butts and 'Butts' bridge. Unexpectedly it rejoined the brook again downstream.

(4) If the bypass were shorter than the meandering channel its gradient would have been steeper. Was this an attempt to reduce flooding? In any case it seems from the 1830 map that all the water from all the man-made ditches in the whole catchment was directed through the drain under the leat (at the same point (d) where the modern cross-over takes place) and into the meandering brook channel. The combined discharge was channelled to the paper mill *via* the leat (at a time when it is assumed that stream discharges were significantly greater than at present, due to modern abstraction from the Chalk aquifer).

It is interesting that the 1830 map (Fig. 3) names the leat as Coldham's Brook, a custom which has been misleadingly followed ever since. 'Coldham's Leat' would be more appropriate.

(5) By 1927 (Figs. 3 and 37) the meandering brook had been straightened and become the main man-made drainage ditch for the whole catchment. However, directional arrows show that water was still flowing along both the straightened channel and along the leat. Incidentally, the former meandering channel between (g) and (d) no longer carried water. Fig. 37 shows the leat/drain cross-over point more convincingly than Fig. 3. As in Fig. 3 the leat is again named as Coldham's Brook.

(6) In Fig. 37 it looks as if the straightened (formerly meandering) channel supplied the bathing pool, near (j). It is notable that the political boundary follows the same alignment in both Fig. 3 and Fig. 37, with the same right-angle turns.

(7) Coldham's Brook has the characteristics of a lake: damned by silt, with an inflowing Cherry Hinton Brook and an outflowing leakage to the East Cambridge Main Drain.

So when is a brook not a brook? Well, when it is a lake, and when it is a leat. And especially when it is a leat without water flowing throughout its length.

The 20ft contour in Fig. 37 is telling. It is universally the case that rivers cross bends (often sharp) in contours where the bends point to higher ground. This drainage channel bears this relationship to this contour. So the meandering stream in Fig. 3 and its straightened version in Fig. 37 did indeed flow gently along the axis of a shallow valley, continuing down slope in the valley seen in the background of Fig. 36. This valley was not fully portrayed in Fig. 3 however.

The man-made leat (named as Coldham's Brook in Fig. 37) was engineered to take water from the brook at (g) and follow the contour at (j) along the side of the valley, with a very low gradient indeed. The discharge of the parent stream was thus reduced. Why the parent stream rejoined the leat at (j) in Fig. 3 has no obvious explanation. Such parent streams normally continue in their old course. Depending on elevations perhaps it was a means of having the drain from southern Cherry Hinton flow under the leat at (d) and then into the leat via the old meandering channel. Perhaps the map was left deliberately incomplete.

In the 20th century the East Cambridge Main Drain was deepened along the line of the straightened channel, in effect re-creating the thalweg of the 'natural', shallow valley, leaving the leat high and dry (Fig. 36). The historical vandalism was now complete.

Coprolites and the Common

Geological maps show the West Melbury Marly Chalk Formation at the surface of Coldham's Common. However, the Upper Gault and even the Cambridge Greensand between the Gault and the Marly Chalk, lie at no great depth. These were the strata which contained phosphatic nodules (known as coprolites) which were of such great value to agriculture in the second half of the 19th century.

On Coldham's Common they were dug from deep trenches which were backfilled, thus reconstituting the original land surface. The Weigh House survives at 101 Coldham's Lane. Though not obvious to the present eye the enterprise had a great impact on the landscape. Notably, large quantities of water were required to wash the nodules which were typically sent to a 'washing mill'. Where was there a washing mill? Where was the silty water discharged? What was the overall impact of this extractive industry on Coldham's Brook?

Connectivity

In any case, whatever the impact, to cap it all, the Cherry Hinton Brook and Coldham's Brook cannot reach the Cam undefiled. Their combined waters enter the East Cambridge Main Drain sooner or later. From (f) in Fig. 34 it is the Main Drain which flows down to the Cam, not Coldham's Brook. It is the Main Drain which turns left under the railway and then heads north-north-westwards to the Cam. Even the abandoned, silted-up ditch alongside the railway is named Coldham's Brook on some maps.

Approximately 100m before the Main Drain reaches the railway a surface sewer pipe drains into it from the Beadle Industrial Estate off Ditton Walk.

The Main Drain can be said to be a Jekyll and Hyde stream. During low flow there is little or no pollution from urban runoff. It then consists mainly of Coldham's Brook and could be mistaken for a Chalk stream. When it rains the Main Drain becomes polluted and turbid from street run-off. There is less change in the Chalk stream component.

It has been suggested, using the modern buzz word, that the Cam and the Cherry Hinton Brook systems should be reconnected, thus enabling brown trout, for example, to migrate from the Cam up to Cherry Hinton Hall. In theory this could be achieved by diverting Coldham's Brook down into the Drain at (c) in Fig. 34 and from K down to B in Fig. 30, with a suitably engineered fish pass to enable fish to negotiate the abrupt change in level.

This raises some fundamental questions. How many, and what kinds of fish enter the polluted Main Drain from the River Cam at different flow rates? Would fish migrate up through the tunnel under Barnwell Road if a fish pass were created? What would be the cost of a fish pass? What would be the cost of a bridge carrying Barnwell Road across a re-created channel for the brook?

A case against a fish pass at (c) is that Coldham's Brook between (c) and (d), the backbone of Barnwell West Local Nature Reserve, would dry out. This would eliminate the water whorl-grass (*Catabrosa aquatic*) which has been observed here in the past, together with other valuable wild life. The whorl-grass is one of the rarest plants in Cambridgeshire, perhaps now only found in this locality though it has not been located and identified in recent times. On the other hand, it is common in the rest of the British Isles and non-tropical areas of the northern and southern hemispheres.

And what about all those many hours of wading, digging, cutting, felling, lifting, pulling, hammering, raking, shoving, and shovelling (Figs. 10 and 33 again) which have been invested in channel restoration between (c) and (d)? A bypassed, 'restored' channel, left high and dry, would be a museum piece (Fig. 10).

David Brooks 1 December 2024