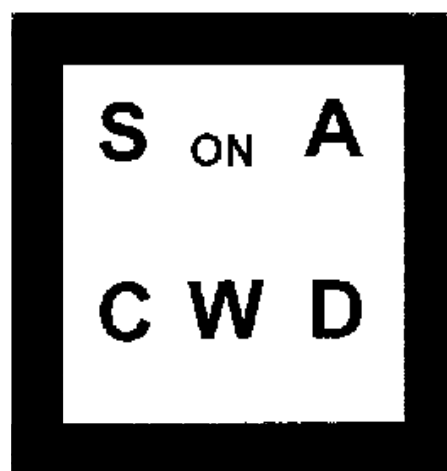
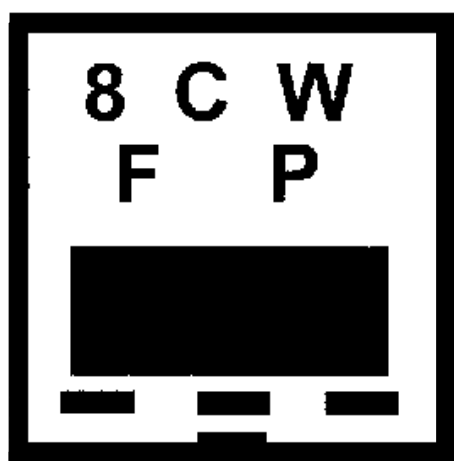


The Stratford - upon - Avon Improvement Works

Stratford's Water and Sewage
1848 - 1906



John Brace

Online Edition February 2011

Introduction to the Online Edition

This work, originally published in 2004, has been reformatted for this online edition. There are no significant textural changes from the original work but the whole has been reformatted and an index added.

John Brace

February 2011

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1848 – 1906

Introduction

In the early 19th century most towns were insanitary. Muck and filth vied with poor housing, vermin and bad water to spread disease. The spread of cholera to these isles, in the 1830's, and the recognition that this was spread by bad water, provided the impetus for the sanitary reforms that culminated in the Public Health Act of 1848. By this act, parliament encouraged towns to improve their condition by setting up Local Boards of Health. These boards could have very wide remits including responsibility for roads, cemeteries and bridges but this work is concerned only with those of water supply and drainage – it would have included public bath houses and public wash houses except that Stratford upon Avon had neither.

The period covered is substantially that from 1848 to 1906 but is extended firstly to 1914 and then to 1921 in order to bring the story of the auxiliary water supply to a conclusion.

The surviving records of these works, or at least to those found, are very often unsatisfactory. Where circumstances have necessitated the use of suspect sources I have sought to make this clear by the text. I have also found it necessary to greatly simplify details of the 1848 Public Health Act and its subsequent revisions.

Finally this work compliments, but does not replace, another by R.I.Pinney published in Warwickshire History Vol.1 Part 6.

The Town before 1850

In 1850 the town had neither a piped water supply or proper sewers. It did however have drains to carry away surface water and such other filth as found its way into them. Details are fragmentary but it is clear that both open ditches and covered conduits were in use. One of the principal drains was an open ditch running on the north side of Guild Street which discharged into the River Avon somewhere about the present boatyard. A

second drain, known to have been partly open and partly covered, is ransdown Chapel Street and across the meadows.

In the 1820's the Stratford canal was extended from its original terminus, about 'One Elm', to the waste ground adjoining the river. Water leaking from this extension subsequently caused problems for properties lying between the canal extension and Guild Street. The extension must have cut through the Guild Street drain somewhere about Clopton Bridge but it is not known how this was dealt with.

Most of the town lies on gravel beds only a little above the river. Water was thus easily drawn from shallow wells which never failed in dry weather. This water although naturally clean was often contaminated by filth seeping from cesspools or ditches. Additionally the hard water from these wells was unsuitable for laundry work unless chemically softened with Soda. Thus it was probably the common practice to use rain water for laundry work in Stratford - upon - Avon but of this no record has been found.

The Local Board of Health for Stratford – upon – Avon

Before 1848 public services were provided, if at all, by a variety of bodies. In, and about, Stratford – upon – Avon these were the church vestry, the town council and the poor law union. By the standards of the day both the town and the vestry had a good income but, although the vestry was instrumental in establishing a committee to save the town from cholera in 1832 [1], neither the vestry or town council seem to have been very much concerned about public health or sanitation. The union was more so and it was the union that, from about 1847, employed inspectors to clean the town of the worst filth [2].

The Public Health act of 1848 was intended to galvanise towns into improving their sanitary, and other, conditions by the establishment of new bodies. These were the General and Local Boards of Health. Local Boards were given powers to do many things (e.g. to dig up the streets and to lay pipes and sewers) all this to be paid for by local taxation. What they didn't get was any power of compulsory purchase or authority to engage in any works (e.g. the laying of pipes) out with their district. They were additionally constrained not to cause nuisance, not to borrow beyond the total rack rent (rateable value) of their district and indeed were not able to borrow without Whitehall's prior approval.

Whilst Whitehall retained certain reserve powers it was intended that towns should voluntarily petition for adoption of the act. Before the end of 1848 the Borough and Parish¹ had combined to present a joint a petition to Whitehall. The criteria that such a petition had to meet was not very onerous and was clearly biased in favour of adoption – the signatures of only 10% of those paying the poor rate were needed to initiate a process that would almost inevitably lead to the formation of a Local Board of Health. This process would start with the appointment of an inspector to inquire into the condition of the town with a view to recommending, or otherwise, its suitability for adoption of the public health act. The inspector was to be a Mr. George Thomas Clark who held his inquiry over three days starting on the 16th. December 1848. Although charged with enquiring into the sanitary conditions of both the Borough and Parish Mr. Clark confined his inquiry to the urban area of the Borough, of New Town north of Guild Street and of Old Town [2]. He was also to include a few houses east of the bridge and partly within the parish of Old Stratford and partly within the

1. The Borough was within but independent of the Parish of Old Stratford.

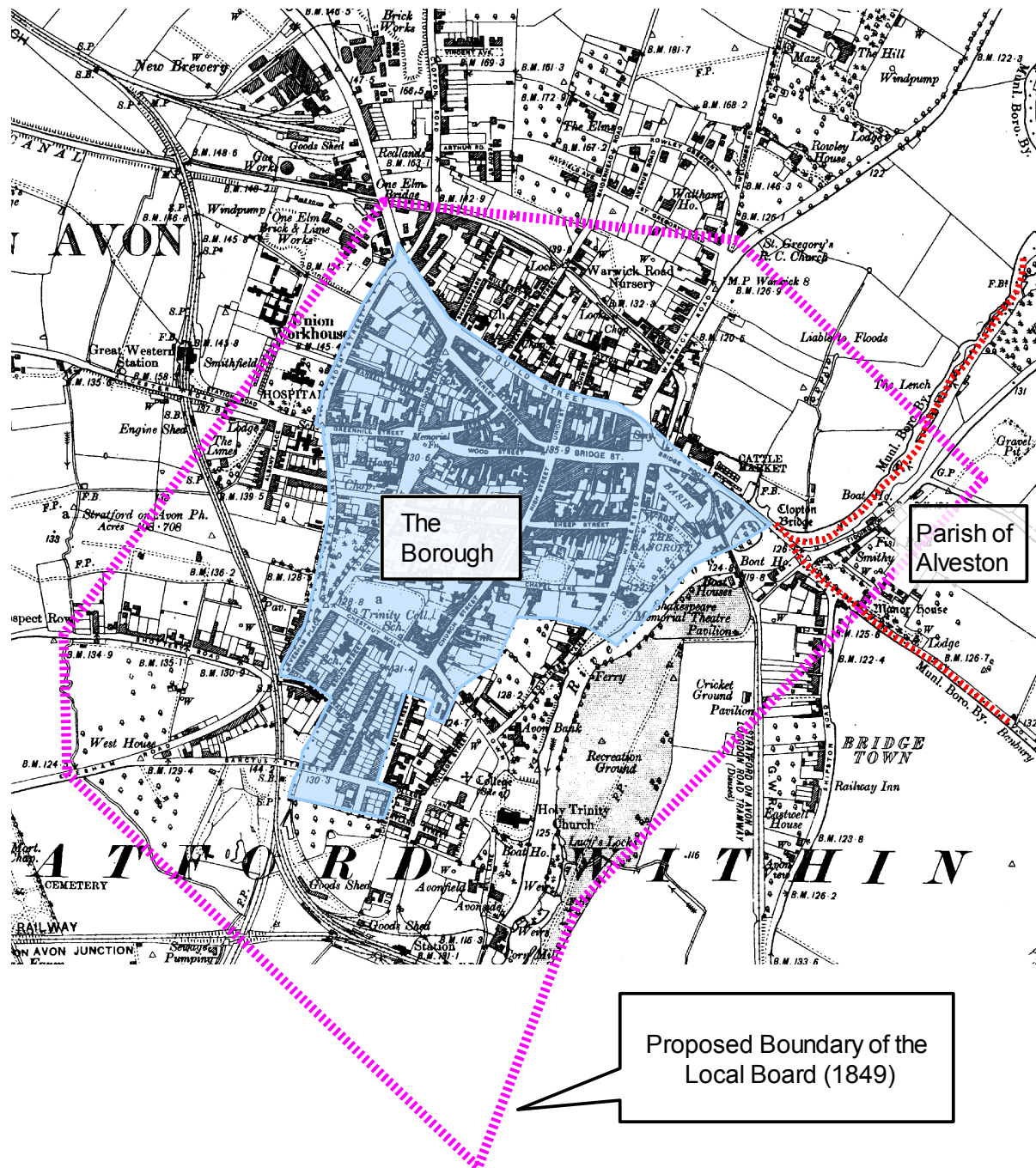


Figure 1
Parish, Borough and Proposed Public Health
District – 1849
 (Details Superimposed on Late 19th Century Map)

parish of Alveston. It was this urban area (see figure 1) that he was to recommend for adoption of the Public Health Act.

Although noting the condition of the town as recently improved by the actions of the Corporation and Guardians he found much that was insanitary and thought the town in much need of a water supply, sewers and separate drainage to carry away rainwater. To serve the needs of the greater part of the town he recommended laying an extensive system of underground sewers, laid at a depth below the basements of the houses, that would be directed to discharging their contents directly into the River Avon just below Lucy's mill [GR SP201541]. Elsewhere he recommended that sewers serving that part of New Town beyond the canal should discharge into the canal. As to water he thought that a population of some 5,000 persons would require some 100,000 gallons per day (gpd) but found no good water to be had about the town. The River water was hard and dirty, the canal water although softer was also often dirty, the waters of the Ingon Brook he found difficult to bring to the town and the water of Shottery Brook was hard. However noting that the canal water was softer than the water of Shottery Brook whilst being fed from the same catchment area² he concluded that some tributary(ies) of the brook must flow with softer water and thought that this should be captured for the towns use. Thus, whilst recommending that a more detailed examination should be made, he assumed that water from the upland parts of Shottery Brook would be captured, stored in a reservoir somewhere below the town and then pumped to a service reservoir. As the storage reservoir was to hold 120 days supply he was clearly thinking that the streams feeding the storage reservoir would fail in dry weather.

Thus having established, to his satisfaction, that the urban area of Stratford – upon – Avon would benefit from adoption of the Public Health Act and that sanitary improvements were practical, it remained only to show that such improvements were affordable. There were two criteria to be met. Firstly that the cost should not lead to the town borrowing more than the total rack rent (rateable value) of the proposed district and secondly that the water and sewage rate for houses compelled to take these services should not exceed 2^d per week. This he did as follows:-

2. A statement of dubious merit.

	£
He estimated the cost of sewers and house drainage as	2400
and the cost of a water supply as	<u>8100</u>
To give a total cost of	10500
The annual repayments due on this sum, if borrowed over 30 years would be	626
to which must be added annual expences of	<u>200</u>
To give a total annual cost of	826
This he proposed to raise in three ways:	
firstly by a water and sewage rate to raise	584
secondly by recovering the cost of private improvement works (see note)	
undertaken by the town	142
and lastly by additional income to be raised by special charges to large	
consumers and those installing additional water closets	<u>100</u>
	Total
	826

Note. Private improvement works were those for which the owner had to bear the cost i.e. internal plumbing and connection to the mains services.

With the assessed rack rent of the district being £13,800 the total cost was thus within the borrowing powers of the proposed district whilst a water and sewage rate of less than 1/- in the pound, and thus less than 2^d per week for a property valued at £10, would be required.

Clearly there were limitations as to what a three day inquiry could achieve but the shortcomings were considerable. The major problem lay with the failure to identify a suitable source of water – the hope that one might be found in the upper reaches of the Shottery Brook hardly justified the conclusion that improvements were both possible and practical. Then the tests for affordability are very suspect. Did the estimates include all the costs that would fall upon the town? I doubt it. I don't believe that proper provision was made for the cost of the enquiry, treasury charges, survey costs, legal and professional fees, the cost of land for reservoirs and pumping stations, or the cost of compensation to those affected by the various works. Then the revenue expectations were unrealistic. At best it would take some time, and perhaps many years, to connect the whole town whilst the debt needed to be serviced immediately. An even greater

problem was the assumption that the better houses would voluntarily agree to pay more than the 2^d per week provided for by law!!

But the report also ran into almost insuperable administrative problems. These revolved around the boundary of the proposed district (see figure 1) for this encompassed parts of three distinct jurisdictions. It encompassed the whole of the 1835 Borough to which it added those parts of the Parish of Old Stratford immediately adjacent to the urban area. It also included land east of the River Avon and within the Parish of Alveston. No part of Alveston should have been included for Alveston had not petitioned for a Local Board and indeed the population of the parish was too small for the principal conditions of the Public Health Act to apply – they could not have a Local Board even if so inclined. The second problem was that Whitehall would only deal with whole towns or whole parishes and so the attempt to separate that part of the Parish of Old Stratford adjacent to the urban area from the rest failed. Not that Whitehall initially recognised either of these problems or the political reality that the old parish structure had collapsed with Bushwood, Luddington and Drayton having long since run their own affairs. In fact the Parish Vestry no where seems to have held sway more than three miles from the town [3]. These problems were not finally resolved until long after the Local Board of Health was established in September of 1850. As revised, in April of 1852 [4], Luddington, Drayton and Bushwood were excluded from the district. It thus seems that both Shottery and Bishopton were included but without proper maps³, or any detailed schedule of the extent of the district, it is impossible to be certain where the boundary ran.

As established the board consisted of thirteen members. Nine of these were nominated by the borough, three were elected to represent the parish whilst the chairman was to be the mayor [5]. Thus although a nominally independent body it was effectively a committee of the town council and unable to work without their consent.

Although the principal reason for establishing the local board was to bring mains water and drainage to the town it also had to deal with lesser problems. Amongst their earlier actions was the purchase of a water cart, horse and harness to water the streets [6]. Another was an attempt to abate nuisance from the existing drains by fitting traps below the gratings [7]. The board also turned its attention to abatement of nuisance arising

³ Maps drawn in the 1880's show political boundaries after the reforms of 1880.

from filth in the canal. It transpired that much of this came not from canal users but from the town and in particular from the brewery. Banned from continuing the discharge of waste into the canal the brewery was only permitted to divert this into the Guild Street drain after agreeing to first filter the waste at its works [8,9].

However the first step towards bringing water and drainage to the town was to obtain accurate large scale maps. These were prepared by the Ordnance Survey and delivered in the summer of 1851 [10]. These were to be used to prepare detailed proposals but the board, perhaps distracted by an attempt by a considerable body of ratepayers to have the board wound up [11], seems to have taken no further action until July of the following year when they appointed a Mr. Pigot Smith to advise them. His report, which has not survived, was accepted in November of 1852 [12] when the works were estimated to cost some £15,000. In fact these works were unaffordable for the total rateable value of the drainage district was only £15,200 [13]. Somehow costs were reduced but at £12,000 they remained uncomfortably high.

It appears that Mr. Smith proposed getting water from Wilmcote very much as suggested by the inspector in his preliminary report. The problem with this lay in the fact that the local board's powers did not extend to Wilmcote. Thus the board could only proceed with the voluntary agreement of the landowners and this was not forthcoming [14]. Thus the whole process was brought to a standstill for there would be little purpose in laying sewers without water to flush the closets. This problem was not unique to Stratford and there was some hope that parliament would grant local boards additional powers to overcome these problems. Unfortunately these were not immediately forthcoming. The only other way forward was to promote a private bill – an onerous and expensive process and one actively discouraged by Whitehall. Thus the board had no option but to defer all plans for bringing mains water to the town. It did, however, obtain approval to deal with one of the greatest nuisances – the open sewer in Guild Street [15]. To achieve this a brick sewer was to be constructed from the junction with the Birmingham Road to a point somewhere below the Mill Bridge where it would discharge into the river. Estimated to cost some £3,000 this plan was also soon in trouble for the landowners about the proposed outfall were not prepared to have the towns filth in their backyard. Their opposition led to a series of court actions with almost comical conclusions [16]. Although the town had the power to lay sewers

across the plaintiffs land they would not be allowed to pass anything through them! The only option was to move the outfall further from the town. In the event this was to be some 1200 feet below the Mill Bridge. Whilst the extension of the sewer was estimated to cost an additional £500 the legal expenses came close to £600 [17].

The new sewer was finished during the winter of 1856/57. Although it remains unclear how much of the town was then drained the board was soon under pressure to extend the drainage throughout the town [18]. This was not a good idea for without a plentiful supply of water the drains would not be properly flushed. The board recognised this and sought to obtain water, for flushing the sewers, from the canal [19]. When terms for taking this water could not be agreed the board sought to pump water from the River Avon [20] but this also came to nothing. Nevertheless the board was soon extending drainage throughout the town at an estimated cost of £2,700 [21].

Although minor improvements and extensions were undertaken in the following years further substantial progress had to await the reforms of 1880.

The Stratford-upon-Avon Corporation Act of 1880

By this act the borough was enlarged to include the whole area previously administered by the Local Board of Health. The town became the Sanitary Authority and the Local Board was wound up.

Although the new authority inherited some ongoing minor works to better flush and ventilate the sewers nothing was in hand to stop raw sewage flowing into the river or to provide the town with mains water. Something had to be done and Whitehall was determined that the sewers would be ventilated to their, and not the towns, standards.

The Sewers

Early Victorian sewers were unventilated and gasses had an unfortunate habit of 'blowing back' into the houses. The simplest, and cheapest, remedy was to install open gratings in the streets to ventilate the sewers. Unfortunately this often resulted in considerable offence particularly where the sewers were not well flushed as was the case in Stratford. An

improvement was to ventilate the sewers at high level with pipes fixed to the houses but this was more expensive and not always a success. Later sewer vents became free-standing and some were fitted with gas burners (destructors) to both improve the draft and destroy the smell by combustion. *As some sewer gases were combustible this sounds a little dangerous but I am unaware of any problems.*

By 1880 Stratford sewers were partially ventilated. A 'chimney' stood somewhere in the town whilst elsewhere a ventilation pipe was taken to the gas works where it presumably went up the chimney [22]. It is little wonder that these arrangements appear to have been satisfactory for without flushing toilets little air entered the sewers. Nevertheless it was national policy to fit sewer vents every 50 yards and Whitehall was enforcing compliance by refusing loan applications to towns that didn't meet this standard. Thus street level sewer ventilators came to Stratford in 1880 [23]. The offence caused was both predicable and considerable for not only were the sewers poorly flushed but they also carried the towns brewery waste. Soon it was agreed that ventilation pipes would be fitted but decisions were so often made only to then be countermanded that it is impossible to establish how many were fitted and when. What is known is that the town found it necessary to purchase another water cart which was to be used both for flushing the sewers and watering the streets [24].

Later that same year the 1856 plan to draw flushing water from the canal at 'One Elm' was resurrected and with the town agreeing to pay the railway company £70 annually for the use of this water [25] work was soon in hand to lay a network of 6 inch pipes, with hydrants, about the town. Intended for sewer flushing and street watering it was soon also being used to water private gardens.

When Snitterfield water (mains water) reached the town, in 1886, most of the canal water pipework was kept to distribute this about the town. The remainder was abandoned until 1889 when Mr. Flower resurrected some of the old pipework to take cooling water to his brewery [26].

In 1885, that is before the town had mains water, a sewage irrigation farm was opened just south of the town. This will be discussed later but the immediate effect of these works was to impede the free flow of sewage. This caused the build up of much obnoxious detritus in the lower part of the main sewer and a great increase in nuisance from the ventilators. The

solution seemed to be better flushing but little could be done without mains water. When this became available the town started to install automatic flushing tanks at the head of some sewers [27]. This should have been beneficial but any benefit is unrecorded. By 1889 the problems had become so acute that a scheme was hatched to better flush the lower part of the main sewer with water drawn from the River Avon a little above the mill [28]. This was initially resisted by the mill owners [29] who were only persuaded to agree after it was made clear that flushing would have no discernible affect on the working of the mill [30]. Unfortunately, although agreement had apparently been reached and all was ready to proceed, nothing has been seen to confirm that the work was indeed carried out.

From 1890 the town often found itself short of water from late summer and continuing into the new year. With a view to saving good Snitterfield water thoughts turned again to the use of canal water for non-domestic purposes. Resurrection of the original scheme was impracticable but in 1894 the Great Western Railway (GWR) had tapped the Stratford Canal, somewhere about Wilmcote, to water their locomotives at Stratford. Apparently then having a surplus of water above their needs the town was able to agree terms for taking up to 10 Mg annually which they did from the summer of 1895 [31]. That the peak demand for Snitterfield water was significantly reduced from 1895 onwards can be seen from figure 2 but, as will become clear later, not all of the saving arose from the use of GWR water.

However welcome this arrangement it was never entirely satisfactory for the water had a habit of running out when the station was busy [32]. By 1911 the supply had become insufficient for the needs of both railway and town. After initially proposing to restrict the town supply [33] the GWR then sought to increase the flow by drawing water from further up the canal⁴ [34]. This brought but limited relief and in the summer of 1913 the GWR abruptly terminated the supply [35]. Urgently needing to replace the railway water the town turned to a well in Warwick Road that had previously been used in times of drought. With improvements to the well, a new pump house, gas powered pumps and piping to a new reservoir at Blue Cap [GR SP205565] this provided the town with a reliable 'Auxiliary Water Supply' from late 1914 [36]. An anomaly is that both 'Bell' pressure filters and an ammonia tank are shown on drawings prepared for these works [37]. These would not be required for a non-domestic supply and so

4. The 1911 inlet is immediately above lock 40.

it is questionable whether they were installed at that time. They would certainly have been required a few years later when the Blue Cap reservoir was partly covered and subsequently supplied both domestic and auxiliary water [38].

The auxiliary supply was finally abandoned in 1923 [38].

Purification of Sewage

Although raw sewage had been discharged into the River Avon from 1856 curiously few complaints appear to have been made about the pollution. Thus whilst many other inland towns had found themselves compelled to clean up in the 1860's Stratford upon Avon avoided doing so for another 20 years. However by 1880 the continued discharge of raw sewage into the river was unacceptable and the town had to do something.

In 1880 the options were few and the process of biological digestion unknown. If disposal was not directly into a watercourse it was applied to farmland as a manure. There were several variants. In 'Broad Irrigation' sewage was used to irrigate meadows. If only occasionally irrigated these meadows could be used for grazing but more generally they would be used only for the production of hay. Otherwise 'Intermittent Irrigation' with deep furrowing required much less land whilst allowing vegetables to be grown on the crest of the furrows. For this to work well the land had to be both well drained and level. This usually required the construction of artificial terraces, so called 'filter beds', with under-soil drainage. In some towns the solids would first be separated from the liquor. This permitted a wider range of crops to be grown but often it was simply an attempt to reduce nuisance. Composted with straw, or other vegetable matter, the solids became a valuable manure but the act of draining a sludge tank and moving the contents was a very great nuisance indeed. The only alternative was to mechanically de-water the sludge to produce a cake that could more easily be transported for disposal in some distant place.

Whatever method was adopted some nuisance was inevitable and it was wise to locate sewage farms at some distance from any dwelling or public place.

By the spring of 1880 the town had identified a parcel of land close by the East and West Junction Railway as a possible site for a sewage irrigation farm but felt unable to proceed without professional advice. To this end a Mr. Bailey Denton was appointed to advise the town for a fee of 25 guineas [39].

He thought the land identified by the town well suited for this purpose but advised that this could only be economically affected if the surface waters were first separated from the sewage [40]. However, and probably under pressure to do so, he then continued to describe a scheme where this was not done and where storm flows were diverted into the river. In this, and planning for the next 30 years, he thought up to 1 Mg of raw sewage must daily be pumped to a sewage farm partly laid out for intermittent filtration. He thought the total cost of this to be about £8,000 with recurring costs of about £450 annually of which £200 would be the cost of pumping. These costs would then be partially offset by income arising from the sale of vegetables which he thought worth £80 annually.

Delivered in July the committee charged with making recommendations did not report until October. Whilst then recommending Mr. Denton's scheme it was clear that their preference would have been to adopt broad irrigation [41]. They were not, however, able to recommend such a scheme on the grounds of cost – broad irrigation would require some 70 acres of land whilst Mr. Denton required only 16.

The consequences were predictable – it was an invitation for everyone to join in. Some looked to dispose of the town's sewage at Borden Hill more than a mile west of the town and others to land south of the river. Some sought to avoid pumping by using low lying land that was not only liable to flood but also too high to serve the lower parts of the town. Some suggested 'Osier Beds' and others to pipe the sewage 10 or 12 miles downstream to where the land was said to be much less expensive.

I will not be describing any of these suggestions other than to note some interesting ideas on pumping. Conventionally sewage would be pumped by steam powered beam engines. However one suggestion was to employ compressed air operated 'ejectors' [42]. Now ejectors came to have some popularity in the 20th century but this is a very early reference to such equipment. Of course the compressed air had to come from somewhere and this was to be from the gas works on the other side of town. Although

there was some merit in this for the gas works was owned by the town it was much too distant for this to be practical option. A second suggestion was to employ 'automatically controlled' gas engines [43]. Potentially a good idea, it would need far less attention than a steam engine, gas engines were in their infancy and the expectation of reliable automatic control unrealistic.

Time passed and the threat of legal action if the town continued the discharge of raw sewage into the river was renewed [43]. In January of 1882 the town appointed a well known local engineer, Mr. Pritchard, to review all the options then before the town [44]. Reporting in April [45] he generally favoured Mr. Denton's scheme above all others but did suggest some changes. In particular he was 'very strongly against' separating rain water from the sewage and thought it unnecessary to plan for pumping more than 800,000 gpd. He also proposed a re-alignment of the intercepting sewer. However he thought the proposed farm too small and proposed that this should be increased to 20 acres of which 5 acres should be used for intermittent filtration with the remainder for broad irrigation. This he thought could be achieved for a cost of only £5,000 but whether this estimate included the cost of land etc. is unknown. The annual costs he put between £150 and £180 which was to be partly offset by farm income of between £120 and £140.

Although not explicitly stated it is clear that Mr. Pritchard intended only to run the sewage pumps during the day. This was less expensive, and it left the filter beds to rest overnight, but the sewage had to be stored when the pumps were off. In fact it was to be held back and stored in the sewers overnight.

By June Mr. Pritchard's proposals had been adopted – by July agreement had also been reached on the purchase of sufficient land [about GR SP196538] for both the farm and a railway siding [46]. It was not, however, until June 1883 that detailed drawings were available [47]. The existing main sewer was to be intercepted just south of the railway viaduct and the flow diverted through a new 3 ft. brick culvert into a receiving tank at the new pumping station. The sewage was then to be lifted by steam engines and centrifugal pumps to a point where the entire land of the sewage farm might be commanded. The land was to be levelled, drained and purification achieved by a combination of irrigation and filtration. The final effluent was then to pass by an 18 inch drain to a new outfall. In order to

relieve the filter beds he also intended that Chambers Meadow would be irrigated in summer i.e. when the river was low. Otherwise the few houses opposite the town would not have mains drainage and the proposed railway siding had been quietly dropped. His revised estimate was now £4,000 + £1,500 for the purchase of land.

Generally well received he was challenged over his preference for steam engines over gas [48]. His reply seems ill advised. He did not favour gas engines over steam where more than 20hp. was required, he thought the cost of gas to be about 24/- per day and that 8 or 10 men might be required to turn the flywheel i.e. to start the engine.

It was November of 1884 before funding was in place. In the interim the pumping arrangements had been changed – now there were to be two, later three, 6 HP Gas Engines with self starting gear driving three Double Acting Sewage Pumps and all arranged so that any engine might drive any pump [49]. This arrangement was clearly intended to provide maximum flexibility in the event of either an engine or pump being unserviceable but the capacity had been cut to the bone – all three engines must run to deal with the design flow.

By June of 1885 work was well advanced with sewage being pumped much to the displeasure of many – Evesham Road was to be avoided when the wind was in that direction and the windows of passing railway carriages were to be kept closed [50].

The works were no great success – smells from the sewage farm now joined the long-standing complaints about those from street ventilators – indeed the construction of an intercepting sewer might very well have added to the offence from the latter for the sewage no longer flowed freely to the outfall but was impounded overnight. The result an accumulation of foul sludge not easily cleared when the pumps started the following morning. Called back, in December of 1886, to explain why his sewage farm was causing so many problems Mr. Pritchard was quick to identify the cause as being the sewage – not the sewage farm! [51]. Indeed there was at least some truth in this for a great deal of brewery waste was discharged into the sewers. In fact this problem had been identified as early as 1854 when the town demanded that brewery waste should be filtered before reaching the drain. How effective this filtration may have been and whether still practised in 1886 is not known but the

effect on the sewage farm was near catastrophic. The filter beds were covered with a hard black crust through which the liqueur would not penetrate [51]. His remedy was to break the surface of the filter beds before the application of liqueur, to better flush the drains and to introduce a straining tank to take out the solids before they reached the land.

The town turned to Whitehall in the shape of Mr. Robert Rawlinson of the Local Government Board. Mr. Rawlinson didn't visit the town – his advice was based solely on his experience and the papers before him [52]. From what transpired he had clearly been asked his opinion as to the effectiveness of both chemical treatment and mechanical de-watering of the sludge. In all of this he was generally supportive of Mr. Pritchard and thought neither chemical treatment or filter presses of much use 'so long as the sewage was strained as it reached the works'.

By June of 1887 the town had installed both a sewage tank and a sludge straining tank [53]. The details of these are very sparse. The sewage tank was near the junction of the main and intercepting sewer and its purpose seems to have been to hold sewage overnight. The straining tank was close by the pump house and was to separate solids and paper from the liqueur. In it raw sewage flowed upwards through a nine inch bed of porous slag. The solids were thus removed from the liqueur and would, eventually, fall to the bottom of the tank. Periodically the sludge had to be removed [54]. What the final method of disposal was to be is unknown but its initial resting place was in a heap close by. If the raw sewage was foul this sludge 'was the most offensive' that one expert witness had ever seen [55]. The new offence was the last straw for Clr. Thompson who promptly sought an injunction to stop the nuisance.

The case came before Baron Huddleston at the Warwick Spring Assize of 1888 [55]. The plaintiffs stated that he had a house on the Evesham Road about 400 yards from the Sewage Farm. He also owned another 11½ acres of land lying beside the Evesham Road that he had purchased in 1881 for the purpose of building upon. He had opposed the proposed development at both the 1881 and 1882 inquiries into the purification of the towns sewage. He was seeking damages for both nuisance and depreciation to the value of his property and land.

The sewage farm had been laid out, without tanks, in 1885. When pumping started there was a fearful stench and he had made his first

complaint on the 22nd. July of that year. Not receiving satisfaction he had followed this up in 1886 by addressing his complaint directly to Whitehall. The town had consulted widely and had tinkered with the works in 1886 and again in 1887 when tanks were installed. The new straining tank was emptied every 14 days when the stench was 'something beyond all belief'.

The town was now intending to flush the sewers and so dilute the sewage - an action which he thought to be useless.

Although the defendants had shown a willingness to accept an injunction, if suspended for two years, they were unwilling to pay damages. This was not acceptable - the plaintiff was however prepared to accept a reasonable sum suspended for one year.

At this point the judge indicated his readiness to issue an immediate injunction if the town was not disposed to remedy the problem.

The first witness was Professor Tidy, an official analyst to the Home Office. He had recently inspected the sewage farm and reported that he found an exceedingly offensive black matter covering the whole farm. As to the sludge removed from the straining tank he found this 'the most offensive matter that he had ever smelt'. He thought useless the town's present efforts to deodorise the sewage with Permanganate of Soda. Although he thought 'it better if the sewage was not so hot'⁵ he thought the only solution was to adopt chemical precipitation.

This concluded the first days evidence and overnight the town considered its position. They would not negotiate but 'fight'.

Given the weakness of the town's case the wisdom of so doing was very doubtful as Baron Huddleston made plain at the commencement of the second day. "I can not refrain from speaking very strongly upon the course which is being adopted in this action ----- I have never heard of so stupid a course as to attempt to fight a cause of this description when it is admitted that it must be remedied and when the only question is one of damages ----- the jury will have it in their power to give exemplary damages."

5. The high temperature came from hot brewery waste.

The town's case was intended to minimise those damages – that they had taken the best professional advice and considered the proposed damages to be excessive. Pertinent to this was a complex legal argument as to whether damages claimed for the period before September 1887 were out of time. This was not resolved but in an effort to ease any appeal that might follow this action the jury were asked to separately assess damages before and after this date.

In the event the jury awarded £1000 in damages arising since September 1887 and a further £250 for the time before this.

Subsequent events are far from clear – that negotiations took place with offers made and rejected is undoubted but the only certainty is that there was no appeal and that the injunction was suspended for one year [56]. As to the final cost both Clr. Thompson and the town had legal costs exceeding £500 apiece which together with the estimated liability for damages brought the total to over £2,100 [57].

In a final effort to abate the nuisance, and fend off the impending action, the town had resorted to chemical deodorising late in 1887 [58]. For this purpose they used a combination of permanganate of soda and sulphuric acid. Details are again sparse so we don't know whether they were introduced separately or together but they certainly did not solve the problem and continued not to do so even after the quantity used was doubled during 1888 [59].

It will be recalled that since 1881 the town had been flushing the sewers – firstly with canal water but more recently with Snitterfield water. From 1877 onwards the means by which the sewers were flushed changed from being by hydrant and hose to automatic flushing tanks discharging at the dead ends of the sewers. By June of 1888 the town had 15 such tanks [60] but if this brought about any improvement it passed without comment.

The town decided to commission yet another report this time from a Mr. James Manserigh.

His first report was discussed in November [61]. He found the sewage abnormally foul partly from the discharge of decomposing liqueurs from privies and middens and partly from the brewery waste. One option was to cut off the middens and to lay a new sewer from the brewery but,

reluctantly, he thought the best course was to build a proper works with chemical precipitation and machinery for pressing (de-watering) the sludge. This the town found unacceptable and he was sent away to try again.

His second report was available in January of 1889 [62]. He had examined the problems in more detail and had now concluded that the present farm might be improved sufficiently to meet the immediate requirements of the town. He thought the sludge tank useless and in its place he recommended the installation of a double screening cage to remove paper before it reached the land. However he thought the greater problem to be poor drainage. This he found to be partly due to compaction of the soil under the filter beds during their construction and partly to insufficient drainage. These problems he proposed to remedy by first exposing and breaking up the compaction and secondly by laying many more drains.

If this was done, the middens cut off, the sewers better flushed and priority given to the management of the farm for sewage disposal and not to the production of crops etc. etc. then all should be satisfactory. All this he thought to cost about £2,000.

With the brewery agreeing to discharge their hot water (no mention of the other washings!) [63] into the canal and Clr. Thompson agreeing to a further deferment of his injunction if the land closest to the town was not irrigated [64], it looked as if the town had finally found a way out of its difficulties. In fact what they had done was to back Mr. Mansereigh into a corner – by rejecting what he thought to be the only satisfactory solution they were now intent on proceeding with works which were, at best, second best.

In the event the improvements were at least a partial success for if complaints did not cease they were reduced and Clr. Thompson never seems to have enforced his injunction. However by 1899 something had to be done. But now the technology of sewage purification had changed – no longer would the principal method of purification be by irrigation but by passing the liquor through ‘bacteriological filters’ not very different, in principal, from many in use today. But the first stage was to separate the solids in ‘liquefying tanks’. These were large tanks, with cross walls, through which the raw sewage passed very slowly. The potential offence that

could arise when the tanks were emptied was very little different from before but with better management and locating the works at some distance from populated areas this could be minimised.

Construction of a new sewage works at Milcote [GR SP183528] started towards the end of 1904. Completed some two years later the cost seems to have been a little less than £25,000 [65]. The works had an automatic machine to remove paper, liquefying tanks and circular bacteria beds. Even so the final treatment was by land irrigation. Storm flow, that is flow in excess of that which could be treated in the liquefying tanks, was partially treated in contact beds⁶ before flowing into the river.

Although the old pump house was retained new 30hp gas engines and pumps were installed to double the pumping capacity. The new works, although a great improvement on the old, were not an unqualified success. One early problem was that of communication between the sewage farm and the pump house more than a mile distant and on the opposite side of the river. This was overcome by the installation of one of those newfangled telephones [66].

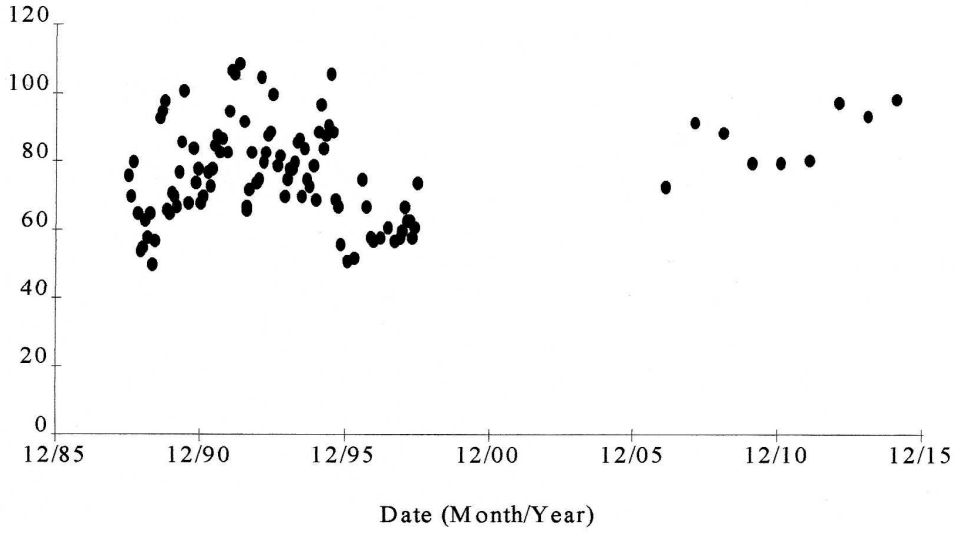
Water

In 1880 the town was still without mains water and the provision of this was not seen as a priority for the new sanitary authority. This attitude was to suddenly change in December of 1881 when it became known that parliamentary powers were being sought to set up a private water company [67]. This news was not very well received and the town decided to oppose its passage [68]. This was an expensive business and one which could potentially be very expensive indeed but there is little sign that this was understood by the councillors. The promoters proposed to get their water from the Snitterfield Brook a little West of the village and somewhere about where Waterworks Cottage now stands [GR SP205593]. To cross the intervening high ground, between Snitterfield and Stratford, the water was first to be pumped to a service reservoir in Big Way Field [GR SP186589], above the Dunn Cow public house on the Birmingham Road [69]. Pumping was a costly business and with the brook not permanently in water a large storage reservoir would also be required.

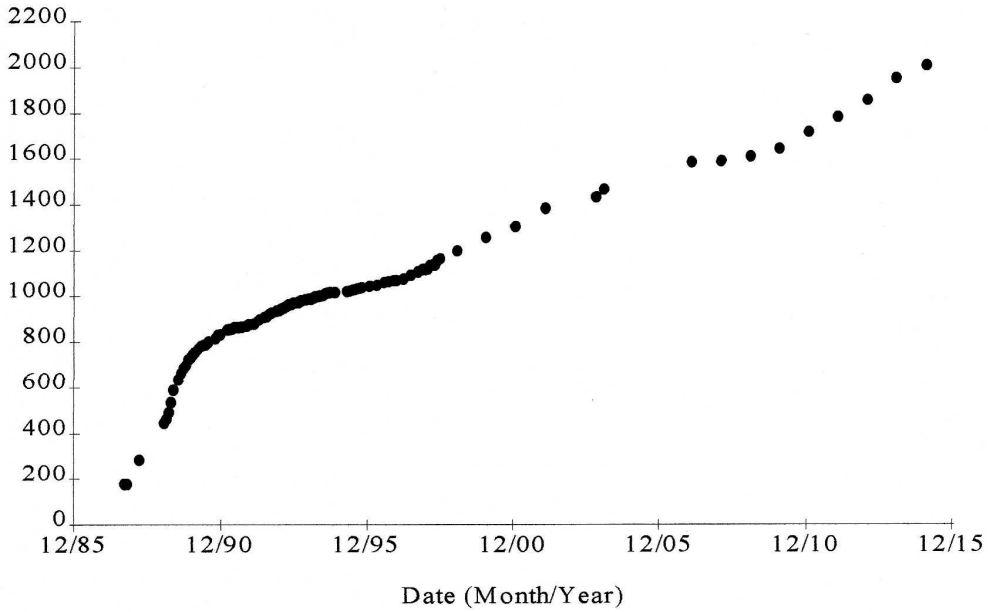
6. Unfortunately I can not describe a contact bed.

Figure 2 The Early Years

Highest Daily Consumption in any Month
(Thousands of Gallons)



Number of Consumers



Note: This data, although suitable for its present purpose, is known to include inconsistencies.

Thus the water would be expensive – up to 2.9^d per week for the smallest houses – and thus way over the maximum charge permitted by the public health acts for the compulsory connection of both water and sewage. The towns opposition, which was by no means unanimous, was principally based on the belief that the supply of water should not be in private hands and that the town could supply itself with water at much less cost.

By January Messrs Hunt and Lunn had been appointed to oppose the bill and Mr. Pritchard engaged to advise the town on getting its own water [70]. Perhaps surprised by the towns reaction, and the potential cost of continuing against this opposition, the promoters were soon offering to withdraw if the town paid £600 to cover their expenses [71]. A short negotiation reduced this to £500 which being agreed the bill was withdrawn on the 27th February 1882 after a parliamentary life of only 14 days. Opposing the water bill had been costly but it had at least one positive outcome – the town was now committed to provide water.

Mr. Pritchard presented his first report in April [72]. In this he advised that the town should allow for a consumption of 15 gpd per person which, with a small allowance for growth in population, became 180,000 gpd. With this in mind he had investigated several possible sources including that from Wilmcote first proposed in 1853. All, except one, he found deficient in either quality or quantity. The exception was water from the gravel beds below Oxstalls Farm [GR SP217584] some 1½ miles along the Warwick Road. This water he proposed to pump to a service reservoir on the Welcome Hills from where it would gravitate to the town.

Nothing was agreed and it is clear that Mr. Pritchard continued his investigations into the summer for in November he was reporting that the gravel beds at Oxstalls were not nearly as extensive as he had first imagined and that he was now looking at Snitterfield [73].

His final report came in June of 1883 [74]. In this he proposed taking water from the Snitterfield Brook as the promoters of the private water company had intended but now the water was not to be pumped but flow through a deep tunnel below the high ground. The water would then be stored in a reservoir to be built on the hillside above Lower Ingon [GR SP206584]. He was also hopeful of finding underground water, during the tunnelling works, which he would use to supplement that obtained from the brook. However until he knew how much water might be found in the

tunnel he could not settle the capacity of the reservoir. The cost he put at £17,500 – an estimate probably excluding the cost of land, way-leaves and other charges.

It was this proposal that the town put before a public inquiry in February 1884 [75] but still the town hesitated. Not until December was funding in place to enable the work to proceed – £16,500 for the works and £1,500 for land [76].

It was essential that the tunnel was driven before work started on the reservoir for the more water found in the tunnel the smaller the reservoir would need to be. However tunnelling work was delayed when hard rock and elsewhere running sand was encountered[77]. In the event although water was found much of this was very hard and although the little that was good was used, the capacity of the reservoir had to be increased from 15 to 19Mg. Even after the reservoir was finished there was a further delay for the brook was dry [78]. Eventually mains water came to Stratford on the 30th September 1886 [79] some 26 years after the Local Board of Health held its first meeting.

Although the town had started some essential preparatory work during 1886 [80] it was not until the water was on that connections could be arranged. This was a slow process and by the end of the first year the town had only 181 consumers when there were probably above 1000 houses in the main urban area⁷. That total increased at a similarly slow rate of about three per week for the next several years (see fig.2). Why the rate of connection should have been so slow is unclear but the failure to proceed more quickly certainly contributed to the financial difficulties that the town was soon to face.

The first water rate (see table) was set in 1886 [81]. Although the town could have set charges based on either on the rack rent (e.g. 1/- in the pound) or on consumption (e.g. 10^d per 1,000 gallons) it chose to obtain most of its revenue by banded charges. The equity of such an arrangement is unclear but doesn't seem to have aroused much comment.

7. In 1886 there were some 1800 houses in the enlarged borough.

Table
Abstracts from the 1886 Water Rate
 (Assumed to include the sewage charge)

For unmetered supplies:

To property valued under £6 pa	2/2 ^d quarterly.
To property valued from £6 to £10 pa.	3/9 ^d quarterly.
.....	
Properties valued at £80 pa.	18/- ^d quarterly.

For stables with a house: add value of stable to the value of the house.

For stables alone: 2/-^d quarterly plus 1/-^d for each additional horse.

Garden watering: no additional charge was to be made for gardens smaller than 10 perches.

Metered supplies:

Up to 4,000 gallons per quarter	5s-0d
Up to 50,000 gallons per quarter	£2-10s-0d.
Up to 100,000 gallons per quarter	£4 - 3s-4d.
Up to 500,000 gallons per quarter	£12-10s-0d.

Two details should be noted. Firstly that the minimum charge was set at 2/2^d per quarter for a very good reason – by law towns could not charge more than 2^d per week to properties that they compelled to take water and drainage. Secondly that banded charges greatly simplified the calculation of bills.

Otherwise how the charges were determined and what revenue was expected is unknown. Indeed we know neither the revenue or expenses of the undertaking for this or most other years. This is very unfortunate for although it soon becomes clear that the accounts were persistently in deficit it is not clear why this was so. Clearly the slow rate of connection was unhelpful as was the rising cost of the various works but I suspect the principal reason was an overly optimistic expectation as to how many houses would voluntarily seek to have mains services connected.

That a charge of 2^d per week would never cover the expenses doesn't seem to have been recognised until February of 1887[82]. The town turned

to Whitehall with a request to increase the charge. This came before a public inquiry in June of 1889 [83]. The town's case was that 'it found 2^d per week totally insufficient' but then rather spoiled their case by not being able to say if the account would balance if the whole town was connected! Nevertheless they were permitted to increase their charges from October of that year [84] but the details are lost.

Soon the water quality was found not to be as wholesome as would be desirable. The problem was that Snitterfield water ran off the fields and was thus easily contaminated. This would be a particular problem with the first run of the stream after a dry spell and Mr. Pritchard had not only recognised this but made arrangements for this first water to run past the reservoir until the quality improved [85]. Other problems had, however, not been anticipated. Ducks were kept close to the Snitterfield inlet and not unsurprisingly these took to the water not only causing fouling but also finding their way down the tunnel. The town's first response was to fix wire netting across the inlet [86] but soon the 'Duck Pond' was enclosed [87].

In 1890 a very curious story unfolded when the vicar complained of low water pressure at Trinity Church. This complaint arose from the poor performance of the fancy new church organ recently installed – an organ that not only used batteries but also hydraulic engines to power the blowers [88]. Soon not only were there complaints of low water pressure but also of cost [89] for the hydraulic engines had consumed nearly 900,000 gallons in their first year [90]. Never being satisfactory the hydraulic engines were replaced by gas engines over the winter of 1894/95 [91].

1890 was also the first year that the town was to experience a water shortage. In sizing the reservoir Mr. Pritchard had seemingly allowed for the brook to be dry for about 100 consecutive days [92] but in 1890 the brook was dry for not only 170 consecutive days but for 234 days in total [93]. To conserve their dwindling supply the town appealed for economy and reverted to the use of well water for flushing and street watering [94]. Although this was said to save about 50,000 gallons every day (about half of the average demand for water) the reservoir level continued to fall. By September the water shortage had become a crisis – not only had the Snitterfield Brook been dry all summer but the adit had also stopped flowing. With only a few days supply left the town resorted to pumping very hard water from a shallow well by the Warwick Rd [GR SP208555] very close to the present pump house [95].

For this purpose temporary steam pumps were hired from Messrs Ball and Hornton who also provided both the fuel and the engine man for 25/- per day, probably 10 or 12 hours, or 26/- overnight. In fact all of the early pumping was done at night so that most of the well water would pass back up the supply main and into the reservoir where it would mix with what little soft water remained. In fact the well water was so hard that boiler water was taken out of the river [96].

The temporary pumps ran for a total of 84 days between the beginning of October 1890 up to the 16th January 1891. At first about 50,000 gallons was pumped every night but from the 26th December the very severe winter weather made it necessary to pump continuously if the pumps, and pipes, were not to freeze [97].

The town hoped that the dry summer of 1890 would not be repeated but this was not to be and the town found it necessary to supplement the Snitterfield supply almost every year thereafter.

For the next several decades the town sought to improve both the quality and quantity of the water supply. So far as quality was concerned the technology was limited to simple filtration. Experiments were made with different filter mediums with the town eventually settling for the incorporation of a layer of porous carbon within the sand/gravel filters [98] but it was soon clear that the original filters were overloaded. The addition of a third filter made it possible to undertake maintenance work whilst maintaining the supply whilst the provision of a filtered water tank made it much easier to meet the peak daytime demand [99].

As to quantity this was addressed by a combination of increasing both the supply and the storage capacity. To increase the supply the town diverted a small brook into the reservoir during 1894 [100]. Unfortunately few details are known – if, as seems likely, this also ran dry in summer, any improvement would have been marginal for the limitation was principally that of the reservoir capacity. This was addressed by raising the height of the embankment. At the same time the original inlet near 'The Wolds' was abandoned in favour of a new inlet a little upstream beside where now stands 'Waterworks Cottage' [GR SP207593]. The full reasons for this relocation are unclear. The only reason given was that the water was cleaner upstream but the visible remains of these works include substantial water filters. It is also possible that the old inlet was too low to fill the

heightened reservoir. Whatever the reasoning all of these works, new inlet, enlarged reservoir, new water filter and filtered water tank were complete by 1897⁸.

The town was now in a much better position for not only had the supply been improved but the demand reduced firstly by the use of railway water, secondly by the removal of the hydraulic engines from Trinity Church and lastly by the brewery discontinuing the use of town water after sinking an artesian well for its own use [101]. However the relief was short lived for in September 1901 the town was again short of water. This time relief was obtained by taking artesian water from the brewery [102]. The brewery seems to have supplied about 40,000 gpd. from the end of November 1901 to the 17 March 1902 charging the town 10^d per 1000g [103].

Water was again obtained from the brewery in 1904/05 and subsequently almost every year thereafter until 1923 when two artesian wells were sunk at Warwick Rd. very close to the shallow well previously used to supply the town in times of shortage. With gas engines and pressure sand filters the new wells not only replaced the auxiliary supply but also provided drinking water from the 'Blue Cap' reservoir [GR SP205566] which was roofed for this purpose.

Frost.

Most Victorian water undertakings had problems with winter frosts. Stratford was no exception and a combination of some exceptionally cold winters and pipework laid at too shallow a depth combined to leave parts of the town without water for long periods [97,104,105]. The borough surveyor did what he could. Hydrants were opened and fires lit in the streets but often this was to limited avail and the only practical relief was to take the water cart round the town. A particularly intractable problem was the pipe over Clopton Bridge for not only was this very exposed but serving only a few houses the water was stationary for much of the time. The problem was first identified over the winter of 1891/92 when houses east of the river were without water for several weeks despite fires being lit on the bridge in an attempt to unfreeze the pipe. The options were limited. If hydrants were fitted these would need to be opened before the pipe froze

8. The progress of these works are poorly recorded. That the reservoir embankment had been heightened by 1 January 1997 is clear from the surveyors monthly reports SBTRO BRR2/11.S

but another suggestion, in the belief that running water didn't freeze, was to divert one of the principal water mains serving the town so that it ran across the bridge and back again. This proposal certainly reached an advanced stage for drawings were produced and submitted to Whitehall for approval but it is not known whether the improvements noted as being in hand in December of 1892 [106] were to implement this scheme or some other.

Extensions

When Snitterfield water was first brought to Stratford it served only the immediate urban area – not Bishopton, not Shottery and certainly not Tiddington or Alveston. However all were to seek water from Stratford.

Bishopton was first [107]. Early in 1888 the town refused a supply to Bishopton on the grounds that the expected small revenue did not justify costs of around £300. This decision was however reversed when the residents agreed to contribute £100 towards this [108].

In 1895 the town received similar requests from Tiddington and Alveston [109]. Despite concerns about offering water outside the borough, and that Stratford was itself short, the town quickly offered a supply at 1/-^d a thousand gallons. It seems very likely that they were intending only to offer the supply up to the borough boundary but no details are recorded. Nothing appears to have come of this first approach and a few months later the town was offering to supply water to Alveston Manor House at 1/6^d a thousand gallons [110]. Again this seems to have come to nothing.

By 1897 the town had been asked to extend the supply to Shottery and the Alcester Road area. For this the town sought guarantees of £25 annually over 30 years [111]. It is not known when the pipes were laid about Alcester Road but Shottery was supplied from about 1900 after the Trustees of The Shakespeare Birthplace Trust, who's interest lay in having hydrants for fire fighting, guaranteed £15 annually [112].

Epilogue

Today whilst the Warwick Road pumphouse and Blue Cap reservoir still supply the town, the Snitterfield inlet and the original reservoir are abandoned. The only evidence, about the town, that Stratford ever had a municipal water undertaking are the many valve cover plates set into roads and pavements such as those illustrated on the front cover. That early printers made some odd substitutions when letters ran short is well known but here we see something similar in a casting.

John Brace February 2011

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Abbreviations:-

SBTRO = The Shakespeare Birthplace Trust Record Office

PRO = The Public Record Office (Kew)