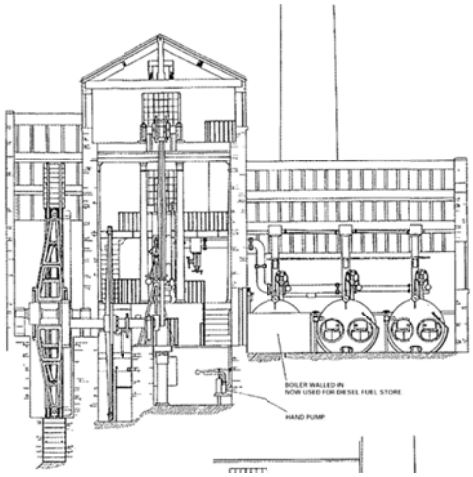
The Landmark Trust

STOKER'S COTTAGE

History Album



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BASIC DETAILS

Built:	**Stretham Old Engine 1831** **Stoker's Cottage 1841**
Listed:	**Grade II, part of Scheduled Monument**
Acquisition:	**2007, 99 year lease from Waterbeach Level Internal Drainage Board**
Opened as a Landmark:	**January 2008**
Contractors:	**Cubitt Theobald**

Acknowledgements

Landmark gratefully acknowledges the support of a generous private donor in expediting the refurbishment of Stoker's Cottage.

The information about Stretham Old Engine in this album draws heavily on the researches of Keith Hinde, Chairman of the Stretham Engine Trust.

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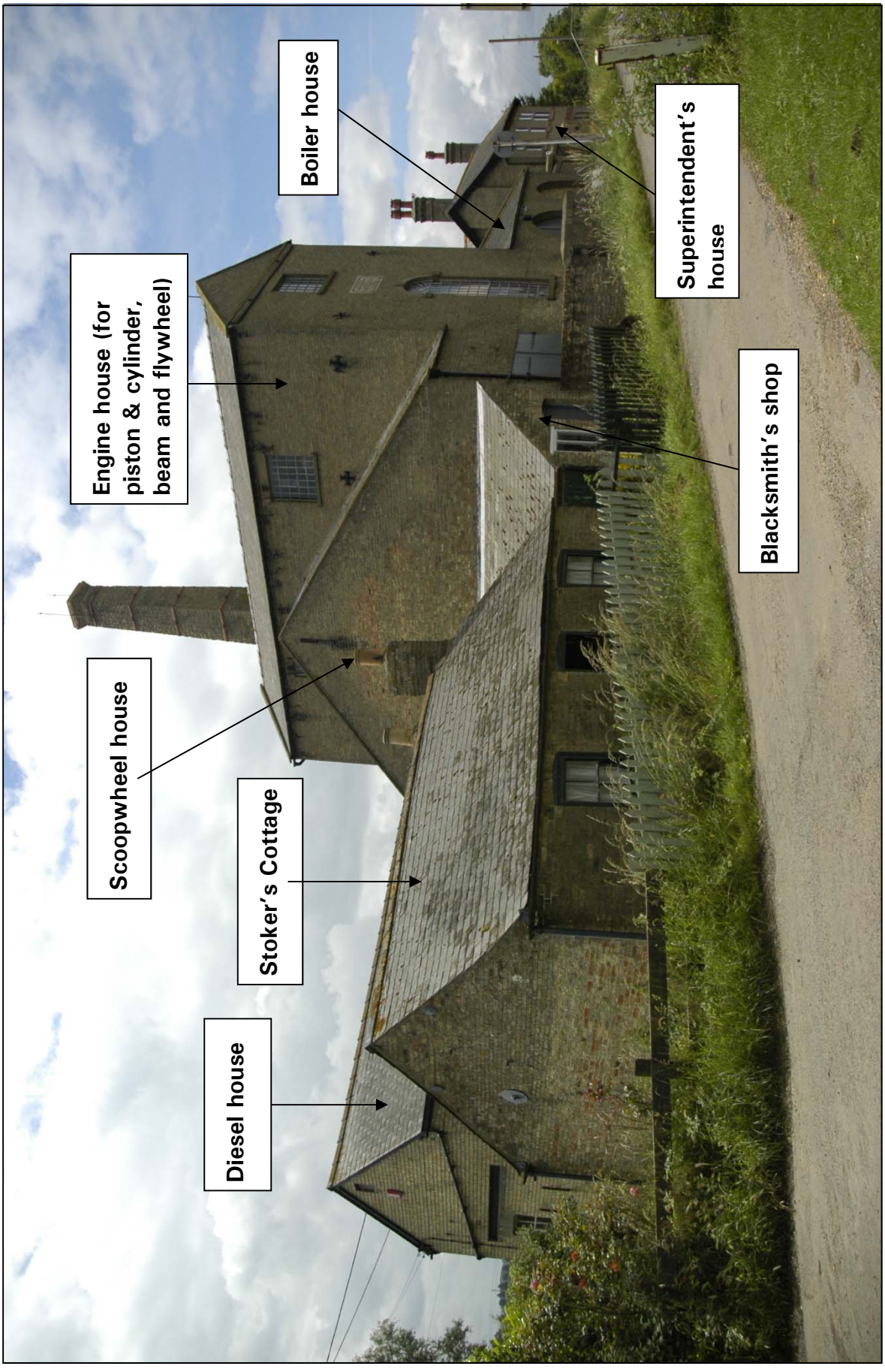

Boiler house
Superintendent's house
Engine house (for piston & cylinder, beam and flywheel)
Blacksmith's shop
Scoopwheel house
Stoker's Cottage
Diesel house

Summary

Situated at the southern end of the fens, or the Great Level as they were known in the seventeenth century, Stretham has been a part of the fen drainage schemes since the days of the famous Dutch engineer, Cornelius Vermuyden and his co-adventurer, the Duke of Bedford. In 1631, they cut the (Old) Bedford River, and the Great Ouse became the canalised loop now known as the Old West River. This and other drainage schemes brought problems of their own; land still needed draining in between the major cuts, and the peat began to waste, leaving watercourses such as the Old West River standing ever higher above the surrounding farmland.

Windmills provided an initial solution to these changes in the land's equilibrium, scooping the water up from the drainage channels and into the main watercourses. The lifts involved became ever greater, however, and wind is an unpredictable power source. By the early nineteenth century, another solution was urgently required.

In 1829, the Waterbeach Level Commissioners commissioned the Butterley Company of Derbyshire for a rotative steam engine to drain the district, an area of some 5,600 acres. A separate contractor constructed the buildings to house the new engine and of the surviving grouping, the engine house, scoopwheel house, boiler house and seventy five-foot chimney all date from 1831, built in good cream stocks typical of the Gault clays of the area. The Stretham engine was among the earliest and largest in the fens, a typical example of its type and age.

To summarise briefly (the Engine Trust's publications provide more detailed descriptions), the Butterley Company's steam engine provided 60 nominal horse power from a double-acting, condensing beam. The flywheel, which transferred the power from beam to scoopwheel, is 24 feet in diameter and turned at 12-16 revolutions a minute, running off a 39 inch bore cylinder with a 96 inch stroke. The beam engine was driven by the two (and later three) boilers, delivering a pressure of 4 pound per square inch (raised to 8 psi in 1888). The stoker kept the boilers running, with the chimney belching smoke above; coal consumption was around 5 tons for 24 hours running time. This power drove the enormous scoopwheel, which turned at 3-4 revolutions a minute and could lift 30 tons of water per revolution, 100 tons a minute. The engine did not, of course, run continuously but was fired up when floods threatened.

Stretham Steam Engine performed its purpose successfully until 1925 when a Mirrlees diesel engine took over, housed in the large building behind Stoker's Cottage. The Old Engine still had a role as nominal standby until 1957, when the Streham Engine Trust was formed to preserve it against demolition. The engine and scoop wheel are still occasionally turned over using electrical power for demonstration purposes.

Stoker's Cottage was originally built in 1840 as a toll house, collecting tolls from those whose animals plied the banks for the banks' maintenance. The cottage was probably partially built of eighteenth-century bricks salvaged from the windmill the engine replaced (they can be seen in the end gable, given away by the redness of their clay and shallow depth). When the railways arrived in the area just five years later, tolls dropped dramatically, making a toll keeper no longer necessary. Since very few engine houses supplied a dedicated cottage for a stoker, the Stretham stoker was fortunate to inherit the toll house.

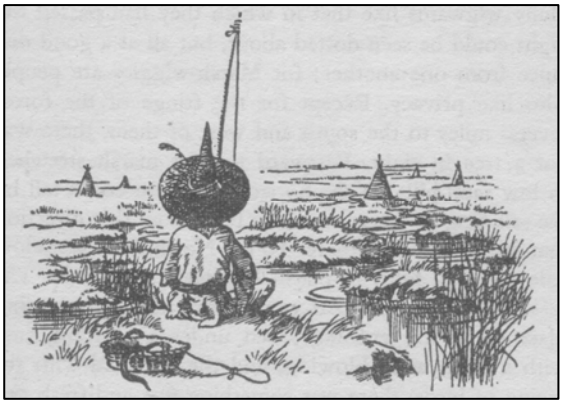
The first stoker known to have lived in the cottage was Mr Murfitt, who held the position from 1855 to 1900. Mr Duesbury followed him until 1911, when William Taylor took over. When he retired in 1933, the diesel engine had taken over and Assistant Engineer, C. O. Clarke moved in. When Mr Clarke became Superintendent in 1943, he moved into the Superintendent's House on the other side of the site and for the next ten years or so, the cottage was lived in by men working on the level. The last resident was Mr Vaile, who left in 1955. The cottage had neither water nor electricity at that stage, with water drawn from a pump behind the Superintendent's House and carried to the cottage in buckets. The only light was by candle or oil lamp. Cooking was done over the solid fuel range that still survives in the back kitchen, with a bread oven to one side. On the other side was a copper, in which water would be heated on washday and for the weekly bath, taken in a galvanised steel bath normally kept outside. With no washbasin or sink, all ablutions or washing up would simply have been done in a bowl at the table, and the loo, of course, was in the privy outside.

In 1994, the Stretham Engine Trust carried out comprehensive repairs to the cottage and installed water and electricity. The cottage was then used for low key visitor services for those visiting the Old Engine site, but the Trust became concerned about maintenance costs. In 2005, the Trust approached Landmark for help, aware that use of the cottage as a Landmark would remove the financial burden of its upkeep, increase public access for the site and help raise further the profile of Stretham Old Engine. Landmark was happy to help and relatively little work needed to be done. The outside was gently repointed and a large concrete reservoir tank to the rear was filled in. Two old garages and a shed were removed. The cottage was redecorated inside and out and a French drain put in across the front to alleviate damp. A new kitchen and bathroom were put in (keeping the old range) and a 1950s fireplace was replaced with something more in keeping with the cottage's age. The cottage has been furnished to evoke its age and setting, a peaceful spot in which to reflect upon the glories of the Age of Steam.

The Draining of the Fens

To understand the history and purpose of the site beside the Old West River at Stretham, it is necessary to go back further than the mid- nineteenth century, which is the date of the surviving buildings on the site. The rivers that flow through the fens, or The Great Basin or Level as the area used to be known, drain a large part of the centre of England. As Daniel Defoe put it, 'All the Water, or most part of the Water, of thirteen Counties, falls into them.' It is a basin of clay, topped by peat or silt, so the water can only drain by finding its slow way to the sea.

Stretham village lies at the south of the fens, on the same 'island' as the canny cathedral builders chose for Ely. It cannot, however, ever have been far from the waters since the Domesday Book records in 1086 that it had fisheries for 3,250 eels. The name 'Stretham' means 'settlement on the street', referring to the Roman Akeman Street, which passed nearby. Stretham is some forty miles from the sea, but the chief river of The Great Basin, the Great Ouse, used to flow close by. Indeed its meandering route towards its estuary at King's Lynn used to take it right past the door of Stoker's Cottage. The Ouse has diminished into today's Old West River, since the loop of the Ouse from Earith to Denver was by-passed in the mid-seventeenth century by the Bedford River. Up to this time, we must imagine a very watery landscape. Isaac Casaubon, on a visit to Ely in the early 1600s, described a landscape where cottagers spent their lives travelling by boat, fishing and fowling amidst bittern and dotterel, walking on stilts or high shoes as they drove their cattle onto the dry pastures.



Puddleglum the Marsh-wiggle – a modern echo of16th-century stereotypes of fen-dwellers (C S Lewis, *The Silver Chair*, 1953).

Through the Middle Ages, the Crown had received continual complaints from disgruntled landowners about inundation resulting from their neighbours' attempts to drain their fen holdings. The dissolution of the monasteries through the 1530s then removed at a stroke some of the largest landowners of the region, who had held responsibility for the upkeep of many of the waterways. The monastic estates were divided and subdivided; responsibilities and liabilities were often disputed by the new owners and the 'custom of the fen' eroded as well as the banks.

As ever, there is much to learn about customary life in the fens from its regulations and the infringements against them. In 1534 *An Acte agenst Destruccyon of Wyldefowle* in the fens was passed: no birds were to be killed from May to August, and no eggs taken from certain fowl. In 1550, this former provision was repealed to help the poor who had depended on such fowl. A code of fen laws drawn up by Council of the Duchy of Lancaster at the Great Inquest of the Soke of Bolingbroke in 1548 remained in force until the enclosures of the early nineteenth century. The code contained 72 articles, which included provisions for branding of cattle, cutting of thatch and reed, interference with common drains, regulation of fishing nets and the keeping of swan. And gradually but steadily, the idea was growing of a large-scale draining project to replace local and individual efforts by some co-operative enterprise, as landowners strove to find ways of improving the yield and condition of their holdings.

In 1600, a General Draining Act was passed. But lack of capital, common rights and the lack of great estates in the region were all obstacles to its success. Many small grazier farmers had adapted quite happily to periodic, short term flooding, which they also thought improved their land.

Meanwhile, stimulated by increasing financial hardship, in 1607 James I ordered a survey of Crown Lands to determine whether their yield could be increased. One of the pieces of lateral thinking to emerge from the 1607 survey was that it

would be profitable to assert royal rights in marsh and fen, in what was to become a typical abuse of royal power by the early Stuarts.

In 1618, the Commissioners of Sewers came to the unanimous decision that to drain the Great Level, it was essential to improve the outfall of the Ouse, Nene and Welland. A Commission in 1618 entrusted the drainage of these fens to Sir William Ayloff and Anthony Thomas Esq., authorising them to take for themselves for their efforts a proportion of the improved lands. This proportion varied from a tenth to one third and was predictably unpopular among existing landowners of the fens. In 1620, Ayloff and Thomas were summoned to Whitehall, where James, stated (disingenuously, we may feel) that there was in fact nothing in his prerogative that enabled him to sanction the grant of improved lands. Ayloff and Thomas must therefore be satisfied merely with half the profit accruing to the lands as estimated by the owners.

In fact, James wanted to be chief undertaker himself but had no funds. In 1621, a Dutchman called Cornelius Vermuyden arrived in England, probably at James' invitation and in 1629 the reclamation scheme finally began. We know nothing about Vermuyden before his arrival in England, but can safely assume that he brought with him a reputation in matters of drainage and his schemes were to play a crucial part in the draining of the fens. Francis, Earl of Bedford was another key player: he owned a large tract of the Level in his Thorney estate and saw draining it as a profitable investment. In the Lynn Law of January 1630, the Earl became the principal undertaker and figurehead of the drainage scheme in partnership with thirteen co-adventurers, one of whom was Vermuyden, as Director of Works and the mind behind the project.

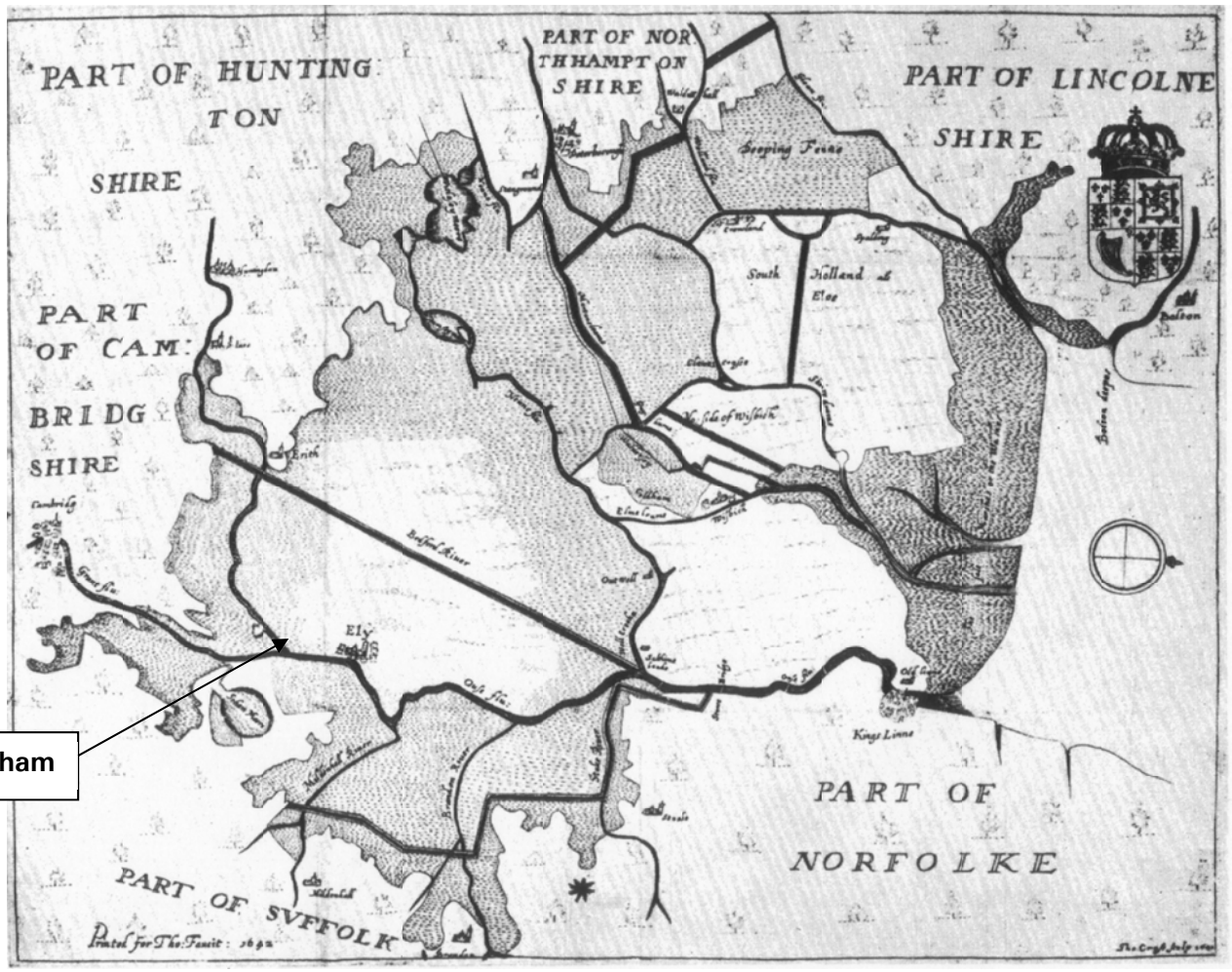
Sir Cornelius Vermuyden, attr. Van Miereveld.

Private Collection.

The recompense for the work carried out was to be 95,000 acres of the reclaimed land 'in free and common Soccage....and without paying any Rent .... other than a Fee-Farm Rent of Ten Pounds by the year.' The drainage scheme had to be completed within six years but there was no clear definition of what constituted drainage.

To drain the Great Level involved not just drainage but also keeping the outfalls clear from the Ouse and its tributaries, the Cam (which joins the Ouse just east of Stretham), the Lark, the Little Ouse and the Wissey; the Nene and the Great Ouse. Like Popham before him, Vermuyden identified that for the southern part of the Level the solution lay in increasing the discharge capacity of the Great Ouse by providing a straight course between Earith and Denver. There he cut the Bedford River, twenty-one miles long and seventy feet wide, completed 1631.

In 1637 at St Ives, the Commission of Sewers duly found that 'the Earl of Bedford had at his own costs and charges, and with the expense of great money, drained the said fenny and low grounds, according to the true intent of the Lynn Law' and decreed that his 95,000 acres be duly allotted to him. A flood of petitions followed this allocation of land to the Earl, to do more with matters of ownership than drainage. The unimproved region was often misrepresented as unproductive by those with an interest in reclaiming the land. A pamphlet in 1646, *The Anti-Projector or the History of the Fen Project,* claimed the undertakers had 'mis-informed many Parliament men, that all the Fens is a meer quagmire, and that it is a level hurtfully surrounded, of little or no value.' In reality, it gave employment throughout the year to 'many thousand cottagers' gathering 'reeds, fodder, thacks, turves, flags, hassocks, segg, fleggweed for fleggeren collars, mattweed for churches, chambers, beddes and many other fenn commodytyes of greate use both in towne and country'.

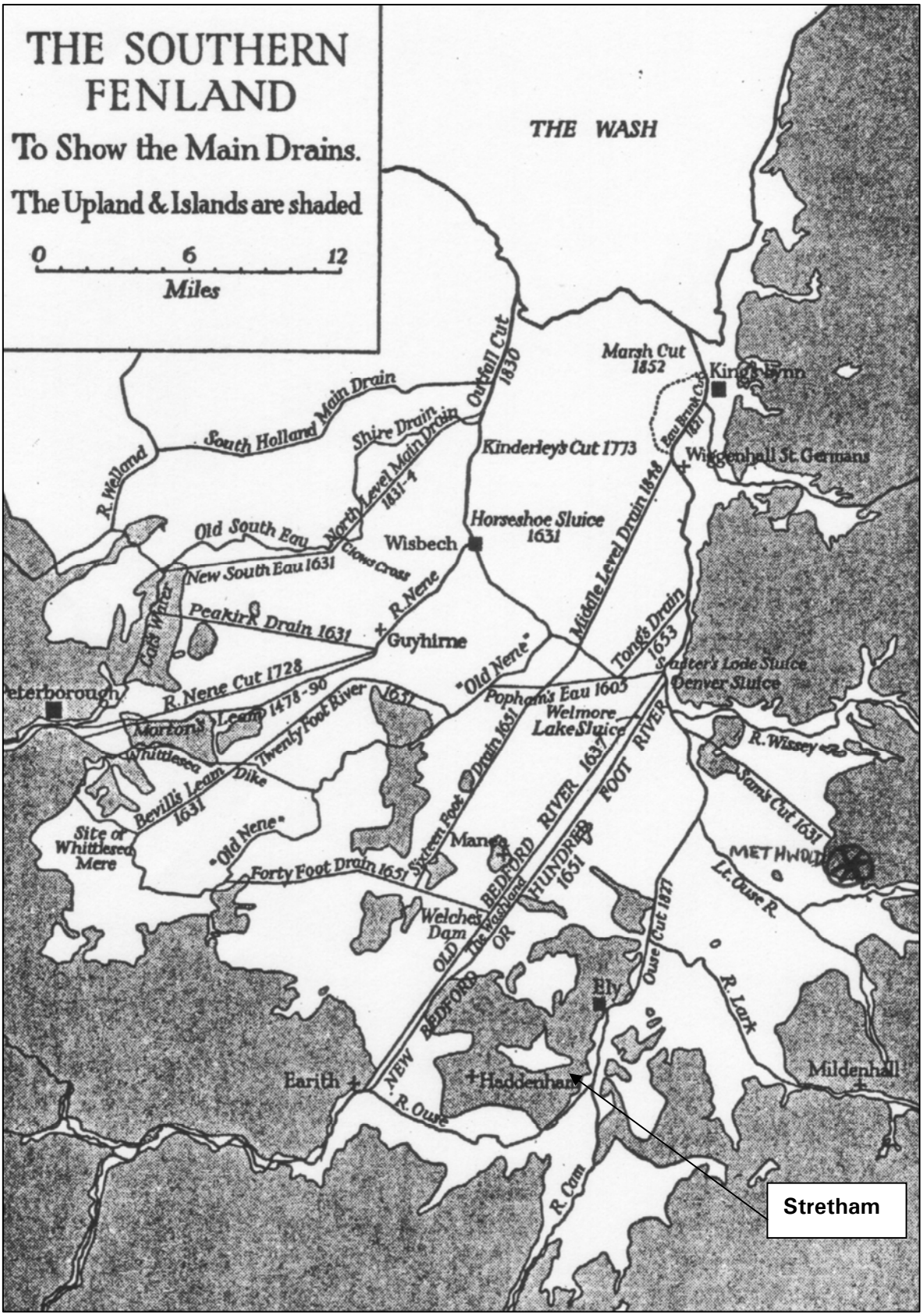


Vermuyden's Map of the Fens, 1642 (which adopts the usual convention of the day of making due north to the right), showing the so-called Bedford River. Cut in 1637, it relieved the drainage pressure on the eastern loop of the Great Ouse that passes Stretham and Ely.

Eventually, Charles I himself became involved in trying to right the wrongs done by the Commissioners at St Ives and a further commission was appointed to sit at Huntingdon. The Commission duly declared that the Earl and his co-adventurers had not after all performed the contract of drainage which was left incomplete and defective, since much of the land still required localised drainage and flooded in winter. The adventurers were not therefore entitled to their recompense and His Majesty the King would therefore take over the undertaking, at an increased recompense. As a sop to the discontented landowners, it decreed that every man should retain his customary rights until the undertaking was complete.

Vermuyden was again appointed as the engineer for the new scheme, which now aimed to create not just 'summer grounds', (i.e. 'fit for meadow, or arable or pasture' in the summer months only) but also 'winter grounds', or land which would be water-free all year round.

Oliver Cromwell, meanwhile, was also intimately concerned with these events. His family had held and farmed territory in the Fens for generations. Interests of gentry and commoners were united against what amounted to enclosure: in 1638 'Mr Cromwell of Ely had undertaken, they the Commoners paying him a groat for every cow they had upon the Common, to hold the drainers in suit of law for 5 years, and that in the meantime they should enjoy every part of their Common.' The Huntingdon Commissioners would almost certainly have reversed the St Ives decision even without the King's intervention, but Charles' impetuosity laid him open to charges of prejudicing the commission in advance. His whole initiative must also be seen in the context of the crisis in the royal finances and increasingly poor relations between King and Parliament. Here was yet another scheme by the Crown to increase income without resource to the House of Commons and one of the many factors contributing to the eventual complete breakdown of relations between Charles and Parliament that led to the

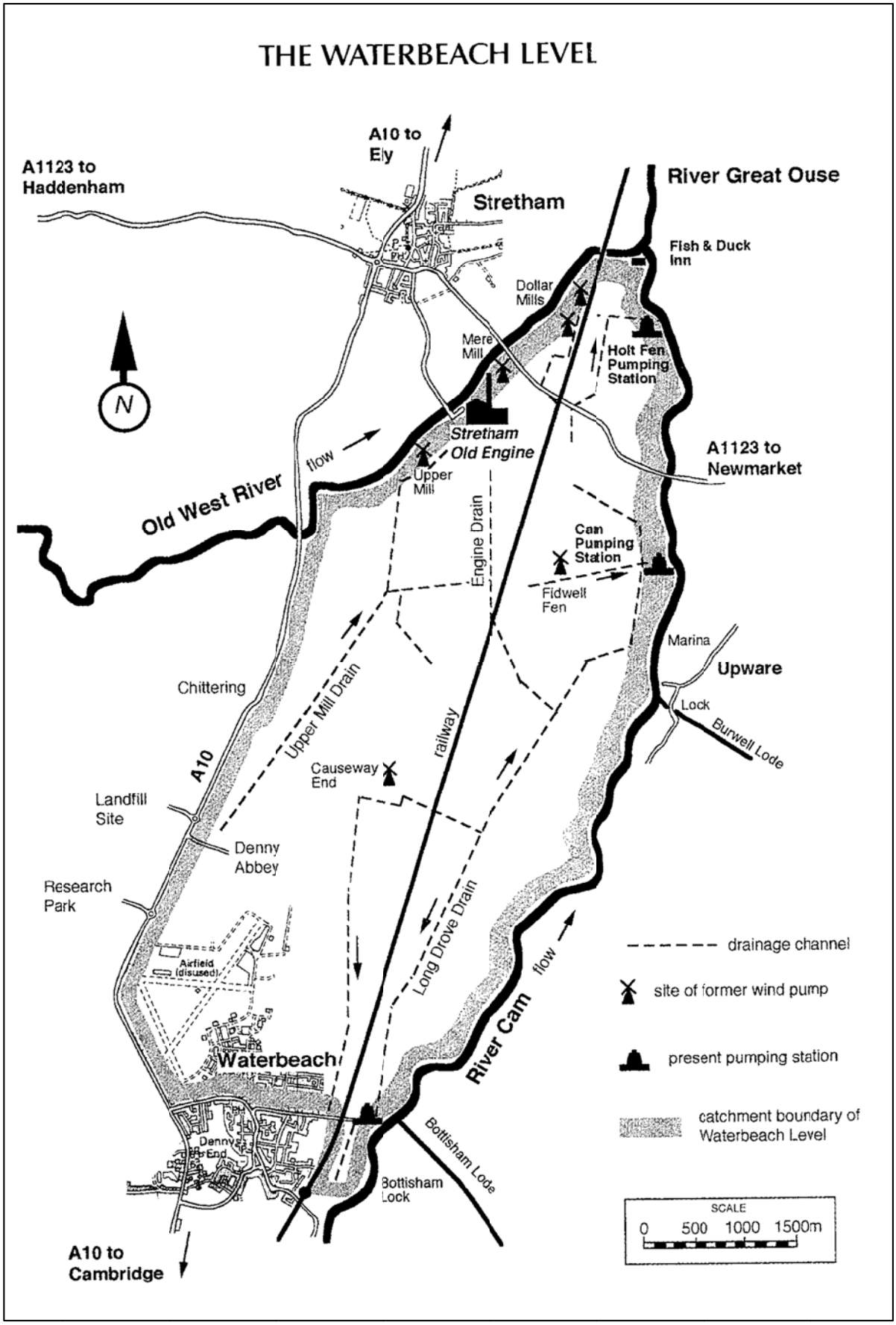


The approximate dates of drains up to the nineteenth century are given, although in some cases there was a considerable interval between the beginning of works and their completion.

Civil War. Inevitably the whole undertaking was shelved for eleven years, by which time the royal undertaker had died on the scaffold.

However, Parliament too recognised the potential of the scheme. By 1646 they had drawn up an Ordnance for the draining of the Great Level and had also reaffirmed the Earl of Bedford's (now William, Francis's son) right to pursue the scheme. In May 1649 an Act was passed 'for the Draining of the Great Level of the Fens.' The Bedford Level Adventurers reconvened and, after much haggling over terms of contract, Vermuyden was appointed as their Director.

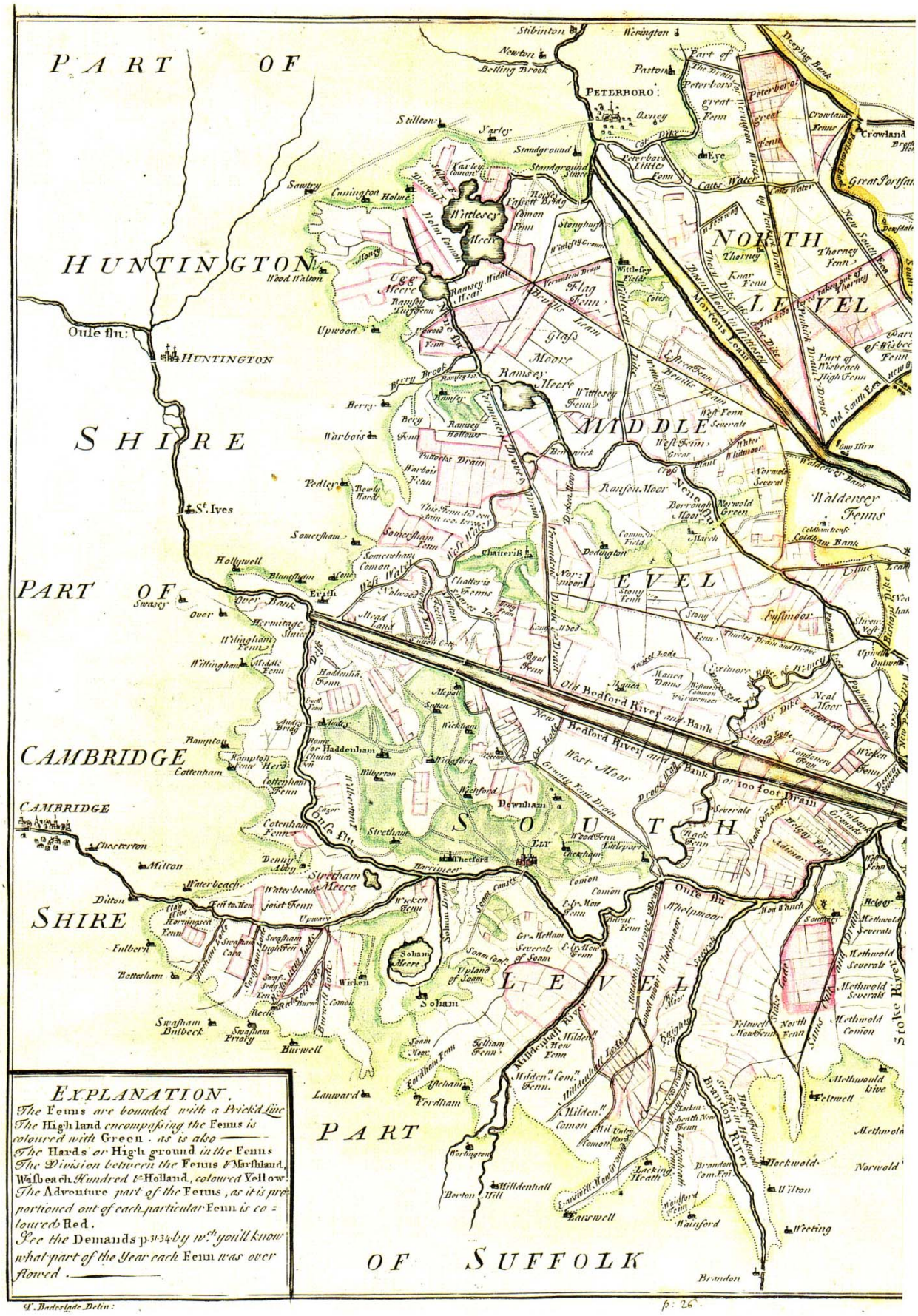
Despite the debatable success of the 1638 scheme in failing to provide winter as well as summer grounds, Vermuyden remained fundamentally committed to this earlier scheme when work began again under the Commonwealth, mainly because the 21-mile-long Bedford River had already been constructed. Vermuyden effectively divided the Level into three sections: North Level from Glen to Morton's Leam; Middle Level from Morton's Leam to Bedford River and South Level, from Bedford River south. Stretham fell within the South Level. The work Vermuyden did to drain the South Level in the early 1650s was largely forced upon him by the conditions that resulted from the creation of the Bedford River, necessitating the parallel cut which became known as the New Bedford, or Hundred Foot, River. This in turn created the Washlands between the two and necessitated the construction of the Denver Sluice. The system worked relatively well in the North and Middle Levels, but flooding became commonplace in the South Level and controversies raged about the scheme long after Vermuyden's death. Nevertheless, the twin Bedford Rivers and the Denver Sluice remain integral parts of the modern flood relief measures for the Fens.



Detailed map of the Waterbeach Level today.

While in theory this meant that twin relief channels now relieved Stretham (and of course Ely and all the other towns on this loop of the Ouse), it soon became apparent that it was still often necessary to lift water from the fields into waterways to clear the standing water. This led to farmers and small landowners clubbing together to build windmills dotted across the fens, using the power of the wind to drive scoop wheels that could lift the excess water into the water channels. Once again, this often led to disputes (fenmen were a litigious bunch), since shifting water and silt from one location to another could damage the recipient by as much as the instigator's land was improved. Four such windpumps were built in Waterbeach Level the late eighteenth century. A much later small windmill is preserved at Wicken Fen, just a few miles from Stretham.

By the closing years of the seventeenth century, the extent to which the symbiosis of centuries had been upset by the drainage schemes was already becoming apparent. The ancient pattern of summer and winter grounds had been disturbed. The introduction of the Denver Sluice had caused waterways to silt up, impeding navigation - the new cuts and sluices made the waterflow more manageable but also more sluggish, so that the banks were no longer scoured by the 'white water' at times of flood. 1696 saw another flood of petitions from local towns and villages against the Bedford Corporation. The Corporation of the Bedford Level prevailed however and the sluice was allowed to stay until the forces of nature intervened. In 1713 the combination of a particularly high tide and violent floods caused the Denver Sluice to be first undermined 'and afterwards blown up and destroy'd by the Tides from the Sea.'



Thomas Badeslade's Map of the Great Level of 1723. Due north is to the right.

The condition of the South Level (upon which Stretham perches at the southern end) worsened still further after the demise of the sluice. The burden of maintenance grew ever greater: the river outfalls became increasingly choked by tidal silts, while the watercourses continued to 'grow' above the level of the surrounding countryside at an alarming rate. Inland, this was primarily due to the wastage of the peat surface, a process apparently unrecognised at the time and yet the single factor that underlay the difficulties of maintaining an effective drainage system.

By the 1720s, the Corporation of King's Lynn reported to their member of Parliament (no lesser person than Sir Robert Walpole, First Lord of the Treasury) 'the total Loss of their Navigation (caus'd by the choaking up of the Ouse River)' and 'that from the same Cause the adjacent Country is overflow'd and rendered unprofitable'. Walpole commissioned Thomas Badeslade to conduct a survey of the present state of affairs and to produce proposals to remedy the situation, published as *The History of the Ancient and Present State of Navigation of the Port of King's Lynn and of Cambridge.* Badeslade's map of the area shows Stretham village as lying just on the edge of one of the higher land contours necessary to place it, like Ely, above flood water level.

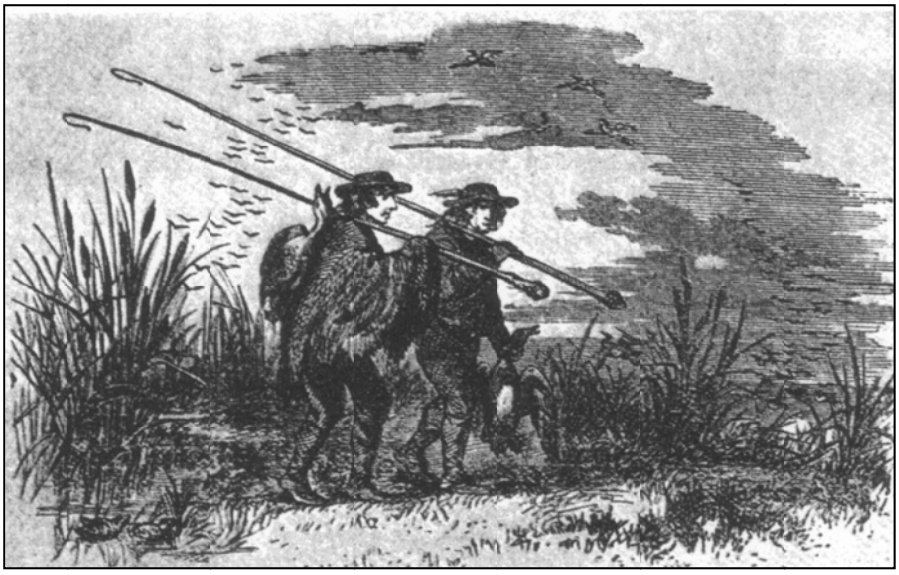
After much debate, a new Denver Sluice was built from 1748-50 to improve the situation. This prompted a fresh wave of activity to improve drainage, culminating in the Eau Brink cut across the Ouse below Salter's Lode, which was completed in 1821. This produced a clear improvement in the condition of the South Level – but the robbing of the peat layer continued and the lifts to the watercourses grew greater, estimated by the late nineteenth century to have increased five or six feet.

By 1775, the Waterbeach Level Commissioners had erected three windmills, Upper Mill, Mere Mill and Download or Dollar Mill. These worked well to begin with, but the peat shrinkage continued and before long, the mills struggled to make the increasing lifts


A MAPP
of the great LEVEL of ŷ FENNS
called
BEDFORD LEVEL,
also, Shewing the Works of ŷ Adventurers, and the several Drains made to convey the Waters of the said Level into the Rivers that have their Course thro' the Fenns, and the proper Outfall of those Rivers to Sea.
By Tho. Badeslade
1724.
PART OF LINCOLNSHIRE
HOLLAND
MARSHLAND
PART OF NORFOLK
Spalding
Crowland
Welland Riv.
Great Portland
Thorney Fenn
Deeping Bank
Shire Drain
St. Leonard
Wisbeach Drain
St. Marys
Wisbeach North Side
Wisbeach South Side
Walderser Fenns
Elme
Walsoken
Emneth
Walpole
Terrington
Tilney
Clenchwarton
Gatt Sand
Thief
Terrington Hole
Brest
Pinque Way
North Sand
LYNN REGIS
Gaywood
Downham Lea.
Downham Market
Ratcham
Deerham Abby
Wretton
Stoke
Stoke River
Methwold
Hockwold
Wilton
Feltwell
Castle Rising
Wolverton
Darfingham
Appleton
Houghton
Raynham
A Scale of Miles
1 2 3 4 5 6 7 8 9 10
S. Parker Sculpt.

A typical fen windmill, of the kind erected at Mere Mill on the Waterbeach Level, and whose salvaged bricks would be used in the building of the 1841 toll house, later known as Stoker's Cottage.

required to dump the water into the Old West River. John Rennie first recommended a steam engine to the Commissioners in 1813, but the Commissioners, concerned to save money, decided to try the double-lift method first and built an additional windmill behind Dollar Mill. Elsewhere, triple- or even quadruple-lift arrangements were tried. Lack of fuel costs began to be outweighed by the number of men required to keep the windmills staffed and maintained, as they proliferated at an increasingly rate. Wind power was becoming increasingly discredited in the Fens, not least because times of flood were not always accompanied by winds to drive the sails. It was time for a new solution.



History of Stretham Steam Engine

Steam arrived relatively late in the fens. In Cornwall, for example, steam-driven beam engines had been in use for decades for lift and force pumps associated with mining. However, the action required to operate the mine pumps were those that could be provided by a single-acting (up-down) engine. Driving a scoopwheel requires a rotative action, and for this, double-acting engines are needed, in which steam is admitted alternately at either end of the cylinder, patented by James Watt in 1782. In 1784, Watt achieved another breakthrough with his patent for parallel motion – a simple but ingenious set of connecting rods translated the up-and-down motion of the piston into the rotative action of a beam capable of driving a wheel. This greatly extended the potential and versatility of steam engines.

(At Danescombe Mine, another Landmark where copper and arsenic were formerly mined, but where the machinery is sadly long gone, we have converted the engine house itself as accommodation. In operation before 1837, the Danescombe engine house in fact held a rotary beam engine. Later in the nineteenth century, Clayton & Shuttleworth were among the suppliers of the fenland pumping engines – helping to make Joseph Shuttleworth's fortune, which he would then invest in an estate at Old Warden, home to another recent Landmark restoration, Keeper's Cottage.)

It was not until 1817, then, that the fuller development of double-acting, rotative engines brought steam to help with drainage in the fens. In this year, an engine was installed to drive a scoopwheel at Sutton St Edmunds. Others began to follow suite and in 1829 the Waterbeach Level Commissioners asked the Butterley Company of Derbyshire to tender for an engine to drain the district, an area of some 5,600 acres extending four miles south of the site and two miles on every other side. A separate contractor was engaged to construct the buildings to house the new engine. Of the surviving grouping, the engine house, the

View of the piston and flywheel in the engine house.

scoopwheel house, the boiler house and its seventy five-foot chimney all date from this brave new dawn of the industrial age, built in good pale yellow stocks. They all sit, conveniently, on a narrow belt of carrstone, a dark brown, iron rich sandstone common across East Anglia and often used as a building material. Had the buildings been built without such natural foundations, they would have needed very deep piling to contend with the diminishing peat level.

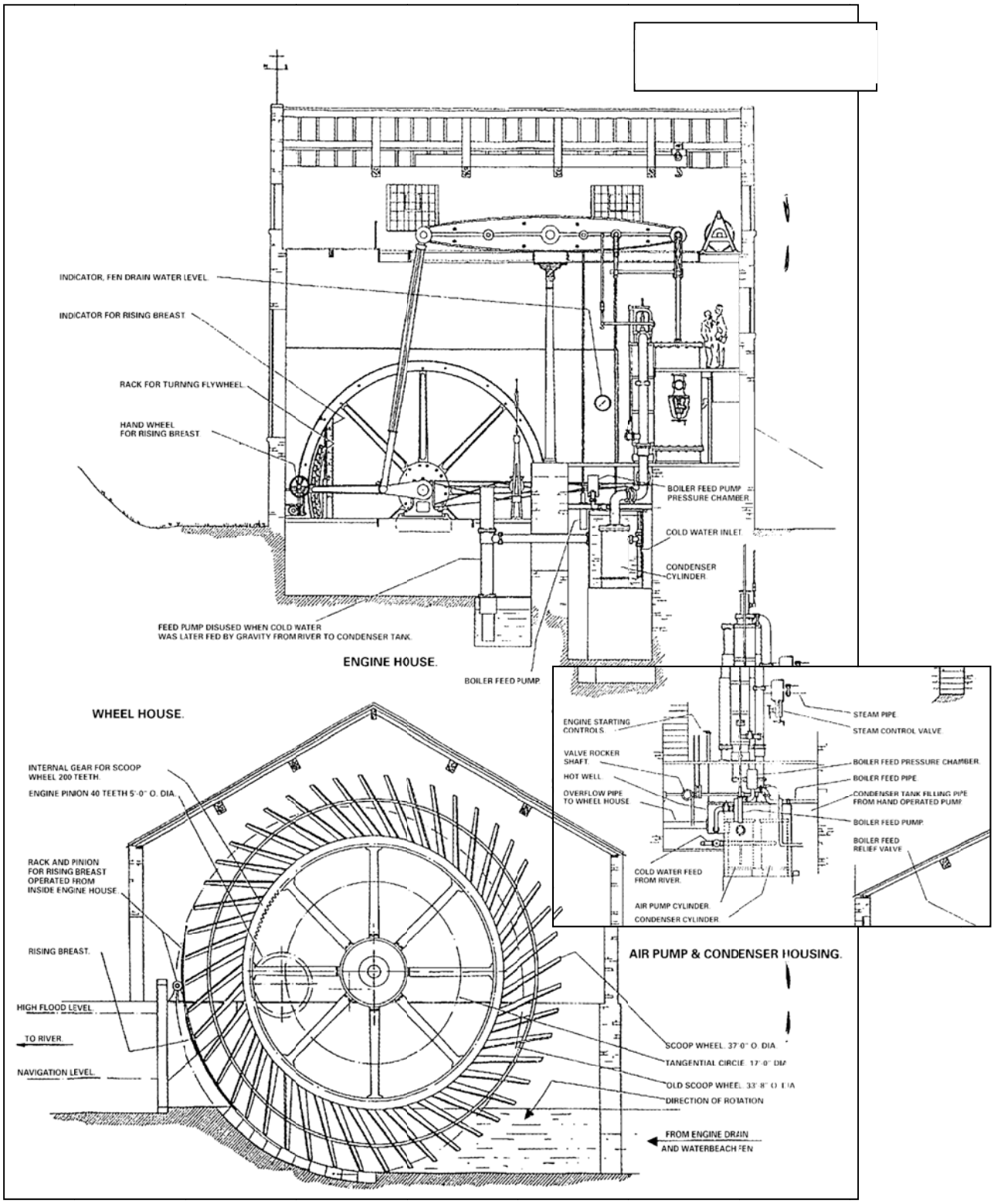
The 1830s were of course also a great age of church revivalism, of all denominations, but at Stretham it is the Nonconformists that are perhaps called to mind. The contractors for the engine house complex produced sensible utilitarian buildings, and yet the addition of the large arch headed window to light the beam engine well is a touch that has something of the Nonconformist chapel about it. The steam engine is impressive today; how much more so it must have seemed when it was unveiled in 1831, still among the earliest and largest of its type in the fens. The Stretham engine and its housing can claim no particular distinction, but they are typical examples of their type and age. As ever, the chance of its full state of preservation (enabled by the creation of the Stretham Engine Trust) gives it greater significance today. During the steam age (in the fens, loosely 1817-1926) 147 steam engines were installed across the Bedford and Lincolnshire Levels. Of these, only three have been fully preserved by the formation of trusts (Stretham, Pinchbeck in Lincolnshire and Dogdyke in Lincolnshire, where the engine is still operated, by steam, on the first Sunday of the month through the summer). Elsewhere, vandalism and demolition have taken their toll on many engine houses and their plant.

From the top of the Stretham engine house, you can survey the fens. In times of flood, the entire area of land in view would have been under water had the engine not been running, and the sight of its chimney belching smoke must have been comforting at such times. One elderly Superintendent is said to have mounted a telescope at this window so that he could supervise the efforts of his men without having to venture out into the fenland himself. You may even catch a

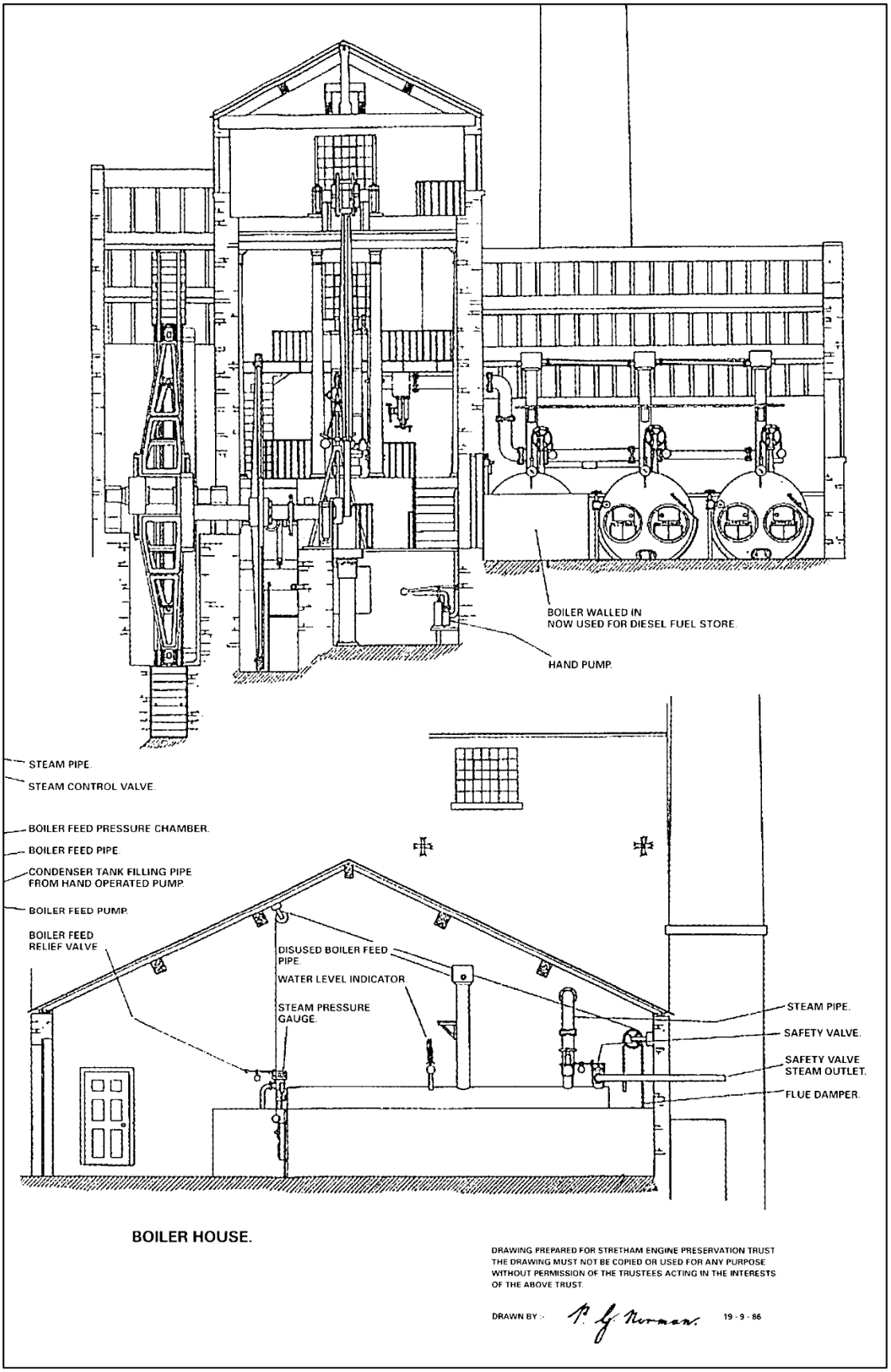
glimpse of Ely cathedral, to which the manor of Stretham belonged through the centuries. Christopher Wren's sister, Anne, was married to the Rector of Stretham (their memorial is in Stretham church), and Wren stayed with her when he was designing a doorway and screen at Ely, a commission no doubt helped by the fact that his uncle Matthew Wren was Bishop at the time. Then, of course, the fens were still newly drained and dotted with windmills rather than engine houses.

The view from the top of the engine house with the towers of Ely Cathedral just visible in the distance.

The Stretham engine house, beam engine and flywheel; the piston; the scoopwheel.



The scoopwheel house and engine house in vertical section, and the boiler house.



On the contents of the engine house grouping, detailed information is available on the Landmark bookshelves and in the excellent publications of the Stretham Engine Trust themselves. To summarise briefly, the Butterley Company's steam engine, which cost £2,900 to produce and install, provided 60 nominal horse power from a double-acting, condensing beam. The flywheel, which transferred the power from beam to scoopwheel, is 24 feet in diameter and turned at 12-16 revolutions a minute, running off a 39 inch bore cylinder with a 96 inch stroke.

The beam engine was driven by the two (and later three) boilers. The current boilers are not the originals. A third was added, and the boiler house extended as a result, in 1846/7. The original pair of boilers were replaced in 1871 and the third in 1878. It was rare for all three boilers to be fired at once. The boilers were cleaned in turn, usually during floods whilst the engine was running. The boilers delivered a pressure of 4 pound per square inch (raised to 8 psi in 1888, necessitating the installation of new valves and fittings). It was here that the stoker would toil away, with the chimney belching smoke above; coal consumption varied according to water levels and the state of the engine at the time of running, but it was always around 5 tons for 24 hours running time, with 10 – 12 hundredweight required to get steam up. The coal also had to be unloaded from the barges on the river to the coal yard, and then brought through to shovel into the boilers themselves – hot and heavy work indeed.

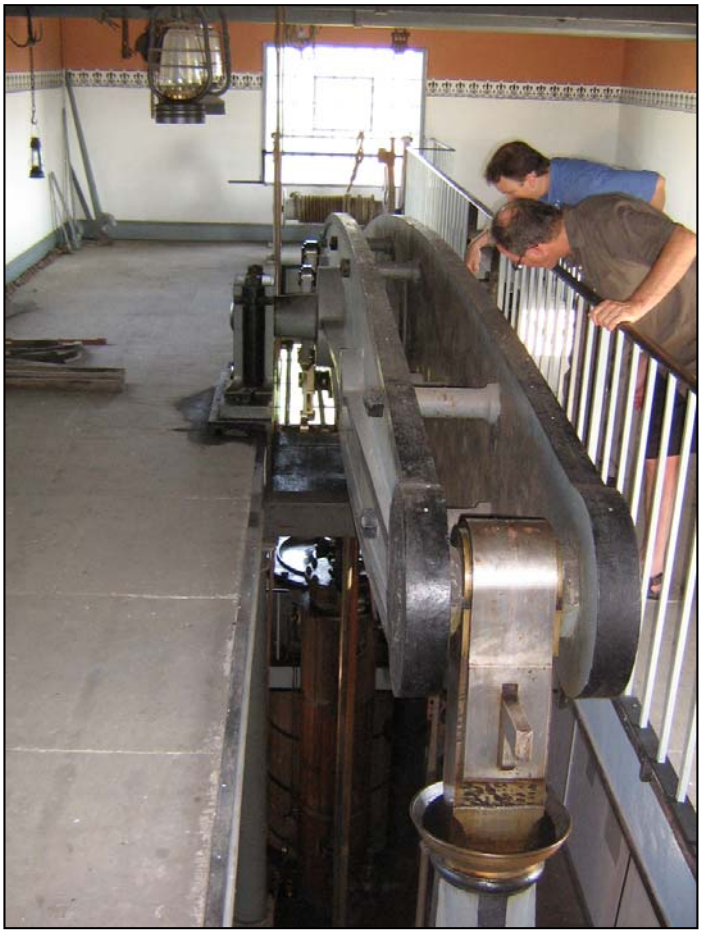
All this power drove the enormous scoopwheel, accessed by a separate door in the front of its house. Turning majestically at 3-4 revolutions a minute, this wheel was capable of lifting about 30 tons of water per revolution, 100 tons a minute. The engine did not, of course, run continuously but was bought into play when water levels in the irrigation channels across the Waterbeach Level were rising such that flooding threatened the fields. The wide, steep banks of the Old West (or Great Ouse) River bear testimony to the wide variation in water levels the area can experience, today as much as in the past.

The surviving wheel, the second on the site, was installed in 1896 and is 37 feet 2 inches in diameter (the original wheel was only 29 feet in diameter, increased to 33 feet in 1849 by lengthening the paddles, the engineers having sensibly allowed for the possibility of such expansion in the original dimensions of the scoopwheel house).

Successive increases in the size of the wheel were mostly necessary to compensate for the decreasing immersion dip of the ladles as the water level lowered with the continued shrinkage of the soil. Today, peat shrinkage has continued to such an extent that the wheel no longer has sufficient dip to perform any useful function without again increasing the size of the wheel.

The surviving scoopwheel, installed in 1896. Today, levels have shrunk so much that its paddles would barely reach the surface of the water, if the drain still remained.

The magnificent Butterley boilers.



Inspecting the beam at the top of the engine house.

Stretham Steam Engine performed its purpose successfully until 1925. By then, the necessary lift had increased still further, and in 1924 a Mirrlees diesel engine had been installed to drive a centrifugal pump. Superintendent Housley (in post from1884-1930 – these were times of long service – and who always wore a top hat, I.K. Brunel-style) had calculated that the diesel engine could shift in 3¾ hours water that it would take the steam engine 11 hours to do, at one fifth the fuel cost. The diesel engine was housed in the large building behind Stoker's Cottage, built by Feasts of Haddenham in 1925. On the wall above the fire alarm are the remains of a pocket watch cemented into the brickwork. C. O. Clarke, Superintendent 1943-74, tells how, as a boy watching the builders work on the diesel engine house with a fellow farmhand named Charlie Bullman, Charlie commented that it only needed a clock on it to look just like a church. The bricklayer asked if Charlie had a watch, and disappeared with it. When Charlie asked for it, the bricklayer said he had cemented it into the wall, so that it really did look like a church. So Charlie Bullman lost his watch.

Superintendent Housley also had a list inside on the engine house wall, where each year during his long tenure, he wrote up the date of the first cuckoo call. It survived within living memory, but then was sadly painted over. It would have been an interesting survival.

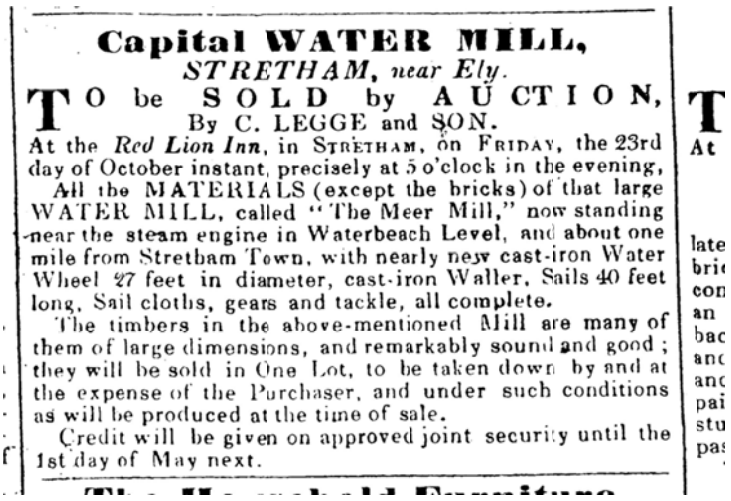
The diesel engine sounded the death knell for steam. The Old Engine was fired up during the 1939 flood and ran without stopping for several days, and again in 1940. It last moved on a six hours trial in 1941, but kept a role as nominal standby until 1957. When the Commissioners then threatened demolition of the Stretham plant, the Stretham Engine Trust was formed to preserve it, which it has successfully done with quiet dedication and rigour ever since. The engine and scoop wheel are still occasionally turned over using electrical power for demonstration purposes.

As for the continuing drainage of the Waterbeach Level, by the mid 1940s it was found that parts of the district were being poorly drained because of uneven shrinkage of the soil levels. The main problem was that the bed of the former mere that lay behind the engine was silt, which does not waste as peat does. This meant the engine was latterly trying to pump water over a hill. Two 150 hp diesel engines driving centrifugal pumps were therefore installed at a different site to the southeast, pumping into the river Cam. The Stretham diesel engine became, in its turn, a standby until 1966, when the main drain was filled in and the Stretham site became functionally inoperational for pumping purposes. Still more recently, the old Waterbeach Level district has been extended to include Waterbeach airfield and Clayhithe to the south, and the area is now serviced by three electrical engines, the Cam diesel engines acting as standby.

History of Stoker's Cottage

When the Waterbeach Level Drainage Commission was created by Act of Parliament in 1740, it was made responsible for the maintaining the banks of the Old West and Cam rivers that bound the Waterbeach district, a responsibility that continued until 1930. In 1797, it was empowered to levy a toll for these purposes on any animals using these banks – the horses that towed the barges that plied the waterways as well as cattle herds when the droves were impassable in winter. Three toll houses were erected to house the collectors of these revenues, and one of these was today's Stoker's Cottage at Stretham. A toll board, now very faint, still hangs in the engine house.

The cottage was largely built using the old eighteenth-century bricks from the dismantled windmill that the Steam Engine replaced. An advert in the *Cambridge Chronicle* for 17th October 1840 announced the sale by auction of 'All the Materials (except the bricks) of that large WATER MILL, called "The Meer Mill," now standing near the steam engine in Waterbeach Level'. These bricks can be picked out in the surviving structure by their thinness of depth and their soft red colour. The advert suggests that the cottage was probably built in 1841, since the winter frosts would have made it impractical to build in lime in late autumn.



Capital WATER MILL,
STRETHAM, near Ely.

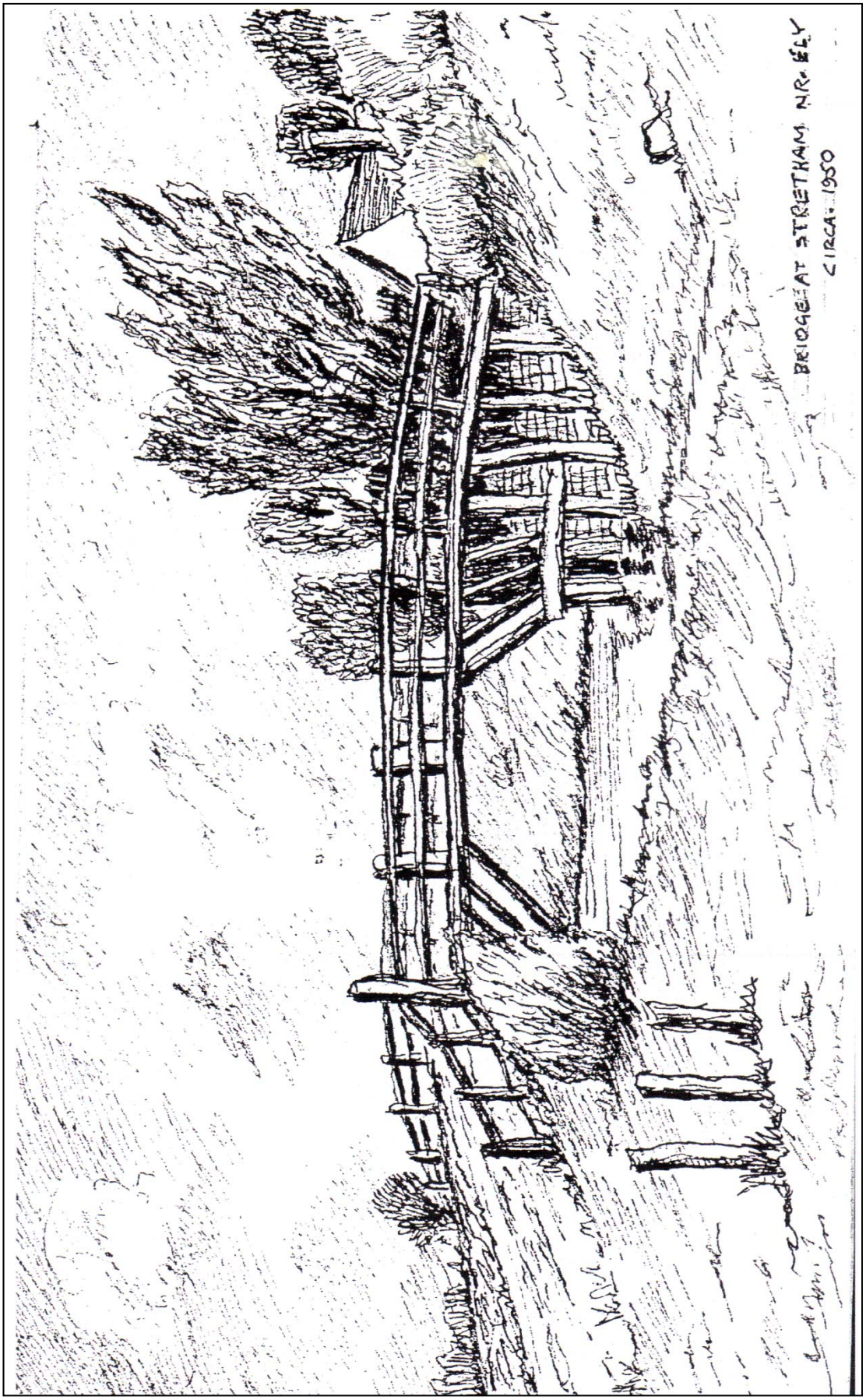
TO be SOLD by AUCTION,
By C. LEGGE and SON.

At the *Red Lion Inn*, in STRETHAM, on FRIDAY, the 23rd day of October instant, precisely at 5 o'clock in the evening,

All the MATERIALS (except the bricks) of that large WATER MILL, called "The Meer Mill," now standing near the steam engine in Waterbeach Level, and about one mile from Stretham Town, with nearly new cast-iron Water Wheel 27 feet in diameter, cast-iron Waller, Sails 40 feet long, Sail cloths, gears and tackle, all complete.

The timbers in the above-mentioned Mill are many of them of large dimensions, and remarkably sound and good; they will be sold in One Lot, to be taken down by and at the expense of the Purchaser, and under such conditions as will be produced at the time of sale.

Credit will be given on approved joint security until the 1st day of May next.



The old bridge at Stretham in the 1950s.

However, the waterways were already being superceded by a new form of transport, also steam driven – the railways. The railways arrived in this part of the fens just five years later, and takings dropped dramatically, making a toll keeper no longer necessary. Only the largest stations needed a stoker, since it was assumed the engineer could cope on engines up to 40 hp, and very few districts supplied a dedicated cottage to house one. The Stretham stoker was therefore fortunate in inheriting the toll house, although his services certainly were still needed.

Until the 1770s, there was no bridge across the river and the Old Engine site was reached by boat across the river. A picturesque timber bridge was then built, replaced in utilitarian concrete in the 1950s in the face of some local opposition, and then again in 1978 with today's rather dull affair. The bridge engineers did not heed local advice about the resilience of the carrstone stratum beneath and encountered some difficulty in driving it to build their own foundations.

The first stoker known to have lived in the cottage was Mr Murfitt, who held the position for forty five years, from 1855 to 1900. Mr Duesbury followed him until 1911, when William Taylor took over. When he retired in 1933, a regular stoker had ceased to be needed and the Assistant Engineer, Cyril O. Clarke moved in. When Mr Clarke became Superintendent in 1943, he moved into the Superintendent's House on the other side of the site and for the next ten years or so, the cottage was lived in by a succession of men working on the level. The last of these was Harold Vail (unaccountably known as Daniel!) and his wife Joan, who lived at the cottage from 1946 to 1955.

Mrs Vail, then a vigorous 82 who had grown up and was still living in Stretahm, came to Landmark's Open Day in January 2007 and reminisced about their life in the cottage. Mr Vail was nominal standby stoker, since the diesel engine had taken over by then, and so he worked mainly on the drainage ditches in the fens. They lived in the cottage 'rent and coal free', since 'there was always plenty of

coal around', and had neither water nor electricity at that stage. Until mains water was put in in 1953, they were allowed two buckets of drinking water a day, drawn from a pump behind the Superintendent's House and carried to the cottage in buckets. A rainwater tank provided water for other purposes.

The front door, as now, opened directly into the living room, with the kitchen behind and both remaining rooms used as bedrooms. The only light was by candle or oil lamp. Cooking was done over the solid fuel range that still survives in the back kitchen, with a bread oven to one side. On the other side was a copper, in which water would be heated on washday and for the weekly bath, taken in a galvanised steel bath in the shed outside. With no washbasin or sink, all ablutions or washing up would simply have been done in a bowl at the table. The loo, of course, was in the privy outside. When they moved in, it was standard practice to clear out the privy's contents and Mrs Vail remembered her husband shifting twenty buckets.

The bedroom had a stove in the corner when they moved in, which they took out and removed its flue. They had the bed at right angles to our arrangement, with a wardrobe in the left hand corner and a dressing table under the window. The bedroom floor was wooden then. Mr Vail also built a porch onto the front of the cottage (then called Green Ways by Superintendent Clarke) to stop water running down the steps into the cottage, but it has since gone.

The garden was originally a good size, extending to the end of the fence behind the diesel engine, but was gradually eaten away as the diesel house was added in 1927 and later the garages. Even so, Mr Vail managed to establish a nine hole putting green, his pride and joy. In the bad floods of 1947, when the banks burst at nearby Over, the diesel engine was called into service and Mrs Vail kept the men going with cups of tea – until things got so bad that she was told to stay inside.

It sounds a hard life, with washing done on Monday and flues cleaned on Friday. Mrs Vail remembers them as poor but happy days.

The cottage was already being left behind modern day life. With the installation of the new diesel engines elsewhere in 1945, the site as a whole was becoming increasingly deserted. After the Vails moved out in 1955, the cottage stood empty until 1994, when the Stretham Old Engine Trust (who had cared for the wider site since 1957) took a long lease on it and renovated it with the help of a grant from East Cambridgeshire District Council, also bringing in mains services.

It was then used for low key visitor services for those visiting the Old Engine, but the Trust became increasingly concerned about maintenance costs, the cottage inevitably taking a subsidiary role compared with its primary purpose of caring for the Engine House and its contents. In 2005, the Stretham Engine Trust approached Landmark for help, aware that use of the cottage as a Landmark would not only remove the financial burden of its upkeep but also increase public access possibilities for the site and help raise further the profile of Stretham Old Engine. This seemed to us exactly the sort of building, and like-minded organisation, that we should help, and the cottage complements Landmark's others of the Industrial Age, like Lengthsman's Cottage and Lock Cottage on the canals.

Landmark's Refurbishment of Stoker's Cottage

Although not lived in since 1955, the cottage was refurbished in 1994 by the Stretham Engine Trust, when new floors were laid, and electricity and night storage heaters introduced for the first time. The cottage was then used as a very low-key visitors' space (and loo) after touring the engine house, and came to Landmark in good overall condition but in need of a use that would generate more income for its upkeep.

External works

The existing wooden picket fence at the front has been kept and extended where mere horizontal rails existed. New fencing in the same style was put in at the rear to separate ourselves from the Engine House. There is evidence that the cottage once had a simple porch to the front door, although in the absence of clear evidence of its appearance, we have not replaced it.

The external joinery was all overhauled before being repainted in the same grey that the Engine Trust uses for the rest of the grouping, to unify the site. Similarly, all the rainwater goods have been painted black gloss to match.

Given how low the cottage is from the level of the road, damp was an obvious problem along the front wall and so a French drain has been installed along this elevation.

Two tin garages and a tin shed in the garden have been removed, but the contemporary privy has been retained and repaired, and a later timber ceiling removed.

The Stretham Engine site in June 2007.

Most of the rear garden was taken up by a concrete reservoir that was intended to hold water to cool the diesel engine and was added to the engine house in about 1933. In fact, it was never necessary as the engine took water from the river, and we were told the reservoir had always leaked. It was known as 'Stevens' folly' after the superintendent who insisted that it would be needed! We had no difficulty in getting consent to remove it and the result is now a decent area of lawn. Its edges were broken down and the space filled in with rubbish and then top-soiled – so the tank still exists archaeologically. A new water supply was laid from the cottage under the path to the blacksmith's shop, so that the engine house too still had a supply. Limited repointing of the external brickwork was carried out.

'Stevens' folly', before and after it was filled in.

Internal works

The brick floor in the bedroom is as we found it, although it is probably not original. Elsewhere had been retiled in rather harsh modern quarry tiles so these were replaced with brick-sized pamments made by the Norfolk Pamment Company, in a pale creamy colour typical of the Gault clays used for bricks and tiles in this area.

The built-in cupboards either side of the fireplace in the sitting room are original. The fireplace we found was a c1950s tiled affair, quite out of keeping with the cottage. Instead, a surround salvaged from an old cottage at Wortham Manor was spotted as being the right style and size, and so was brought here instead. (Interestingly, the size of the chimney stack suggests there may once have been twin flues, which suggests that the kitchen flue once fed into this stack, and that the kitchen stack may be a later addition.)

Given the damp along the front wall, the low level plaster (which itself was a gypsum repair) has been renewed in lime for greater breathability. The skirting boards in the sitting room had been done in cement, but being incompatible with lime, have been renewed in timber. Almost all the cottage has been rewired and replumbed.

In the kitchen, the chimney breast with its cast iron cooking range has been retained, the cooker and fridge squeezed in on either side. False backs have been built to both the walls to hide the electrics and plumbing. The larder, which provides a useful amount of storage space, was given new timber shelves on its original brackets, and the gauze window was unblocked.

The bathroom fittings are entirely new, placing all sanitary ware along the outside wall against a panelled section with oak shelf to hide all the pipework. (The ceiling is too low for a proper shower.)

All the ceilings in the cottage had been renewed in lime plaster as part of the 1994 works under the supervision of English Heritage. All of them had cracked in multiple places. We filled the cracks and tied a couple of places in the kitchen ceiling back to the joists. All the walls had been limewashed, to which we have added further coats.

The living room as we found it.

The kitchen before work began.

The re-used bricks from the earlier windmill on the site are clearly apparent in this end gable.

Creating the parking space, after the demolition of corrugated iron garages.

Newly laid French drains, before the front lawn was laid.

The river bursts its banks: Lakenheath, *c.* 1900. What happens if the pumping stations fail to cope. Wind pump and 40 hp beam engine and scoop wheel erected in 1844.

THE FEN STOKER by C O Clarke
(former stoker who lived at Stoker's Cottage as Assistant Engineer from 1933 until he became Superintendent of the Stretham station in 1943).

"She's coming up, William; you'll have to get the fires lit".

So might the driver of a beam engine in the fens in the latter half of the nineteenth century have spoken to his regular stoker. One says "regular" stoker, because there was invariably one such, who lived either on the premises in a tied cottage or at a very short distance from the engine. The stoker was not as mean a character in the hierarchy as he might seem. He ranked next below the engine driver, and was often the only other permanent member of the staff, beside the Superintendent, in the district. Other stokers there would be, since no one man could be in constant attendance. After all, he would have to sleep some time. But these stokers would be ancillary men who were only called in to work when the engine was running a twenty four hour shift. This regular stoker was always there, and to him would fall the job of lighting the fires in the first place.

When I was appointed assistant engineer at Upware in 1931, to run the Swaffham diesel engine, it was made clear that I was also expected to learn to stoke at the steam engine there. At times I have stoked both the Upware and the Stretham engine.

When I was first taught how to light and stoke the fires at the Upware engine, I found it was not just a matter of putting together paper, kindling, and coal, but was, one might say, quite a skilled job. The furnace in which the fire was to be kindled was about nine feet long from the doors to the bridge, or end of the furnace.

First of all, about four to five hundred weight of coal, in lumps of about one and a half feet by one foot were placed in a horseshoe formation in the fore part of the furnace. The dampers at this time would be no more than an inch or two open, though this would vary slightly according to the amount of, and direction of the wind prevailing at the time. On a windy day they would need to be open only a minimal amount.

One thing which had always to be guarded against was what was termed as a "blow back". This was caused by a build up of gases in the furnace, and as a result of this, the fire would not seem to be drawing well. If an inexperienced or careless stoker open the furnace door wide at this juncture, thus admitting more air, these gases would speedily ignite, and the flame, seeking the line of least resistance, would flash out of the door, and could cause bad burns.

This happened, in my own time, to a young man who worked at Stretham engine, with the result that he lost his eyebrows and some of his hair, and suffered bad burns to his face and hands.

Having laid these lumps of coal, as described, in the furnace, a small fire using faggots of willow wood and small pieces of coal would be lit just in front of them. This fire was carefully watched and larger pieces of coal were added when it was burning well. Draught for the initial fire was regulated, not by the dampers, as these would be used for the fire when it was pushed back to cover the whole of the furnace, but by opening or closing the doors which gave access to the ash pit situated beneath the furnace. Once a good fire was burning, the damper was lifted slightly to induce the flames to draw into the larger lumps first laid. The fire was now left to itself for the time being, while the procedure was repeated in the second furnace alongside in the same boiler. Should the occasion demand the use of two boilers, then the two furnaces in the adjoining boiler were dealt within a similar manner. It will be realised therefore, that if both boilers were to be used, the stoker had already picked up and barrowed in from the adjoining coal yard approximately a ton of coal purely for starting the fires.

It was usual to have two boilers, i.e. four furnaces in use when the engine was fighting a big head of water in the river, but for normal winter work one boiler was generally sufficient. It can be seen that one did not wait until the water in the drain and the river were at high level before lighting the fires, since it took approximately twelve hours to raise steam when starting from cold.

Let us now look at the fires in four to six hours time, when the originally laid lumps of coal had become red hot. More coal would now have to be shovelled on, approximately a barrow-load to each furnace, always remembering to keep the firebars at the front of the furnace well covered with coal, since cold air would otherwise enter here and blacken the fires. At this juncture, an experienced stoker would be able to tell by the heat at the bottom half of the boiler whether it was now time to push the fire back so as to cover the whole of the furnace bars. The fact that the steam gauge on the front of the boiler registered three or four pounds pressure was no indication that there was any steam there since this could be caused by "hot air". The engine driver would have noticed this apparent stream pressure, and he, in the engine room would bleed it off through the blow down valve into the condenser.

A special tool, fashioned like a large hoe was used to push back the now large heap of well-burning coal so as to cover all the furnace bars. As quickly as possible the fire would be covered with more coal in the following manner. The first shovel full was flung with a spreading motion right up to the brick arch or

bridge at the back of the furnace towards the centre. Then two further shovels full were flung, one to the left and the other to the right of this, and this pattern was repeated right to the front of the furnace. The dampers were now raised, probably to their full extent, as this was the crucial time when steam pressure began to rise.

As well as watching the pressure gauge and the water gauge, one had to find time to pay attention also to the boiler feed pump. This was a ball valve which controlled the amount of water entering the boiler and it was regulated by a small hand wheel. It would never do to allow this ball valve to be screwed down tightly and each stoker had his own method of setting it. My method was to file a small V-shaped notch on one of the spokes of the wheel, so that I could see at a glance if it were in the right position. The old stoker who taught me had a blob of white paint inside the wheel, known only to himself. The water gauge had to be as carefully watched as the steam gauge, since too much water coming in would mean surplus water to heat, and this required a lot more coal, whilst on the other hand too little water would have disastrous effects by melting the lead plug and putting out the fire entirely.

To maintain the fires, large lumps of coal, weighing more than half a hundredweight were lifted on to the barrow, wheeled into the boiler house and there broken into pieces which could be efficiently shovelled on to the fires. When two boilers were being used this was a continuous job as may be well realised, since, at Stretham engine each boiler used approximately one ton every four hours. The dampers also needed constant attention, as they were the main source of steam control. They consisted of a large steel plate counter balanced with a large iron ball, so that the slightest touch of the stoker's hand could alter the draught.

If the water was still rising in the outside drain and the river, the engine driver, possessing as he did an extensive knowledge of the fens and their drainage, would now realise that this flood would probably last for a week, or considerably more, and that the engine would be in constant use for the whole of that period. He would therefore arrange for his regular stoker to take the twelve hour night shift so that he, himself, could snatch a few hours sleep in that time.

The regular stoker was conversant enough with the engine to be able to oil up every hour, and to know by the sound of the engine if all was well. Provided that he kept a sharp eye on the steam pressure once the engine was going, there was not a lot that would be likely to go wrong with one of these massive pieces of machinery. I do not know of any case where a stoker actually started or stopped the engine, but I do know that at Stretham engine on various occasions,

the engine driver, Mr I Housley, who was also the Superintendent of the district would have to go out to inspect damage to various parts of the river bank whilst the engine was running. The regular stoker, William Taylor, was at such times left in charge for several hours.

Amongst the regular stoker's other duties would be the lubrication of the scoop wheel bearings, and also the pouring of warm pitch on to the driving cogs which meshed into the cogs on the scoop wheel. This pitch was used to form a cushion around the cogs because immediately it touched the cold iron, it set. If his duty was neglected, it would soon become apparent by the noise which would arise from the protesting cogs.

He had also to keep watch on the weed screen in the drain, at the bars which were used to stop wood or pieces of tree branches from getting into the wheel race. These must be pulled out before they got near the scoop wheel, where they would otherwise cause extensive damage to the paddles. This could be a very hazardous job, as is instanced in the case of a stoker whom I know well, when he slipped and fell into the drain, and not being able to make himself heard above the noise of the water and the engine, had to pull himself across the flooded drain from bar to bar, before he could get out. It was only when the steam pressure began to fall that the engine driver realised that something was amiss. Had the man been so unfortunate as to be sucked through the bars, he would have been dashed to pieces by the paddles of the scoop wheel.

The terrific heat in the furnaces would sometimes produce large masses of clinker which had to be cleared from the bars. This would be indicated when a black fire could be seen in the ashpit. With a special tool, barbed at the end, the stoker then had to break up this clinker by running the barb along the bars and drawing the clinker to the mouth of the furnace where it could be removed. This was called "clinkering out".

By doubly feeding the other furnace, the fire to be clinkered could be allowed to die down a little for a short while. This was a very warm job, and caused some hard work in building up the fire again when the clinker had been removed. This was a regular routine on every shift as was also the clearing of the ashpits at the end of every shift. As these ashes were very hot, a special low iron barrow was used. This was drawn up in front of the ashpit, and the ashes were scraped into it using a long hoe-shaped tool.

The one thing that a stoker dreaded was an emergency which necessitated drawing the fire. This meant using another special tool which was long enough to pull all the fire out of the furnace. One might add here that this operation could be much to the detriment of his clothing and his boots. This happened to

me twice, once at Upware when a pump rod broke underground, and at Stretham when a boiler seam split.

One might assume that the life of a stoker was much easier during the summer months. But this was not so, since in the summer the engine would be certain to run for part of the time and there were always some routine jobs to be carried out. One of these was to chop the scale off the boilers. To do this, he would have to crawl into the manhole at the bottom of the boiler and he would use a chipping hammer. He would be lying flat in the sludge and would be working by the light of a candle. Afterwards he would have to sweep all the sludge and the lime scale back to the manhole and then remove it. For this he would have to be both slim and fit, but I personally, in my time never encountered a fat stoker. Another distasteful job was the cleaning of the boiler flues. The soot in these was quite unlike any other soot. It was of a dirty grey colour, and was extremely light and puffy. For this job a hole was made in the wall between the boilers inside the boiler house. The stoker had to crawl through this hole and along the flue which was between two and three feet high. He would crawl halfway and then being unable to turn, would work back towards the hole bringing the soot with him.

Then the other half would be tacked, this time crawling right to the base of the chimney. As the old stoker who taught me said, "You'll know when you get underneath the chimney, because you'll be lying on your back, and you'll be able to see the stars". The extra remuneration for this particular job was three and sixpence and a bar of soap.

Having read this account, I think you will agree with me that a stoker's job needed quite a bit of knowledge and also expertise.