Where did the water come from?
(Part 1 - Raising the Pressure at Hockley)

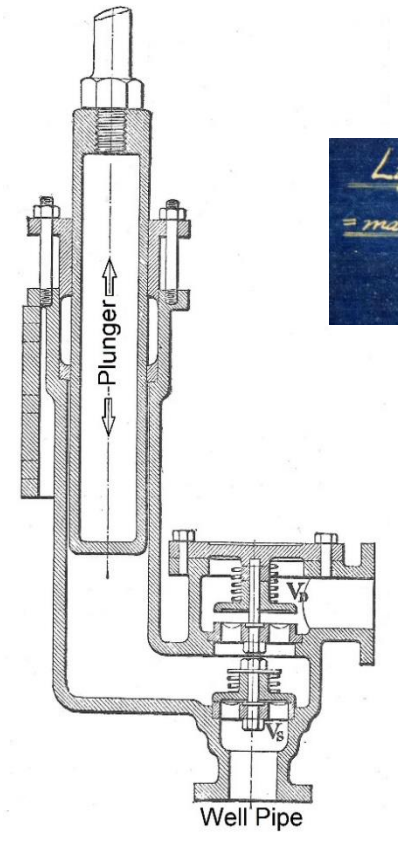
Knowing that Tyseley Locomotive Works was built on made up ground adjacent to the River Cole, this Great Western Railway Diagram showing a Loco Water Main stretching from Hockley to Tyseley came as a surprise. I had always assumed that the water required in the Tyseley Locomotive Works had either been extracted from the river or possibly a well on site.

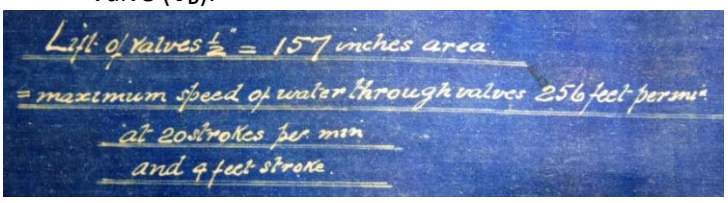
The water was actually obtained from the Birmingham Sherwood Sandstone Aquifer, which lies under central and west Birmingham. It was extracted from an artesian well at Hockley Goods Depot, from where it was piped alongside the main railway line through Snow Hill tunnel and within Bordesley viaduct to Tyseley. Water from this aquifer was used by many local industries, including both the Ansell Brewery at Aston Cross (where the first well was sunk in 1858) and the Mitchells & Butler Brewery at Cape Hill (where a well was sunk in 1879).

Hockley Goods Depot was established in 1854, but it is unknown when the first well was sunk on the site. It was however recorded as being one hundred and nine feet (33.2 metres) deep.

In late 1904, a second nine inch (229mm) diameter well was sunk by Messrs A. Stubbs to a depth of three hundred feet (91.4 metres). The Great Western Railway issued a series of Contract Drawings in February 1905 (contract Q92). These drawings depict cast iron bottom valve boxes for high pressure cylinders and in the following month (contract Q93) show the steel pipework, foot values and a displacement plunger and rod.

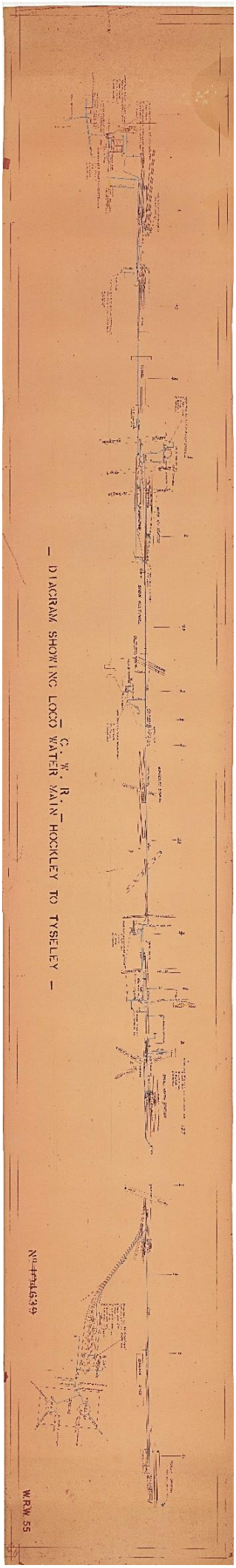
These details indicate that this was a slow running reciprocating pump of the plunger type. Foot values and priming apparatus were advisable on pumps with a high suction lift. The drawing shows this type of pump. The withdrawal of the Plunger creates suction in the chamber, drawing water up through the one-way Suction Valve ($\mathbf{V_S}$) at the top of the 'Well Pipe'. When the stroke is reversed, the plunger descends and this forces the raised water in the chamber through the second one-way Delivery Valve ($\mathbf{V_D}$).



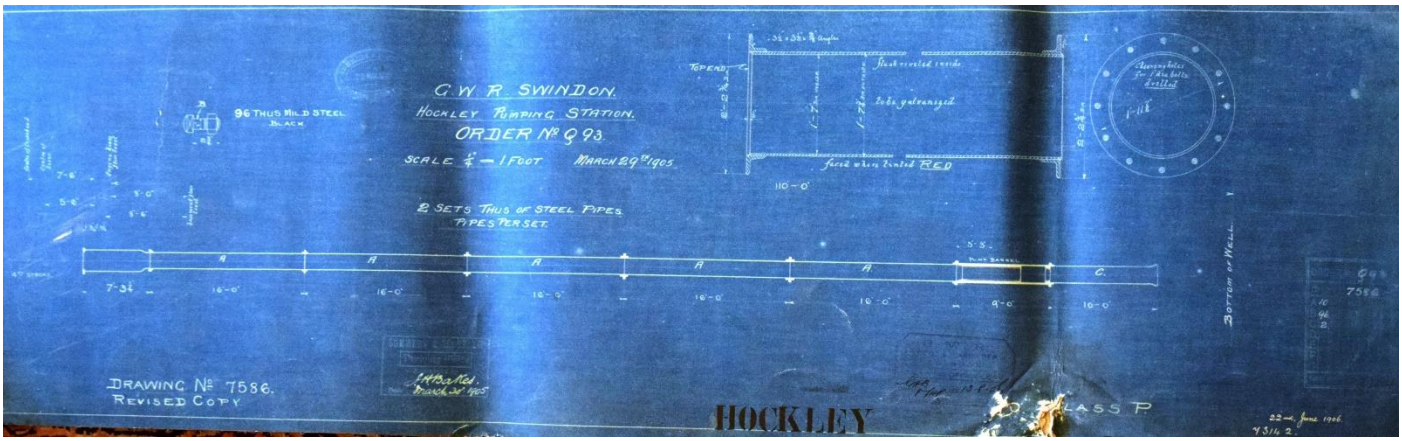


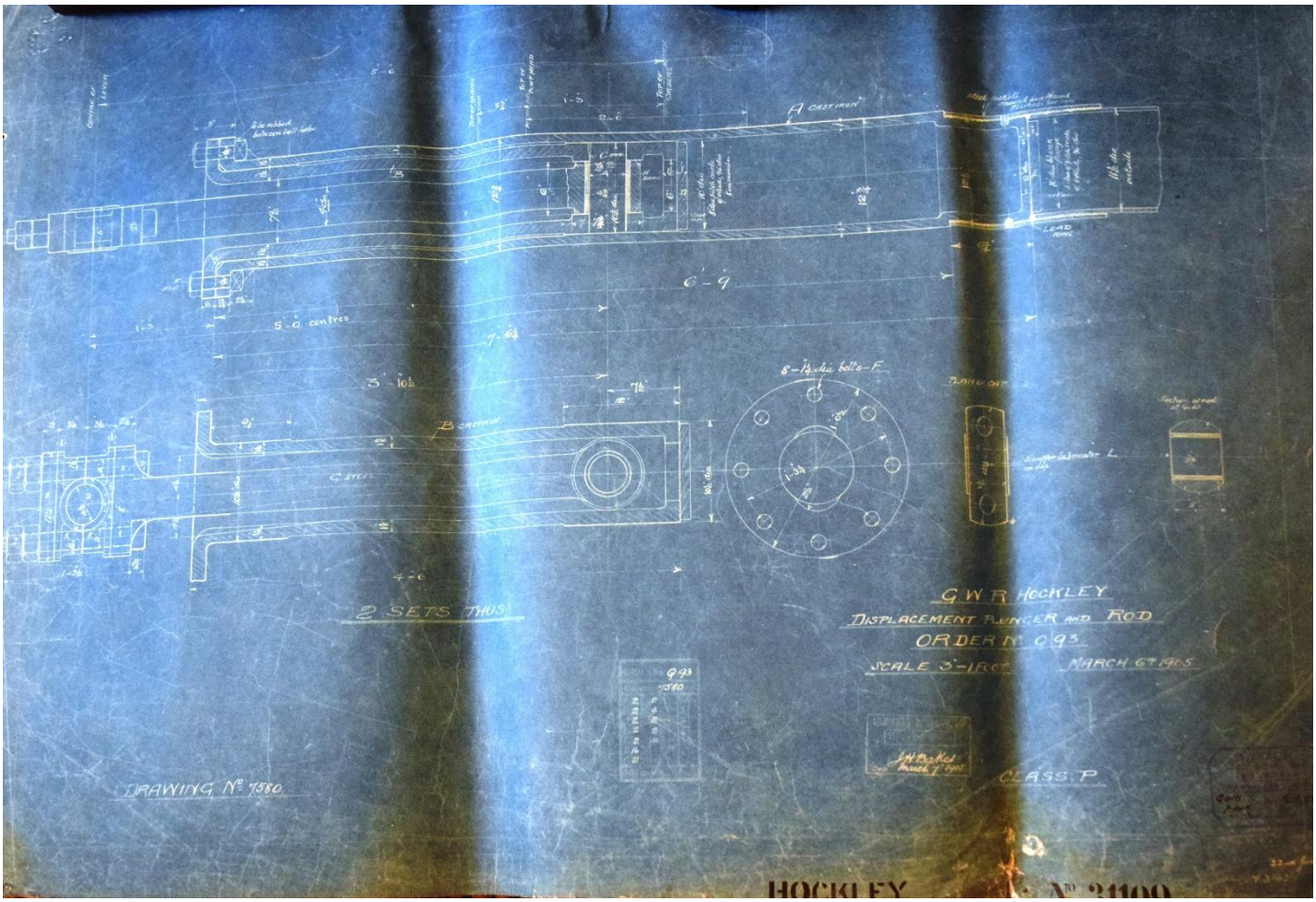
Notes on the drawings show the pump was designed to operate at a maximum speed of twenty strokes per minute with a four foot (1.2 metres) stroke. The relative slow speed and long stroke allowed large quantities of water to be extracted while minimising the reversals of direction of the pistons. This reduced the shock loading on the equipment and the potential for slip at the large (14 inch / 356mm) diameter valves.

Slow running reciprocating pumps can be vertical or horizontal, but the vertical type has the advantage that wear on the plunger is evenly distributed resulting in increased durability.

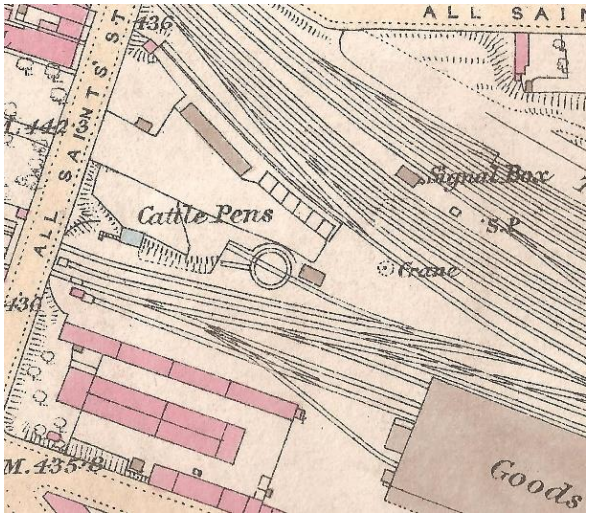


Two of the Blueprint Drawings showing; (1) Steel Sleeve Pipe for the well and (2) Displacement Plunger and Rod:





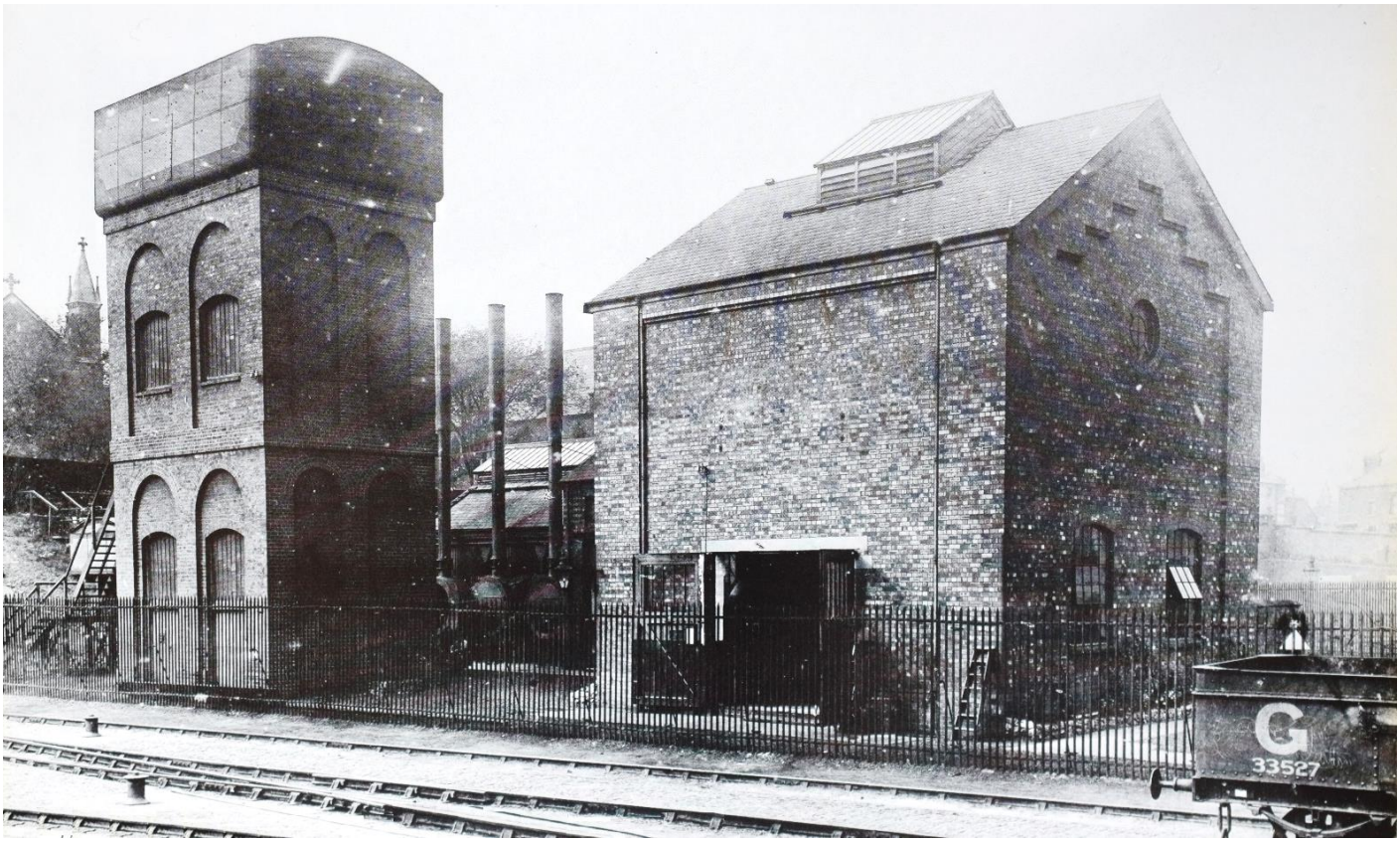
A later drawing (dated 1907) indicates that some components were manufactured by Messrs Summers & Scott Ltd of High Orchard Ironworks in Gloucester. This company was a manufacturer of long-stroke, duplicate, vertical, compound steam engines with horizontal condensers. These were supplied for both industrial purposes and to waterworks.



Initially the reciprocal pumps and stationary steam engines that powered them appear to have been located together in a combined Pump / Engine house. The steam to drive the engines was produced in boilers housed in an adjacent Power (or Boiler) House, while behind the Power House was a coal pen and rail siding. These buildings and facilities were situated within the

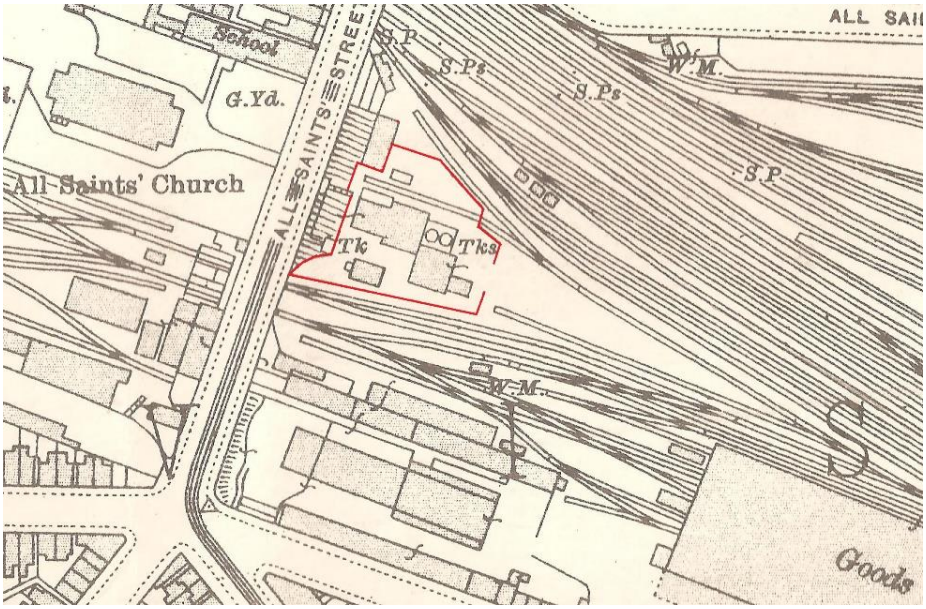
confines of the Hockley Goods Depot, next to All Saints Street. The area had originally contained a turntable and cattle pens (see GWR land survey map dated 1890), but later ordnance survey maps show that these facilities had been cleared by 1902.

Two further wells, both approximately sixteen inch (400mm) diameter, were sunk by London based Artesian well engineers; the first was sunk in 1913 by Messrs C. Isler & Co. (Southwark) and the second (which extended the original well) was sunk in 1932 by Messrs Le Grand, Sutcliff & Geli (Southall). These two wells were both recorded as being 614 feet (187.1 metres) deep. The boreholes were lined with steel tubes to a depth of 310 feet (94.5 metres) to prevent unsuitable waters from the upper stratifications entering the borings. The water level in the boreholes was approximately 215 feet (65.5 metres) below ground level.

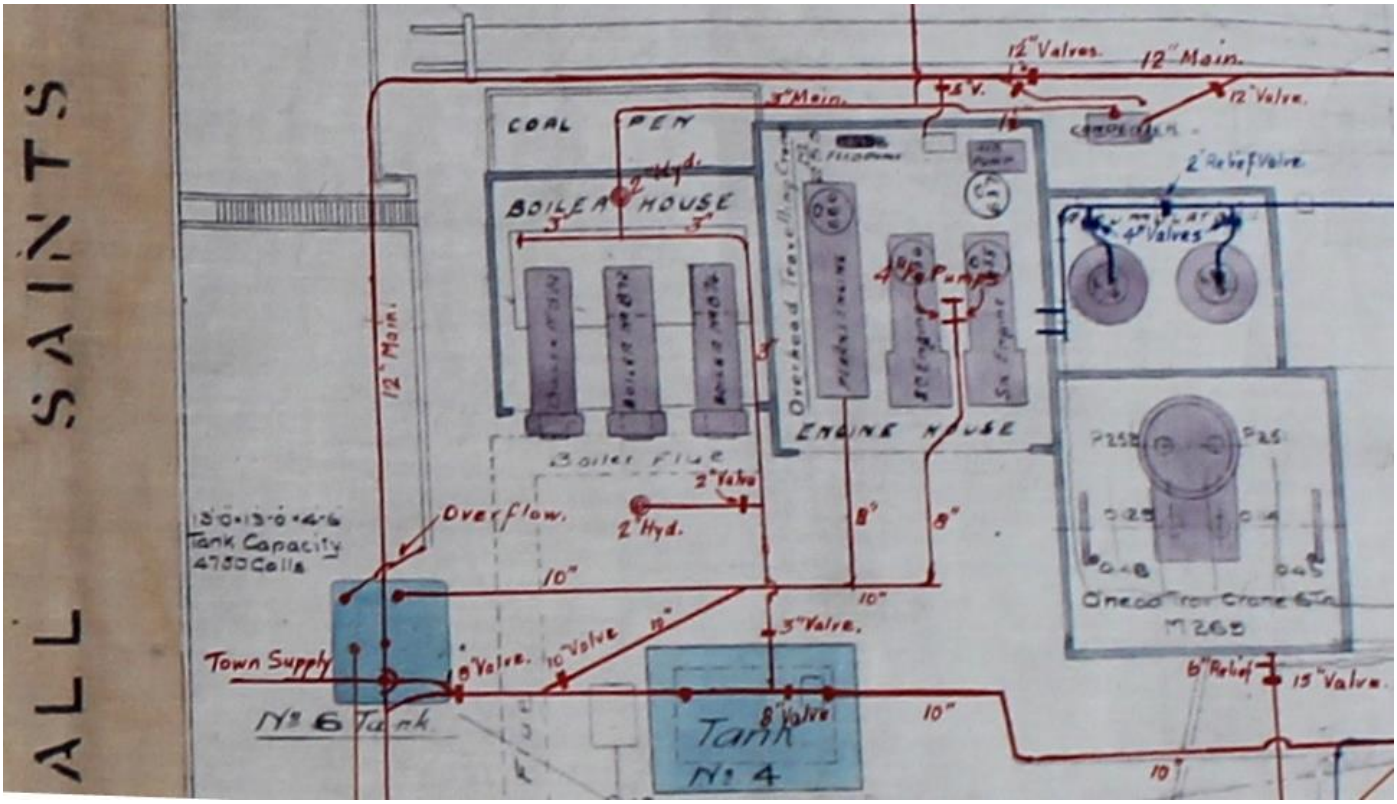


This official GWR photograph shows the Hydraulic Pumping Station at Hockley after the completion of a new Pump House. This large Pump House was built over the artesian well sunk in 1913 and in this view it obscures the first Pump / Engine House containing the original reciprocal pumps and steam engines. The low building visible behind. is the original Power (or Boiler) House. This has three tall chimneys, one for each of the coal fired stationary boilers. Coal for these boilers was delivered by rail siding on the far side of the building. The photograph also shows elevated Water Tank No.4 (25,000 gallon / 113,650 litres). The water extracted from the aquifer was delivered to several elevated tanks around the site, where it was stored as potential energy. On the extreme left of the photograph is the east end of All Saints Church. The church was on the other side of the embankment that carried All Saints Street.

The attached 1918 map shows these buildings within the boundary of the Hydraulic Pumping Station compound. The compound boundary is outlined in red on the map.



Plans of the hydraulic system at Hockley are available at the Archives of the Wiltshire & Swindon History Centre in Chippenham. An enlarged extract from one of these plans (dated June 1927), shows the equipment layout within the Hydraulic Pumping Station with the low pressure pipework to the hydraulic equipment in red. The Power (or Boiler) House with three boilers on the left, with the coal pen adjacent. In the centre, adjacent to the Power House is the original Pump / Engine House with three reciprical pumps and their associated steam engines. This building contains an overhead travelling crane. Finally on the right, are a pair of Accumulators, while adjacent to these is the 1913 Pump House. The drawing indicates that there was a six ton overhead travelling crane in the Pump House.

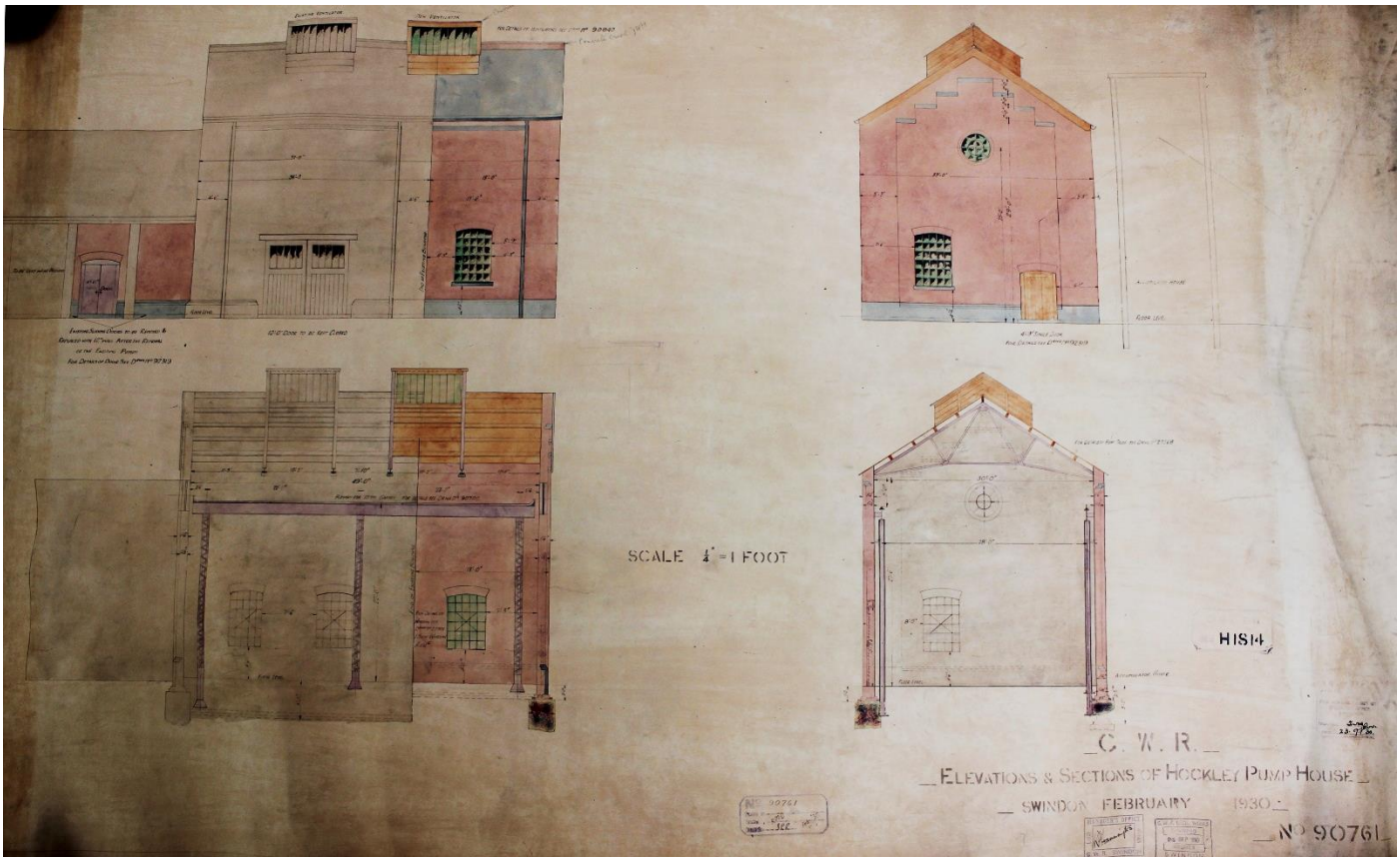


It is believed that the hydraulic system at Hockley operated at a single pressure of 800lbs. This was classified as a Medium Hydraulic Pressure (300lbs to 1500 lbs), which was typically used to power workshop machinery. The hydralic system included a total of five raised weight Accumulators in three locations distributed around the Depot. On the plan Blue lines are Medium Pressure Hydraulic pipelines. The raised weight Accumulators here were the externally guided type.They are designed to maintain a constant hydraulic pressure irrespective of the usage.

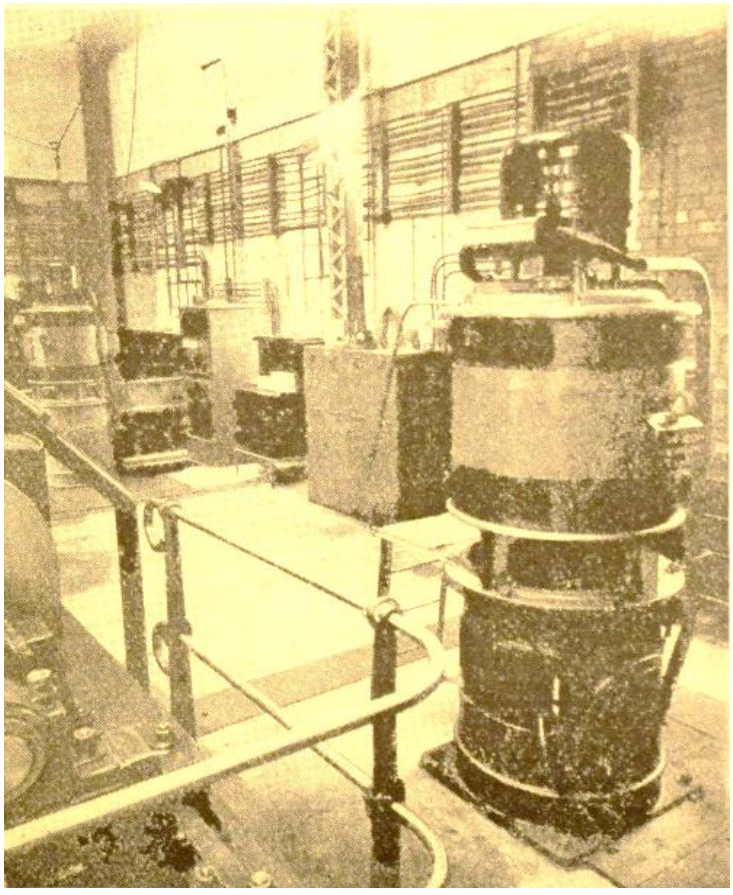
Systems without accumulators would suffer from a drop in pressure as the water was used and the head of water decreased. Raised weight accumulators consisted of large vertical cylinders in to which water was either pumped or gravity feed (in this case from Water Tank No.4). The water was then compressed using a series of weights to ensure the constant pressure. These hydraulic accumulators provided the prime source of hydraulic power for the machinery in the Hockley Goods Depot. This included; Capstans, Cranes, Transversers, Wagon and other Lifts. One of the largest items moved by hydraulic power was the twenty-five ton Goliath Gantry Crane located in the Round Yard.

This next drawing dated February 1930 shows an elevation and section through the Pump House, with the alterations proposed to accommodate the final artesian well, which was sunk in 1932. An eighteen foot (5.5 metre) extension to the original building was added, creating a building; 52 feet (15.8 metres) long by 33 feet (10.0 metres)

wide with side walls 29 feet (8.8 metres) high. The drawing also indicates the building contained a gantry for a ten ton overhead travelling crane at a height of 22 feet (6.7 metres). The faint outline of the steel framework which acted as an external guide for the two weighted hydraulic accumulator is also visible adjacent to the building. The new pump was to be electrically powered and notes on the drawing refer to the existing sliding doors in the original Pump / Engine House being bricked up after the removal of the reciprocal pumps and steam engines.

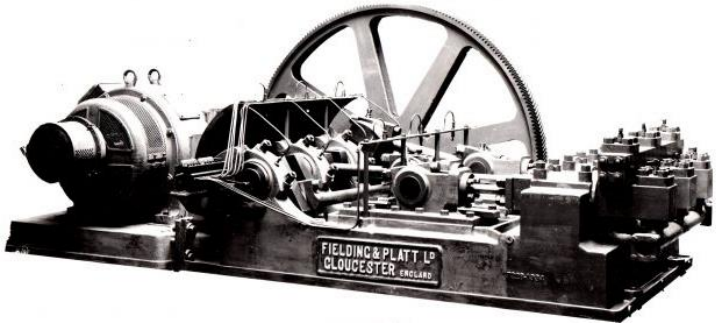


In June 1930 it was reported in the GWR Magazine that a contract had been placed with Messrs Tangyes Ltd of Birmingham for one electrically driven borehole pump and another with Messrs Fielding & Platt of Gloucester for three electrically driven hydraulic pumps.



The Tangyes vertical turbine borehole pump was installed directly above the borehole. The pump was powered by an 80h.p. (59.6 kW) electric motor positioned in-line with a 1¾ inch (44mm) drive-shaft, which extended downwards to a depth of 239 feet (72.5 metres) in a $7^{7}/_{8}$ inch (200mm) tube. This drive-shaft was kept central in the tube by guides every 5 feet (1.5 metres). A six-stage turbine pump operated at the bottom end of the drive-shaft. The motor was designed to run continuously at maximum speed of 1,460 rpm, which allowed the turbine to raise 30,000 gallons (227,300 litres) of water per hour to a raised tank sixty feet (m) above the surface.This photograph appeared in the GWR Magazine.

The second photograph show a typical electricly driven three throw, dual action, long stroke pump as manufactured by Fielding & Platt in the early 1930's. The three pumps supplied to the Great Western Railway for Hockley were described as electrically driven, three throw with a five inch (127mm) diameter ram and 15 inch (381mm) stroke. The use of three throw pumps with dual cylinders and a long stroke ensured a relatively constant water output.

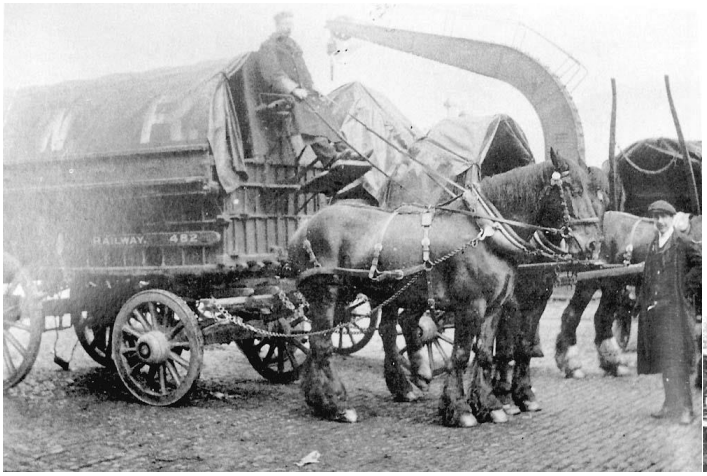


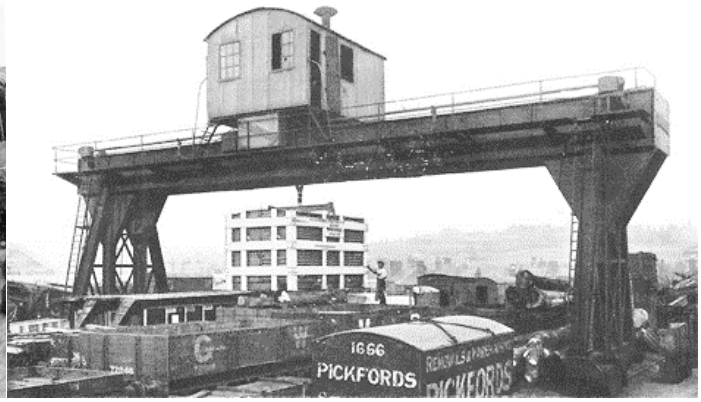
This photograph taken in March 1938 shows Hockley Goods Depot from the bridge carrying All Saints Street over the northern rail entrance to Hockley Goods Depot. In the background is the Goods Outward Shed, while on the right, is the other side of the Hydraulic Pumping Station (with the Pump House extension). Adjacent to this building are the two raised weight hydraulic accumulators with the steelwork that acted as an external guide.

By 1934, the Great Western Railway had concentrated freight transhiping at Hockley Goods Depot and the Depot had also become the freight railhead for Birmingham. This made it necessary to reorganise the Hockley site to provide more covered accommodation for these activities. The medium pressure hydraulic system would be abandoned to allow removal of redundant parts of the Pumping Station, including No.4 Water Tank. Most of the hydraulic equipment in the Goods Depot would either be replaced by (or converted to) electical driven equipment.

The next photograph taken in 1939 shows water tank No.4 removed from the top of its tower in preparation for demolition of this structure. The extended Pump House is directly behind on the left.

Hydraulic Equipment at Hockley Goods Depot



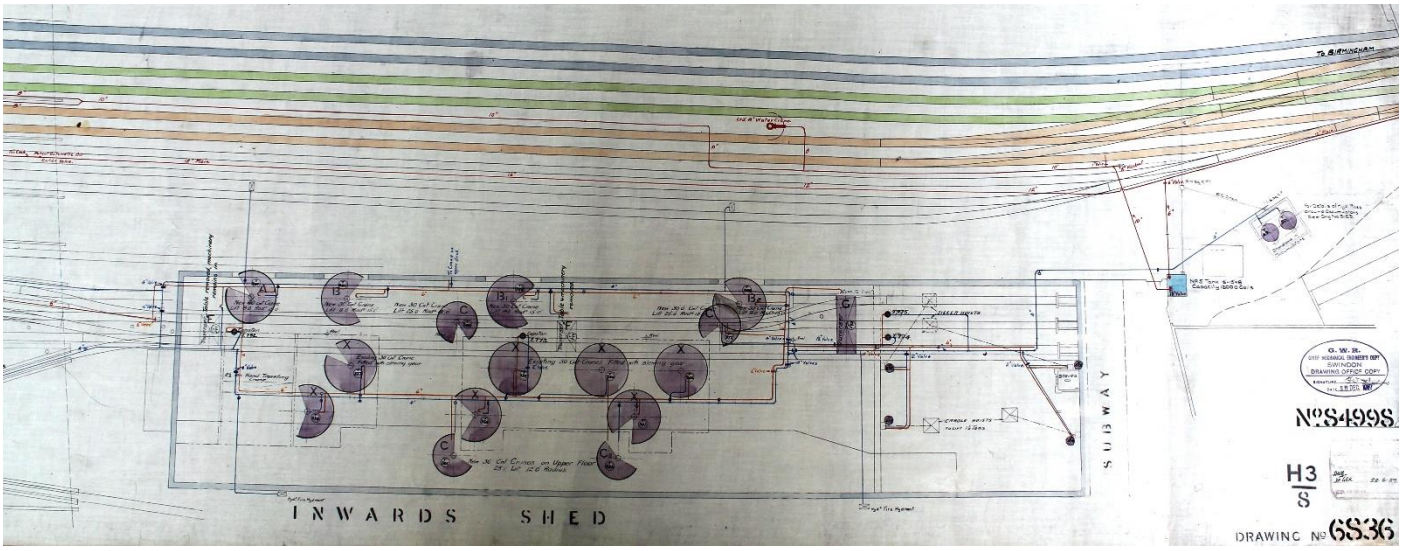


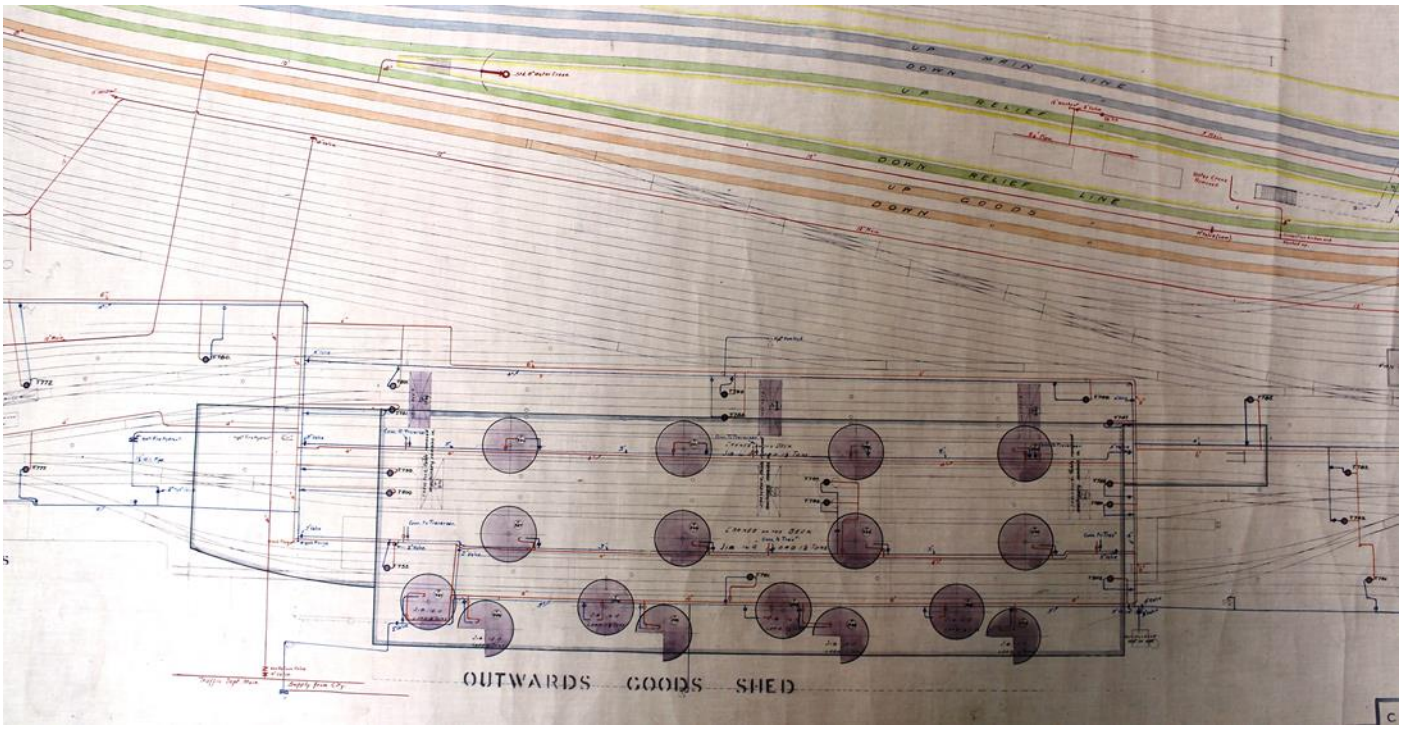
Hydraulic Cranes and Traverser Tables – A hydraulically powered five ton capacity crane was situated between the Inward and Outward Goods Sheds. This can be seen behind the two horse tilt wagon in this photograph of Hockley Goods Depot. Also between the two sheds was a hydraulically powered wagon Traverser Table which had a two track table operating between two pairs of tracks. Previously mentioned was the twenty-five ton goliath travelling gantry crane in the Round Yard north of the station, which was moved by hydraulic power. The lifting mechanism was however steam powered by a vertical boiler in the cabin above the gantry girders.

There were numerous smaller capacity hydraulic cranes and wagon Traverser Tables in the three Goods Sheds at Hockley. The 1927 diagram indicates that these included:

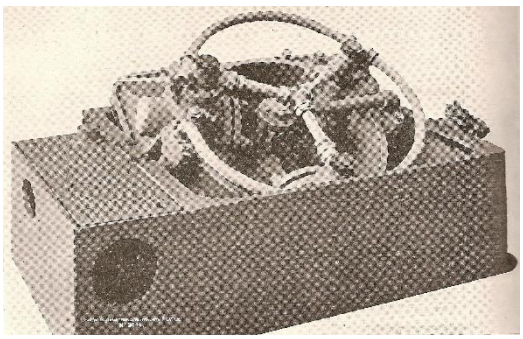
- Inward Shed - One 40 cwt Crane, fourteen 30 cwt Cranes and a three track wagon Traverser Table (notes indicate that a further two other wagon Traverser Tables had been removed, although their machinary remained). There was also two hydraulically powered one and a half ton Cradle Hoists and two Jigger Hoists
- Outward Shed -.Four 2 ton Cranes, ten 1.5 ton Cranes and three wagon Traverser Tables (notes indicate another wagon Traverser Table had been removed , although the machinery had been retained).
- Transhipment shed (adjacent to the canal basin) - six 30 cwt Cranes

Note there were another two more accumulators at the other end of the site.

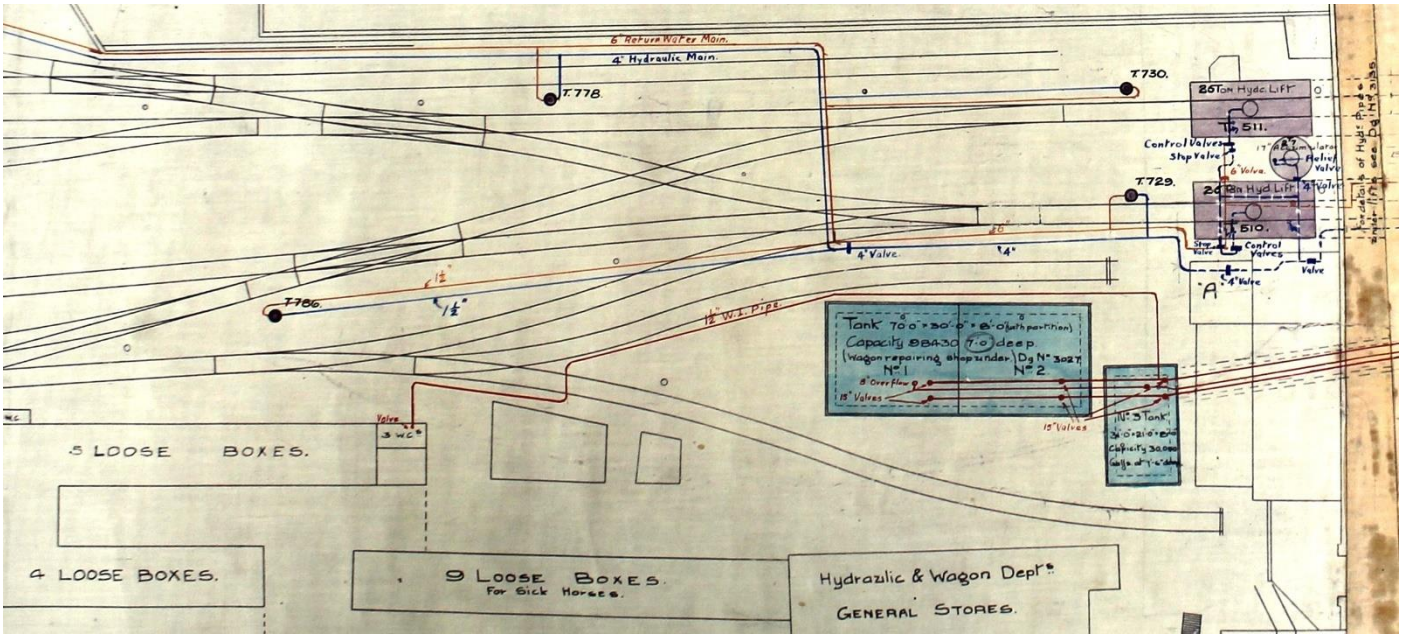




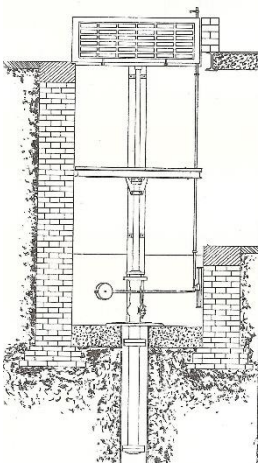
Hydraulic Powered Capstains - Powered capstans were used extensively in the Goods Depot to move wagons. This avoided the need for shunting locomotives or horses. They were particularly important in the Canal Basin as it was impossible for locomotives to reach this part of the site. There were seventeen hydraulicly powered capstans in the Canal Basin and at least a further thirty in the main Goods Yard and the two Sheds. The capacity of Capstains is generally expressed in terms of 'Snatch pull'. This is the force exerted on a wagon in a state of rest and not the continuous pull. Capstains in Goods Depots like Hockley were typically rated as one ton snatch pull, so that they could haul a number of wagons coupled together. A one ton snatch pull was sufficient to haul eighty tons of aggregated load on the level from a standing start. The capstain mechanism comprised three rams operated by a foot pedal. The capstain could be turned over to expose the mechanism for maintenance (as shown in this catalogue photograph).



Hydraylic Wagon Lifts - A pair of hydraulic wagon lifts, each with a capacity of 26 tons, gave access to the canal basin. The basin was at a higher level than the rest of Hockley Depot and the wagon lifts were located adjacent to All Saints Street. The lifts were reached by two short tunnels under All Saints Street. The Medium Pressure hydraulic power to operate the two ram lifts was supplied from a single raised weight accumulator located between the two lifts.

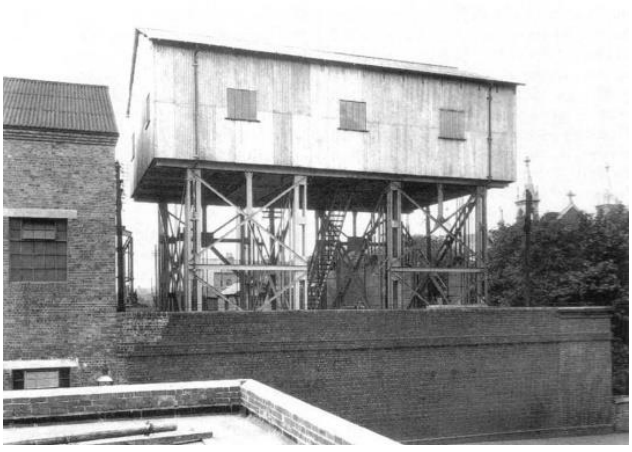


This plan dated June 1927 shows the two wagon lifts with a raised weight Accumulator between (coloured grey). The Medium Pressure Hydraulic pipeline (coloured Blue lines) connects to the Accumulator as well as several powered capstains in the yard. Low Pressure Hydraulic pipelines (coloured red) provide the return pipework from hydraulic equpment as well as general water supplies to the Stable block and feed pipes to the two high-level water tanks (two rectangles coloured Blue).



The diagram shows a typical hydraulic ram type wagon lift as used at Hockley. The ram and other equipment is all below the lift platfom and no equipment is required above.

The photograph shows the two wagon lifts at Hockley with the later mechanism enclosure above. This photograph was taken after the lift mechanism had been converted to electricity and the hydraulic rams and Accumulator has been removed.



The second photograph shows another raised Water Tank (Tank No.3) which was behind the adjacent building.

A one ton capacity Hydraulic Luggage Lift was also provided on Hockley Station's Island platform to transport passengers luggage and parcel traffic to the subway underneath.

In addition to powering the Hydraulic machinery at Hockley Goods Depot, the water raised by the pumps at Hockley was used to supply water to all the Great Western Railway's Stations and various Water Tanks between Hockley and Tyseley. This will be the subject of a second article.

Robert Ferris (Volunteer Arcivist)

March 2022

References

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