OFFICIAL OPENING

of

HOMESFORD WORKS

(The Central Area Reinforcement Scheme)

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7th JULY 1970

Official Opening of Homesford Treatment Works and Pumping Station

Historical Development - to 1961

The water supplied from these works is derived from the Meerbrook Sough, which is an underground tunnel extending from the River Derwent adjacent to the works, across the Wirksworth valley and under the town of Wirksworth with several contributory branches. The tunnel which has a length of some 5 miles and a depth of up to 700 feet was originally constructed to drain the lead mines of the Wirksworth valley. The water appears to come mainly from the millstone grit formation with perhaps 30 per cent from the limestone. It has a total hardness of approximately 285 p.p.m.

Outlet of Meerbrook Sough at Homesford

In the late nineteenth century the Borough of Ilkeston and the Heanor Urban District Council promoted a joint scheme to provide for the water needs of their respective areas at that time and for the probable growth during the succeeding 30 to 40 years by purchasing for a sum of £5,000 the rights of the Meerbrook Sough Company. As a result the Ilkeston and Heanor Water Board was constituted by Act of Parliament in 1901, the Board being given powers to abstract from the Sough up to 3,000,000 gallons per day. It was estimated that the total quantity required in 1901 was 1,000,000 gallons per day and that this would rise to 2,000,000 gallons per day by 1941.

The original works were designed to produce up to 2.4 million gallons per day and were completed in 1904. They comprised steam driven pumping plant and a "fill and draw" lime softening plant. Water from the works was pumped through an 18" diameter main to a reservoir which was built at the same time at Chadwick Nick. By 1927 it was reported that production had nearly reached the limit for which the Works were designed and, particularly since no stand-by had been provided, it was apparent that further works were necessary. Accordingly the Works were extended and duplicate plant and mains were installed and commissioned by 1932.

The Ilkeston and Heanor Water Board Order of 1953 raised the permitted abstraction from the Sough to 4,000,000 gallons per day. In addition a further 400,000 gallons per day were available from two boreholes sunk on the site during the period 1923 - 1926.

Further Development - from 1961

In April, 1961, the Works of the Ilkeston and Heanor Water Board were transferred along with those of the other thirteen constituent authorities, to the South Derbyshire Water Board's Undertaking. The latter is a constituent member of the Derwent Valley Water Board and, at that time, was entitled to receive from it in the statutory area of supply, some 11,000,000 gallons per day.

The other principal works of the South Derbyshire Water Board are at Little Eaton, near Derby which in 1961 could deal with an average of some 7,250,000 gallons per day of water mainly abstracted from the River Derwent. The Board also had in service at the inception of the undertaking 19 well and borehole pumping stations and 22 spring sources with a combined reliable daily yield of 3,820,000 gallons.

The aggregate reliable daily quantity thus available of about 26.5 million gallons per day was seen to be inadequate to meet rising consumer demand and an early increase in resources was imperative.

Furthermore, the works of the newly formed undertaking were not integrated and in many places of insufficient capacity to enable available supplies to be used effectively, while the existing works at Homesford needed complete reconstruction.

The reinforcement of the distribution system to serve those areas where supply conditions were much below requirements was the newly formed Board's first priority. By 1966 some £1,500,000 had been expended on capital works, principally on the distribution system, and plans wore being formulated to complete the integration of the undertaking's works and to meet the rapidly approaching condition when resources would be insufficient to meet demand. The decision to reconstruct the Homesford Works to the capacity of the then existing station had previously been taken and work on this was started in the autumn of 1966.

In character, the waters available from the Board's sources except that from the springs in the Matlock area, is hard to very hard, while that from the Derwent Valley Water Board is soft.

A major policy decision was taken by the Board in April, 1965 which underlies all subsequent design. This requires that, in general water supplied to each part of the statutory area Should have the same total hardness and necessitates the blending of hard and soft waters before supply and the softening of Homesford and Little Eaton waters to a degree determined by the blending ratios available.

The Board were aware that in the thirty years from 1935 the lowest recorded flow in the Meerbrook Sough was 10,800,000 gallons per day and the maximum 19,000,000 gallons per day. The water derived from this source was of excellent quality, though having a high temporary hardness. and required no filtration before being put into supply.

As the works at Homesford were, in any case, to be entirely reconstructed it was apparent that considerable economics could be achieved by developing this source to the maximum. The Board therefore sought a further increase in the permitted abstraction from the Sough and the South Derbyshire Water Board Order, 1967, raised this to 10,000,000 gallons per day from 26th April 1967. The permissible abstraction at Little Eaton was increased to 9,250,000 gallons per day in 1968.

In order to utilise the additional water made available at Homesford the Central Area Reinforcement Scheme, which took into account the policy of blending, was developed and approved by the Board. This scheme, when complete in about twelve months' time, will bring about a final measure of integration of the works of the Board so that these can be regarded as a single unit.

The Homesford Works - 1961

The Homesford Works 1970

Description of the Works

Water from the Meerbrook Sough enters the works through a brick culvert, constructed as part of the original works, into a reinforced concrete channel. Two low lift pumps deliver water drawn from this channel in two streams to the riverside compartment of the reinforced concrete storage tank situated between the pump hall and the River. One steam passes through softening plant in the adjacent treatment hall and the other by-passes this plant and blends with the softened water in a proportion such that the required total hardness in the storage tank is achieved. The softening plant consists of four ion exchange units, 10 ft. dia. x 9 ft. high, each containing 490 cu. ft. of resin. The softening process consists of passing water through these resin beds, which have the property of removing tile temporary hardness in the water

At intervals the resin has to be regenerated and this is done by passing dilute sulphuric acid through the bed. Sulphate effluent is produced which is discharged into the tanks to the south-east of the works and which, after dilution is passed into the river at a constant rate.

The water leaving the units after softening contains a considerable amount of carbon dioxide which is discharged to atmosphere from the tower adjacent to the storage tank. This tower is approximately 34 ft. high and is charged with porcelain packing rings in which the water and air meet in counterflow, i.e. the air passes up through the down flowing water. The very large volume of air used in the de-gasser tower is supplied by the three fans mounted on the cantilever platform on the riverside. The water enters the sump of the tower in the form of very fine spray leaves by an outlet at the bottom of this and passes to the treated water tank.

Since the softened water is too acidic for supply purposes tile PH is corrected by adding a lime solution at a point between the de-gasser tower and the treated water tank. The lime dosing plant consists of a 12 ton silo, a lime mixing tank fitted with a level electrode and two lime saturators. Hydrated lime is transferred from the silo to the mixing tank by blowing it at a fixed rate and water is added to make a lime slurry which is pumped into the bottom of the Lime saturators. An air-operated flow control valve is fitted in the water supply pipe to the saturators. This valve is operated by signals received from the pH metering equipment mounted on the control panel and connected to a continuous flow electrode at the entrance to the treated water tank. The flow of water into the saturator is thus increased or decreased according ....

to the pH of the final blended water and the lime solution overflows into the outlet funnel and is piped to the injection point.

Regeneration is done automatically in three stages and the automatic controls are interlocked so that only one unit at a time can be regenerated. Raw water is first passed upwards through the unit being regenerated for 5 minutes at the rate of 350 gallons per minute. This loosens and cleans the ion exchange material. A measured amount of 98 per cent sulphuric acid is diluted in a continuous dilution tank to give a 0.8 per cent solution and this diluted solution is pumped downwards through the unit at a rate of 520 g.p.m for 25 minutes.

Finally raw water is passed downwards through the unit at the rate of 350 g.p.m. which brings the acid into contact with tile whole of the bed of ion exchange material. This rinse is continued for 30 minutes. The total water used in regeneration is 25,250 gallons

The acid is delivered by bulk tanker to the delivery point whence it is transferred to three bulk storage tanks adjacent to the Plant. During the backwash stage of the regeneration cycle this acid is drawn from the bulk acid storage tanks into a measuring tank using a vacuum ejector so arranged that when the required volume of acid has been drawn contact is made with a level electrode and the valve controlling the supply of water to the vacuum ejector is closed. The partial vacuum is thus destroyed and the acid ceases to flow. When required the acid pump is started and water is drawn from a continuous dilution tank and injected downwards through the unit. This causes the level in the dilution tank to drop and the ball valve opens to admit dilution water. The discharge valve from the acid measuring tank opens as the acid pump starts and acid discharges at a pre-set rate to give the requited strength of solution in the dilution tank on mixing with the dilution water. The pump is controlled by a timer which stops after 25 minutes.

Two further low-lift pimps draw water from the raw water channel and pump it directly to the other compartment of the treated water tank.

Sterilisation is achieved using chlorine gas to super-chlorinate the water at the inlet side of each of the compartments of the treated water tank and sulphur dioxide to de-chlorinate at the outlet of the treated water tanks to give a pre-determined chlorine level monitored on a residual recorder. Stand-by chlorinators are included to dose at the outlet of the tanks should the primary chlorinators fail.

Seven high-lift pumps installed in a line adjacent to the front wall of the pump hall are capable of drawing water from either of the storage tanks. The blended water is pumped to Chadwick Nick Reservoir, part

of the original scheme, and the hard water is pumped to Crich Reservoir which was constructed as part of the new scheme. The other three pumps installed in the hall boost water drawn from the Derwent Valley Water Board's Aqueduct at Holloway to a high level reservoir at Wirksworth.

The new 24" dia. main from the works to Crich Reservoir crosses the river over a pipe bridge which was built as part of the 1932 works and which has now been strengthened to carry the extra load by tensioning the bottom chords with stressed high tension rods.

Apart from the treatment block and pump hall the new, building incorporates .r fitting shop, an Electricity Board sub-station garages and an administration block including offices, laboratory, mess-room and locker room. The pump hall basement is formed from the basement of the original building

Strengthened Pipe Bridge

Further Design Features

The site is generally underlain by alluvial strata to a depth of approximately 30 feet, beneath which are a series of sandstones and mudstones It was therefore decided to construct the new works generally on piled foundations, except where use could be made of existing proven foundations. Piling was made difficult in places by the presence *of* isolated boulders in the alluvial strata and of uncharted features of the old foundations. Pile lengths varied from 15 ft to 35 ft.

Each compartment of the Treated Water Tank has a capacity of 250,000 gallons with a water depth of 12' 6". This is supported on 72 piles each capable of bearing 58 tons. The Effluent Disposal Tank has a total capacity of 170.000 gallons and the bottom falls to a channel of 6' 0" x 6' 0" section. This structure is lined with a polyurethane pitch material, which resists the action of the high sulphate content in the effluent, and is supported on 37 piles of 58 ton bearing capacity. Since in flood conditions the water has been known to reach 3' 0" above ground level both the Treated Water Tank and the Effluent Disposal Tank have been designed to resist flotation using the piles as anchorage. In this condition they are capable of resisting an upthrust of 7.5 tons each.

The de-gasser tower is similarly lined with polyurethane pitch and is built on four piles.

The Treatment Building und Pump Hall are founded partly on the old building foundations and partly on a piled foundation comprising 111 piles each capable of bearing 87 tons.

Crich Reservoir - Wall footing during construction

Associated Works

The Central Area Reinforcement Scheme previously mentioned includes those works which were required in order that the full output from the Homesford Works could be utilised. These include a 3,000,000 gallons storage reservoir at Crich a 24" dia. aqueduct from Homesford to Crich and a 24" dia./21" dia. gravity main from Crich Reservoir to the Board's works at Little Eaton. These works were completed at the same time and commissioned in January, 1970. The hard water passing through this system is blended at key points with soft water drawn from the Derwent Valley Water Board's aqueducts. Arrangements have also been made for the fluoridation of all ware leaving file works.

Design and Construction

The design and supervision of construction of the whole of the works was carried out by the Board's staff with the collaboration of Messrs. T. H. Thorpe & Partners for the design of the super-structure of the treatment building, pump hall, garage and office at Homesford and of the F.C. Construction Co. Ltd. respect of the structural design of tile foundations for the same buildings.

With the exception of the installation of pumps, pipework and certain ancillary works, which were carried out by the Board directly, the remainder of the works were executed by contract.