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(DISTRICT) WATERWORKS :: JOINT COMMITTEE

CHAIRMAN : ALDERMAN R. S. OLDHAM, J.P.

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TOWN HALL CHAMBERS,
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MAY, 1935

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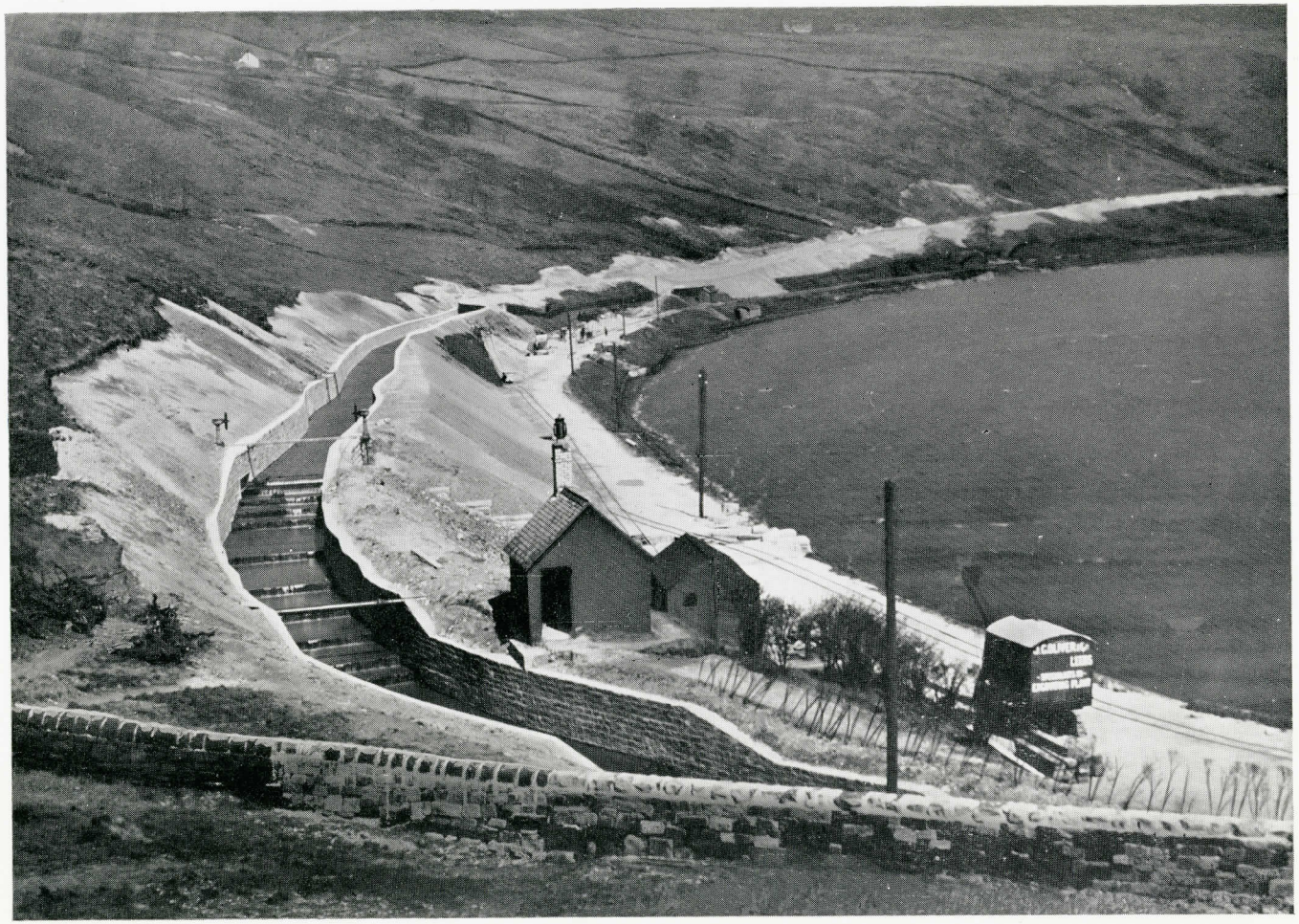

The bye-pass is shown here, where it curves towards Yeoman Hey embankment. The primary leaping weir is indicated by the capstan wheels. The secondary weir is situated in the water course connecting the bye-pass to the reservoir. In the foreground stands the ¾ cubic yard Priestman's excavator used during construction.

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Description of the Yeoman Hey Flood Water Course

INTRODUCTION

Greenfield Valley in which are situated the Greenfield and Yeoman Hey Reservoirs is a beauty spot which claims admirers from a very wide area. The rugged grandeur of the encircling hills, at whose feet the reservoirs lie, is reminiscent of Wales or Scotland.

Massive escarpments of millstone grit stand above precipitous slopes seamed with watercourses, the majority of which are dry in the summer months, but which during time of storm pour torrents of water into the reservoirs below.

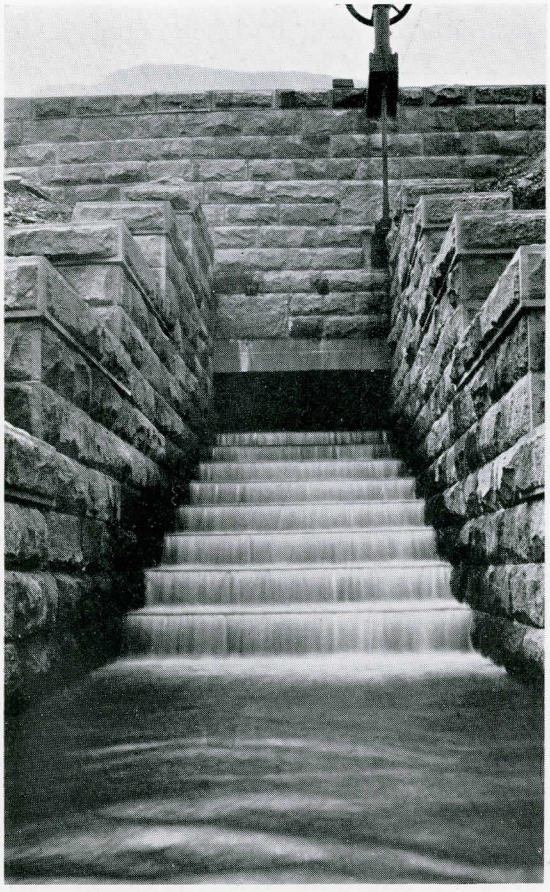
The Valley is a poet's sanctuary on a quiet summer's afternoon, but when the poet has gone and forgotten Greenfield Valley, and

MASONRY CHUTE AT GREENFIELD BROOK.

is afraid to venture out of doors because of hurricane and tempest, the hills assume an aspect more associated with fear than reverence.

Trickling streams become rushing torrents, the cascade at Ashway Gap house thunders with its load of chocolate-coloured waters, conversation is impossible within 20 yards of the reservoir overflow, and everyone associated with the maintenance and safety of the reservoirs is affected by that feeling of fear called up by nature's forces unleashed.

September the 4th, 1931, was such a day. Rain started falling at 7-0 in the morning, and continued without cessation until 4-0 in the afternoon, during which time three inches and a quarter were recorded.



Outlet from pool below primary leaping weir at Yeoman Hey embankment. The secondary leaping weir is situated immediately below, and it is possible to discharge the water flowing from the pool either into Yeoman Hey reservoir or into a conduit connected to the filter house.

An inch of rain deposits one hundred tons of water on an acre, so that 970,000 tons of water fell on the 3,007 acres of Greenfield Valley in seven hours. In the words of the Valley Superintendent: "Water seemed to spout from heaven and earth." The water level of Yeoman Hey reservoir rose rapidly above the overflow cill until fourteen inches were recorded over a 70-foot width. Two 24-in. scour valves were opened in the valve shaft and after an anxious 12 hours normal conditions were resumed, but not before it had been made abundantly clear that some extra provision would be required if the safety of the works was to be put beyond doubt.

The rainstorm of September 4th was severe, but records of storms in Lancashire and Yorkshire showed that even greater intensities of fall had been experienced.

From September, 1931, to February, 1932, investigations were undertaken in the Valley to establish its characteristics from which could be prophesied its behaviour under storms of varying intensity. A report was presented to the Committee and adopted. This report afterwards formed the basis of an application to the Ministry of Health for permission to borrow £22,000 to construct a flood watercourse from Greenfield reservoir to the Brook below the Yeoman Hey embankment.

Other methods of dealing with storm water had been considered, chief of which was the enlargement of the spillway below the 70-foot weir at Yeoman Hey. The Waterworks Committee had, however, been viewing with growing concern the immense accumulation of sand and peat washed into the reservoir by floods, and when it was realised that a flood watercourse would serve the dual purpose of safeguarding the works and preventing the silting up of the reservoir, the latter scheme was approved.

This process of denudation of the hilltops and deposition in the valleys is continually going on and the deep scars formed by the watercourses is evidence of fairly rapid erosion. Geologically, the valley consists of millstone grits which formerly lay below the coal measures. The grits alternate with bands of loose shale and are capped by a dreary expanse of peat averaging eight feet in thickness.

The peat causes discolouration of the water in periods of flood and is itself carried forward together with the eroded sand and shale to be deposited in the quiescent waters of the reservoirs.

Sanction for the proposed works was obtained from the Ministry of Health in the Autumn of 1932, and work was immediately commenced.

The estimated cost of the original scheme was £22,000, and although modifications of that scheme have occasioned more excavation and constructional work, the actual cost has been limited to the original estimate.

The proposed scheme provided for a flow of 400 cubic feet of water per second at a gradient of 1 in 200. The works as constructed will take the same quantity of water, but it was considered advisable in the interests of safety to reduce the velocity in the channel by adopting a gradient of 1 in 500. This meant the construction of a channel of larger cross section.

The whole of the work has been done by administration and Mr. Edward Wilson Dixon, Chartered Civil Engineer, was retained by the Waterworks Committee to consult with the Committee's Engineer regarding details of construction.

DESCRIPTION OF THE WORKS

The provision of a flood water channel larger in cross-section than was estimated for, at the same price has provided a constant spur to economy. This economy could not be exercised at the expense of the stability of the work, and other means have been adopted which are not usually associated with this type of construction. The depression in the cotton trade has, unfortunately, seriously affected the prosperity of the towns forming the Joint Committee's area of supply and as a result of that depression the Pennington Mills at Mossley were being demolished when work at Yeoman Hey was started. A suggestion put forward by Alderman Farr, of Mossley, was quickly acted upon by the then Chairman, Alderman J. W. Greenwood. Negotiations for the purchase of all the stone forming these Mills were put in hand, and a price fixed which assured a saving on the estimated cost of £1,500. What was once the Pennington Mills is now two miles of excellent walling five feet high.

Yeoman Hey quarry, owned by this Committee, was opened up and a stone-breaker and screening plant installed. This quarry has provided all the mason dressed stone and concrete aggregate used in construction. Power for operating this plant was obtained from a turbine in the filter house actuated by compensation water discharged from Chew reservoir. This plant has produced since installation 6,000 tons of crushed stone, 2,000 tons of sand, and 1,000 tons of dressed stone at a price which has represented a considerable saving over purchased stone, due to low operating costs and proximity to the works.

Transport on works of this nature is always a difficult problem and this has been overcome by the use of one and a half miles of light railway track and two petrol locomotives.

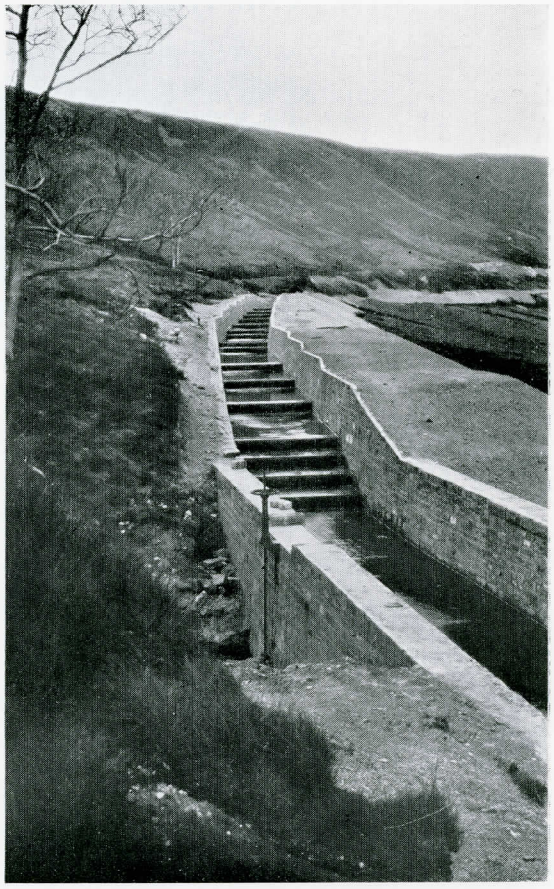
Using the quarry as a centre, track was laid to all parts of the work. The cement shed and stores were placed near the screening plant in a position to facilitate loading and unloading and no hitch has been experienced in the maintenance of a uniform flow of materials.

Twenty thousand cubic yards of material have been excavated by means of a Priestman Cub Excavator of quarter cubic yard capacity. This small excavator was able to work in the twelve foot cutting and load jubilee wagons on the side.

Concrete mixing was carried out at a central depot placed so that the mixed concrete could be put in position in less than five minutes. The mixer is of the self-loading type, manufactured by Messrs. Stothert & Pitt.

Weekly checks on amount of work done and cost as compared with the estimates have been maintained during the progress of the works. These costs have shown a consistency which in itself is a tribute to the supervision by the resident engineer, Mr. J. G. Smith, A.M.Inst., C.E., and the foreman on the works, Mr. J. Chamberlain.

The flood water course, which is one mile in length, bye-passes the water from the Greenfield Bywash and discharges below the Yeoman Hey embankment into Greenfield Brook.



Detritus intercepting pit and sluice valve constructed at the intersection of the gullies with the line of bye-pass.

Provision is also made to collect water from the Yeoman Hey Catchment *en-rou'e* and the watercourse is gradually increased in size as this additional water is collected. The cross sections range in size from 8 ft. 9 in. wide by 5 ft. 0 in. deep at the Greenfield end, to 12 ft. 6 in. wide and 5 ft. 3 in. deep at the Yeoman Hey end. The total fall between the inlet and outfall is 200 feet, and, with the exception of the intake and outfall, a uniform gradient of 1 in 500 is maintained throughout its length.

To adhere to this gradient it was necessary to construct 112 steps in the floor of the watercourse. The steps are formed in stone securely keyed into the floor and backed by a key course.

The walls are constructed in masonry with a backing of 7-3-1 concrete, and the floor is in general 9 in. thick in 4-2-1 concrete. Where excessive pressure is anticipated on the walls additional thickness has been provided, and where erosion is likely to take place on the floor stone aprons have been laid on top of a concrete foundation.

Where the watercourse crosses the various gulleys worn in the hillside by storms, the foundations are carried down to solid rock and keyed in to a depth of 18 in. The key extends into the adjacent hillside to ensure watertightness. At the gulleys which bring down large quantities of detritus during storms catch pits have been provided and these will be cleaned out when necessary.

Penstocks have been fixed to give complete control of the water flowing down the hillside. The water can be passed under the watercourse into its original bed or be taken into the watercourse.

Near Yeoman Hey embankment two leaping weirs are installed which gives further control of the water as follows :—

(a) The whole of the water flowing in the watercourse can be intercepted and passed into Yeoman Hey reservoir.

(b) A leaping weir can be set to take only clean water into Yeoman Hey reservoir, and should the water become dirty owing to storms it will automatically pass the water direct to the Greenfield Brook.

(c) The whole of the water may be passed direct to the Greenfield Brook.

(d) The water may be taken direct to the filters.

In order to keep true records of the run-off from the catchment a Venturi Flume has been constructed just below Yeoman Hey embankment to measure the quantity of flood water discharged into Greenfield Brook. The recording instrument, which is housed in a stone building on the side of the watercourse, was manufactured by Messrs. Lea Recorder Co. Ltd., of Manchester.

After the bypass crosses Yeoman Hey embankment it descends quickly to discharge into Greenfield Brook down 50 steps in several flights, and then down a chute. This portion of the work is constructed more substantially than the major portion because of the high velocity and turbulence of the water at this part.

The bypass is capable of conveying 400 cubic feet of water per second, in addition to which it prevents debris, sand and peat from being washed into the reservoir during storms to the detriment of the quality of the water and the storage capacity of the reservoir.

Experimental Concrete Bays in Floor of Byepass.

Six experimental bays of Concrete have been incorporated in the floor of the byepass. This work was undertaken in collaboration with the Department of Scientific and Industrial Research.

The concrete in the bays is composed of stone from Yeoman Hey Quarry and Mersey Sand with various types of Cement.

The Cements used are as follows:—

Bay No. 1. Normal Portland Cement (High Alumina Content).

Bay No. 2. Normal Portland Cement (Low Alumina Content).

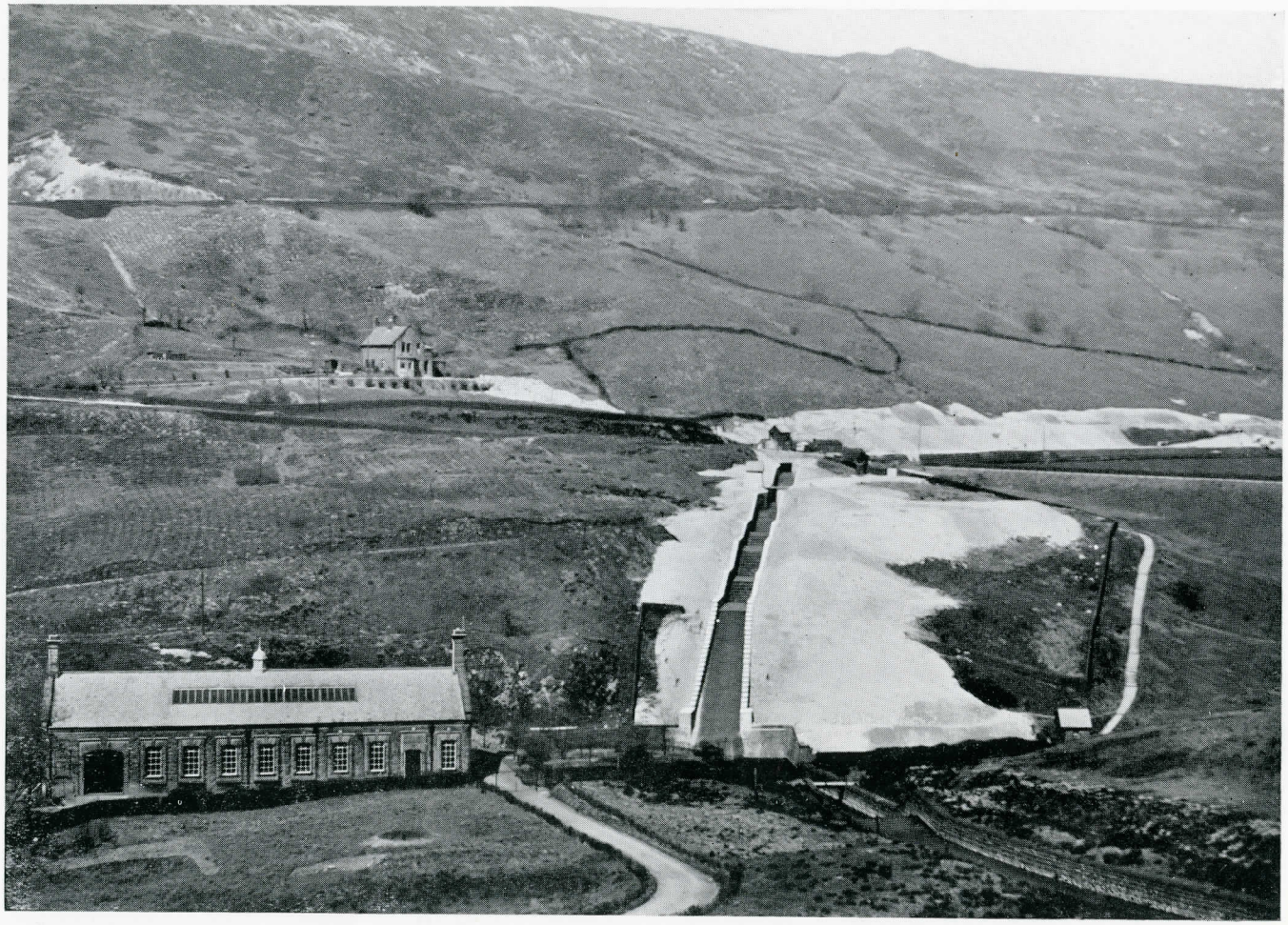
Bay No. 3. Shale Pozzolana Cement.

Bay No. 4. Normal Portland Cement,

Bay No. 5. Portland Blast Furnace Cement.

Bay No. 6. High Alumina Cement (Ciment-Fondu).

It is known that water containing the acids due to fermentation in peat bogs attacks concrete, but no guide has so far been given as to the reasons. It is hoped, as a result of the work done on the experimental bays and the information collected that the reasons for the decay of concrete exposed to peaty water will be established.



After the separation of the water the bye-pass descends to Greenfield Brook by means of a series of fights of steps and finally discharges into the Dovestone Clough cascade pool down a masonry chute. The contraction of the channel shown near the top of the photograph increases the depth of water behind it, this increase being a measure of the quantity of water flowing in the channel.

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