A.C. TWORT.
TITTESWORTH DAM
DATE 1959 - 1962

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STAFFORDSHIRE POTTERIES
WATER BOARD

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TITTESWORTH RESERVOIR SCHEME

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Visit of the
Institution of Water Engineers
May - 1961

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STAFFORDSHIRE POTTERIES WATER BOARD

TITTESWORTH RESERVOIR SCHEME

TITTESWORTH DAM

The original Tittesworth dam was built about 1858 for the purpose of supplying compensation water to Millowners on the R. Churnet. No water was taken from the reservoir for public supply. By an Act of 1949 the Staffordshire Potteries Water Board obtained powers to raise the existing dam, to use the reservoir for public water supply purposes and also, by means of two intakes and a catchwater, to divert into the reservoir water from Solomon's Hollow, a tributary of the Churnet which joins the main river just below the dam. By the same act powers were also obtained to enlarge and use for public supply another existing compensation water reservoir at Deep Hayes (constructed about 1849) and on completion of the Tittesworth reservoir works the Board were required to supply compensation water from the two reservoirs at the rate of 4.25 m.g.d. of which not less than 3.25 m.g.d. has to be given from Tittesworth reservoir.

The gross reliable yield of the enlarged Tittesworth reservoir, after allowing for an abstraction from the river upstream of the dam by Leek U.D.C. is estimated to be about 8 m.g.d. The resulting net reliable yield to the Board as the result of the enlargement of Tittesworth reservoir will therefore be between 3.75 and 4.75 m.g.d., although over the last ten years the yield has averaged over 8 m.g.d.

In 1957 the Board decided to proceed with the raising of Tittesworth dam, as authorised by the 1949 Act, and an extensive soil mechanics investigation of the existing dam and of the site generally was then embarked upon to enable alternative designs for the raising to be prepared.

These investigations showed that the material forming the existing dam was very variable, much of it being of very poor quality, and that the factor of safety against failure was close to unity. A peculiar feature of the original dam was the bulge on the downstream side to the east of the original outlet and spillway channel (see Fig. 1). The most economical scheme for raising the dam would necessitate the removal of this bulge and an extensive boring and testing programme was therefore carried out to see whether it would be safe to do so. It was concluded that the bulge could safely be removed in open cut to ground level—a conclusion which, as will be shown later, subsequently proved to be erroneous.

It was stipulated that throughout the raising of the dam the existing reservoir should be kept in operation as far as possible, emptying being allowed only during such limited periods as were essential for constructional purposes. The design initially adopted for raising the dam is shown in plan on Fig. I and in section on Fig. II. The design includes a tunnel through the left bank which will

act as the new overflow (being connected at its upstream end to a vertical shaft and bellmouth spillway) but the tunnel will also contain the supply and compensation water pipelines, a valve tower with intakes at different levels being provided adjacent to the spillway shaft. Temporary openings are provided in the vertical spillway shaft to deal with flood discharges during the construction period.

In 1959 a contract was let to Messrs. John Howard & Co. for raising the dam and work commenced in May of that year.

By early May, 1960, the tunnel and lower part of the valve tower and spillway shaft had been constructed; the reservoir had been emptied prior to constructing the inlet channel to the valve tower and the stone toe on the upstream side of the original dam; and excavation in open cut of the downstream bulge had been substantially completed to ground level.

On Sunday, 8th May, 1960, a major slip occurred on the downstream side of the dam in the area of the bulge. The slip extended over about one quarter of the total length of the dam and resulted in a maximum drop of 16 feet at the crest. (See photograph opposite.)

Emergency measures had to be taken to stabilise the slipped section and to provide for flood flows as although the reservoir was empty at the time it was liable, if heavy rain occurred, to fill and start overflowing within a matter of hours.

Apart from these emergency measures the slip necessitated major changes in the design of the raised dam. Fig. III shows a cross section of the revised design to which work is now proceeding. The main changes in design were moving the centre line of the raised dam 30 feet further downstream and substituting an articulated concrete core wall for the rolled clay core originally proposed. A somewhat similar design with a concrete core wall was considered in 1958 but was then rejected due to its greater cost.

It was further considered impractical to continue on the basis of the original contract and on the advice of their consulting engineers the Board agreed to change over to a cost plus fixed fee type of contract and work is now proceeding on this basis.

Water Treatment Plant and Pumping Plant

The treatment plant will be of the rapid gravity type with upward flow hopper type sedimentation tanks and will be capable of dealing with flows up to 10 m.g.d.

There will be three draw-offs from the reservoir connected to a 36" dia. concrete-lined steel main leading to the water treatment plant which is sited below the dam on the hillside on the east of the river.

When the level of the reservoir is too low for water to gravitate to the water treatment plant, the water will be pumped to the filters by raw water pumps sited just below the stilling basin.

After treatment the clear water will be pumped through a 30" dia. steel main to a new 10,000,000-gallon concrete service reservoir, and from there through a 27" dia. steel main to a new 2,000,000-gallon reinforced concrete service reservoir recently constructed at Bucknall and also to an existing 3,000,000-gallon service reservoir at Birches Head.

Chemical treatment before filtration will be by Alumina and Potassium Permanganate. Chlorine and Lime will be used before and after filtration. The design and layout is such that two sedimentation tanks and two filters can be used for experimental purposes whilst the main plant is operating. The filters are sited on top of the clear water tank which is in two sections each of 250,000 gallons capacity.

The raw water and clear water pumps will be capable of dealing with quantities of water from 2.5 to 10 m.g.d. and will be of the vertical spindle centrifugal type, driven by variable speed commutator type motors.

The electrical supply will be taken from the local electricity authority at 11,000 volts and transformed down to 415 volts. Two
diesel driven alternators are being installed to act as standby in case of failure of the electrical supply, and also for generating during peak periods of electrical demand by arrangement of special tariff rates with the electricity authorities.

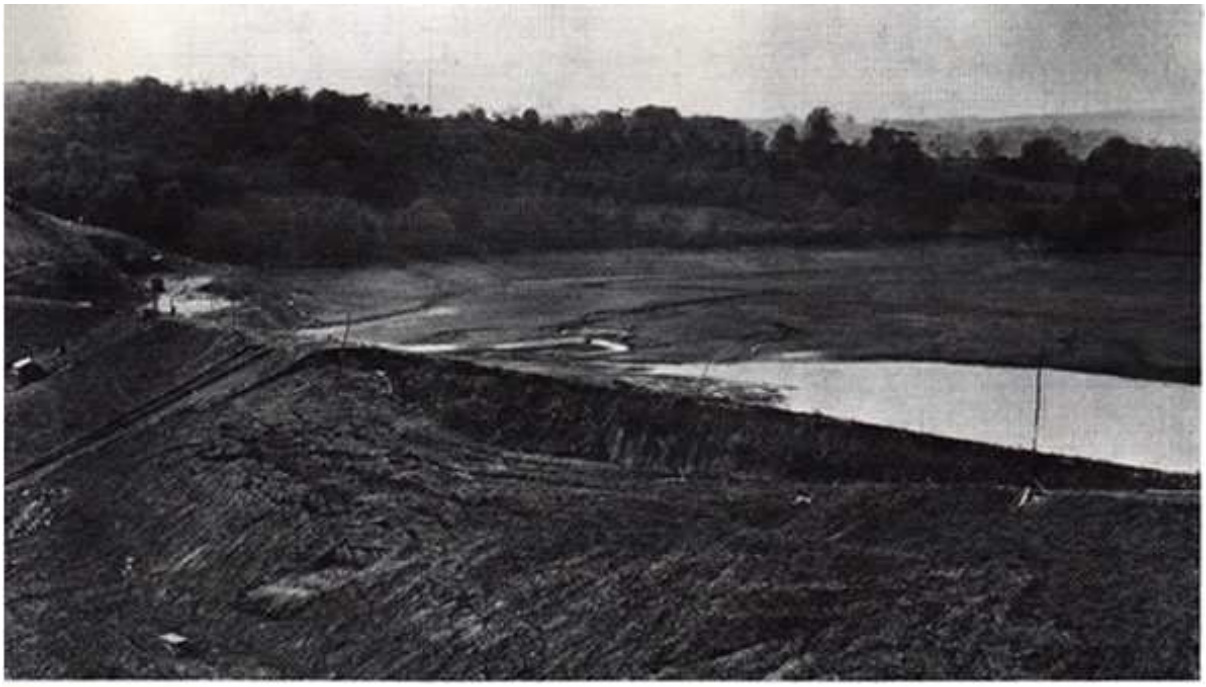
DYEWORKS EFFLUENT TREATMENT PLANT

A dyeworks is situated on the River Churnet, feeding into the Tittesworth Reservoir, and under the terms of the Act for constructing the reservoir the Board have to treat the effluent from the dyeworks.

Accordingly the effluent from the dyeworks will flow by gravity through a pipeline to a separate treatment works sited downstream of the dam on the hillside to the east of the river and above the water treatment plant. The effluent treatment works will be capable of dealing with up to 250,000 gallons per day. The treatment will be by copperas and lime, followed by settlement, the clear effluent being taken to the river below the dam, either direcdy or after land irrigation.

GENERAL NOTE

Since its inception in 1849 the undertaking has relied entirely, for supply purposes, on naturally purified water from underground sources. The enlarged Tittesworth Reservoir, on completion of the works, will impound water for supply purposes, and the Board will therefore be provided with two well tried systems of supply, ensuring a more economic operation of the undertaking, and the best possible use of the water resources available for the benefit of industry and commerce as well as the inhabitants of North Staffordshire generally.



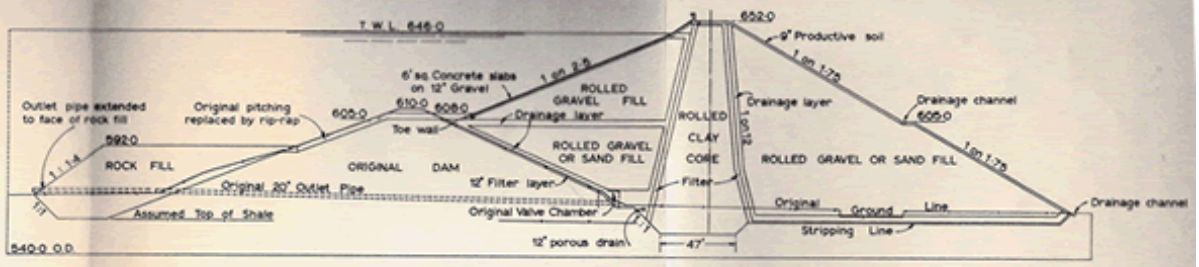


FIG. II INITIAL DESIGN FOR RAISING DAM

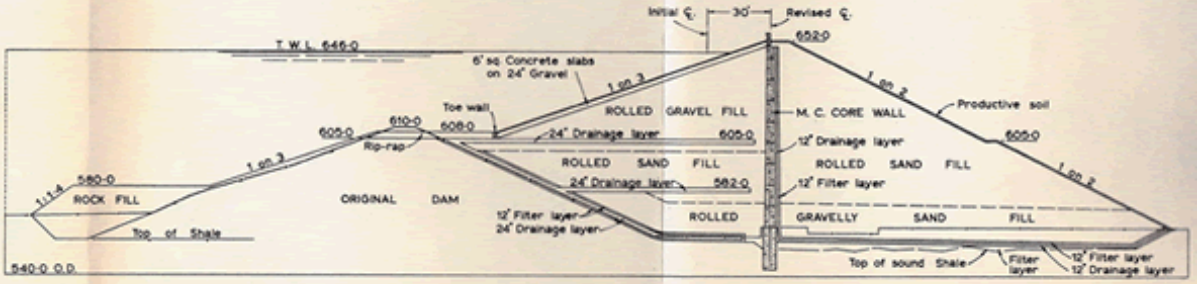


FIG. III REVISED DESIGN FOR RAISING DAM

SCALE FOR SECTIONS

10 0 50 100 150 Feet

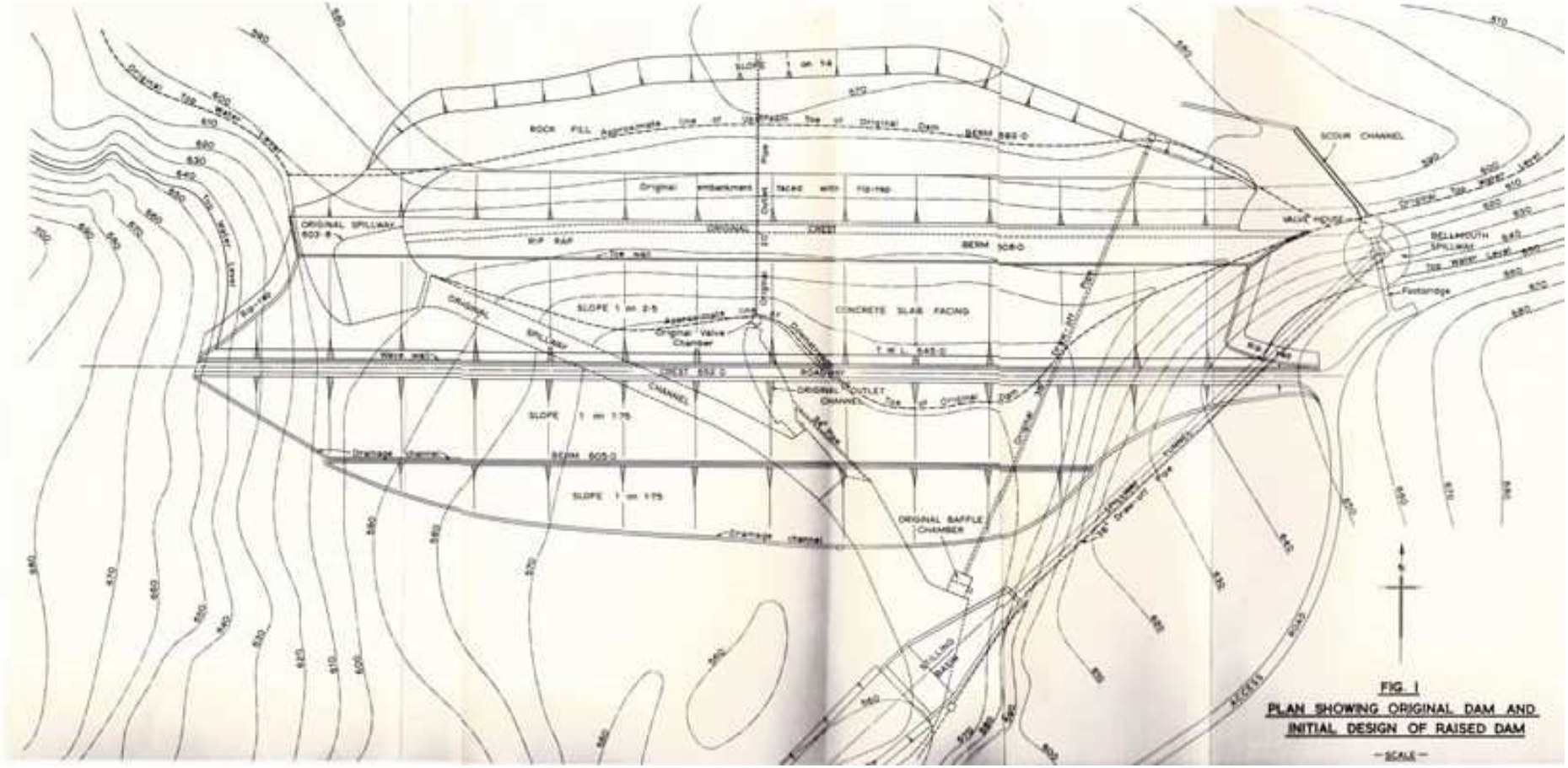


FIG. 1
PLAN SHOWING ORIGINAL DAM AND INITIAL DESIGN OF RAISED DAM

— SCALE —