[redacted]

Information Management Unit
IT Suite
Westland House
40 Old Westland Road
Belfast
BT14 6TE

Tel: 03457 440088

Email: imu@niwater.com

Your reference:

Our reference: NIW 2425624

Date: 19 March 2025

Dear [redacted]

Environmental Information Regulations 2004

Thank you for your email of 16 March 2025 in which you requested access to technical drawings of Ben Crom Dam.

As your query falls under the definition of a request for environmental information, NI Water is replying under the disclosure provisions of the Environmental Information Regulations (EIR) 2004.

NI Water can confirm the information requested relating to the Ben Crom Reservoir in Silent Valley, is considered exempt under Regulation 12(5)(a), and cannot be disclosed due to security, and public safety risks.

Regulation 12(5)(a) national security/public safety

A public authority may refuse to disclose information to the extent that its disclosure would adversely affect international relations, defence, national security or public safety. It is the adverse effect on national security and on public safety to which

NI Water is referring on application of this exception. NI Water has guidance from its sponsoring Department, in the form of an Advice Note, which highlights general categories of information and the control measures to be applied. The guidance is intended to cover information deliberately placed by NI Water into areas where there is uncontrolled access by the general public, to ensure that information placed in the public domain does not compromise the security requirements of the Company.

The Advice Note advises that controls are necessary in relation to disclosure of information that is deemed to be sensitive, including details of sensitive sites. This is a qualified exception, meaning NI Water must consider the public interest in disclosure versus that in maintaining the exception.

The public interest in release of the data requested is that it would demonstrate NI Water's willingness to be open and transparent in its activities. Against this, however, NI Water is tasked with ensuring the security of its assets and with protecting the safety of the public by not making assets more attractive by placing sensitive information into the public domain via the EIR.

Current guidance advises that controls are necessary in relation to the disclosure of operational asset information that is deemed to be sensitive, or which could compromise our security requirements, or the health and safety of our customers. As a prudent operator, NI Water cannot reasonably put detailed, data relating to our potable water sites, infrastructure or assets into the wider public domain via the EIR, where NI Water, as the relevant water and sewerage services undertaker, would have no control over the data's wider dissemination, circulation, availability or intended use.

This type of detailed proprietary knowledge could be used maliciously to undermine the effectiveness of NI Water's water network with parallel implications for health and safety. As such, there is a robust argument for not detailing such infrastructure to the public via the disclosure provisions of the EIR as the release of specific asset details could provide an overview of potential vulnerabilities in the system. NI Water's position is to protect detail about our critical operational sites, assets and infrastructure from disclosure to the public, particularly because it highlights areas where, if someone was so minded, they could do the most damage. Any information that places the public,

public infrastructure and/or the environment at an increased risk of being targeted must be protected at all costs and carries a very significant weight in favour of non-disclosure. It is felt by NI Water, therefore, that the public interest arguments in favour of disclosure are wholly outweighed by those in favour of safeguarding the withheld information from wider public dissemination.

The attached (Annex A) non-sensitive information may be useful and assist in your friend's studies.

You have the right to request that NI Water formally review this response within forty working days of the date of this letter. If you wish to do so, please email imu@niwater.com or write to NI Water Information Management Unit, IT Suite, Westland House, 40 Old Westland Road, Belfast, BT14 6TE.

If, after such an internal review, you are still unhappy with the response, you have the right to appeal to the Information Commissioner at Wycliffe House, Water Lane, Wilmslow, CHESHIRE, SK9 5AF, who will undertake an independent review.

If you have any queries about this letter, please contact us. Please remember to quote the reference number above in any future communications.

Yours sincerely

Information Management Unit
Northern Ireland Water

Annex A

Ben Crom Reservoir is formed by the impoundment of the upper reach of the Kilkeel River with a straight mass-concrete gravity dam which was completed in 1957. The reservoir has a capacity of 7721 Ml and a surface area of 28.0 ha at a top water level of 247.19 mOD Belfast. The main dam is aligned North West to South East and the reservoir extends 2 km to the North, North East.

Geology of dam

The reservoir is situated in an ice deepened valley and the dam is founded on granite.

Catchment

The 939 ha of direct catchment is made up of rugged mountain terrain.

- Item Direct Catchment Area ha 939
- Max Elevation mOD Belfast 727
- Long Term Average Annual Rainfall (mm)1765
- Period of Recorded Rainfall 1941 – present
- Slopes of ground surface Steep
- Nature of surface Rocky mountain terrain
- Details of aqueducts and controls -None

The dam, which was first filled in 1957, is a straight mass-concrete gravity dam 215 m long and formed in 15 blocks. The maximum height above ground level of the 3.76 m wide crest is approximately 37.8 m at a level of 250.24 mAOD. A reinforced concrete wave wall runs along the crest with a top level of 251.46 mOD.

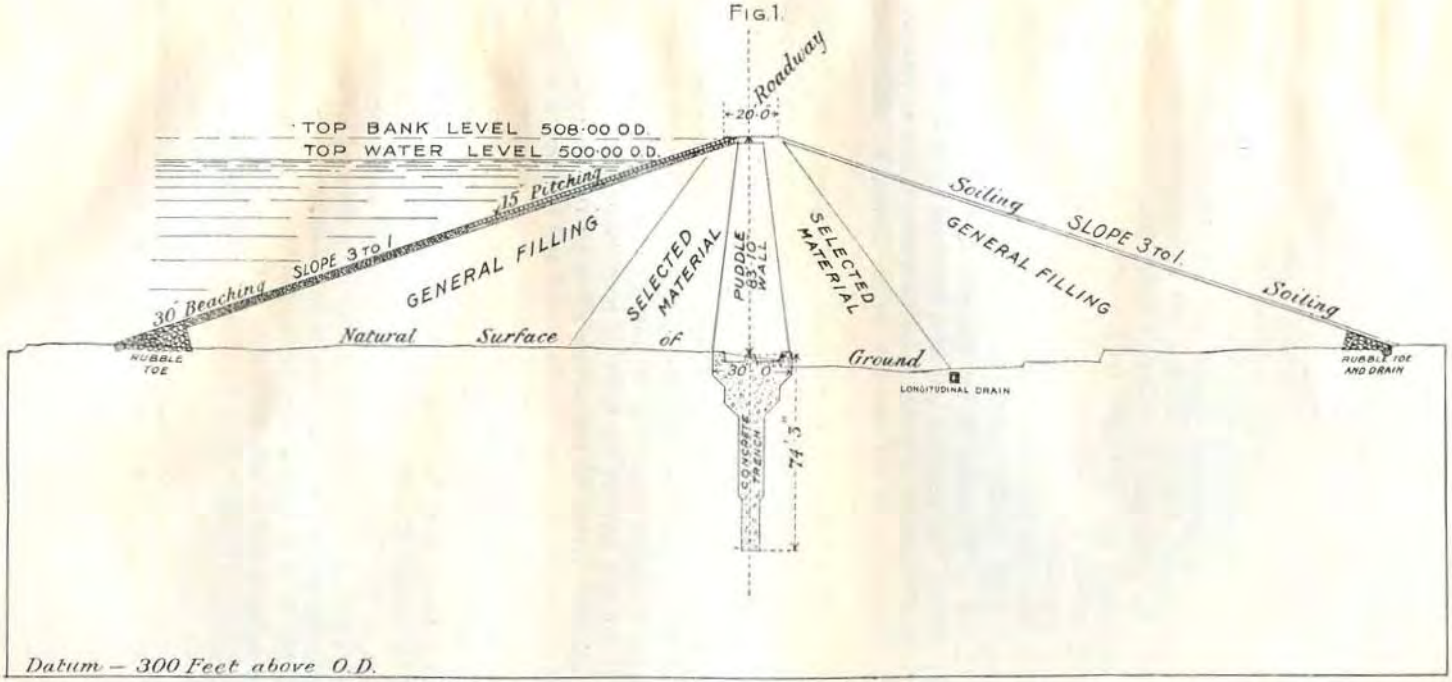
The dam has a downstream slope of 1 horz: 1.5 vert and an upstream slope of 1 horz: 30 vert. The concrete cut off trench was grouted up to 20 m deep.

Details of modifications, remedial works and history

There have been no significant modifications or remedial works. Instrumentation for the monitoring of settlement, alignment, joint movement, uplift pressures and seepage flows was installed in 1990.

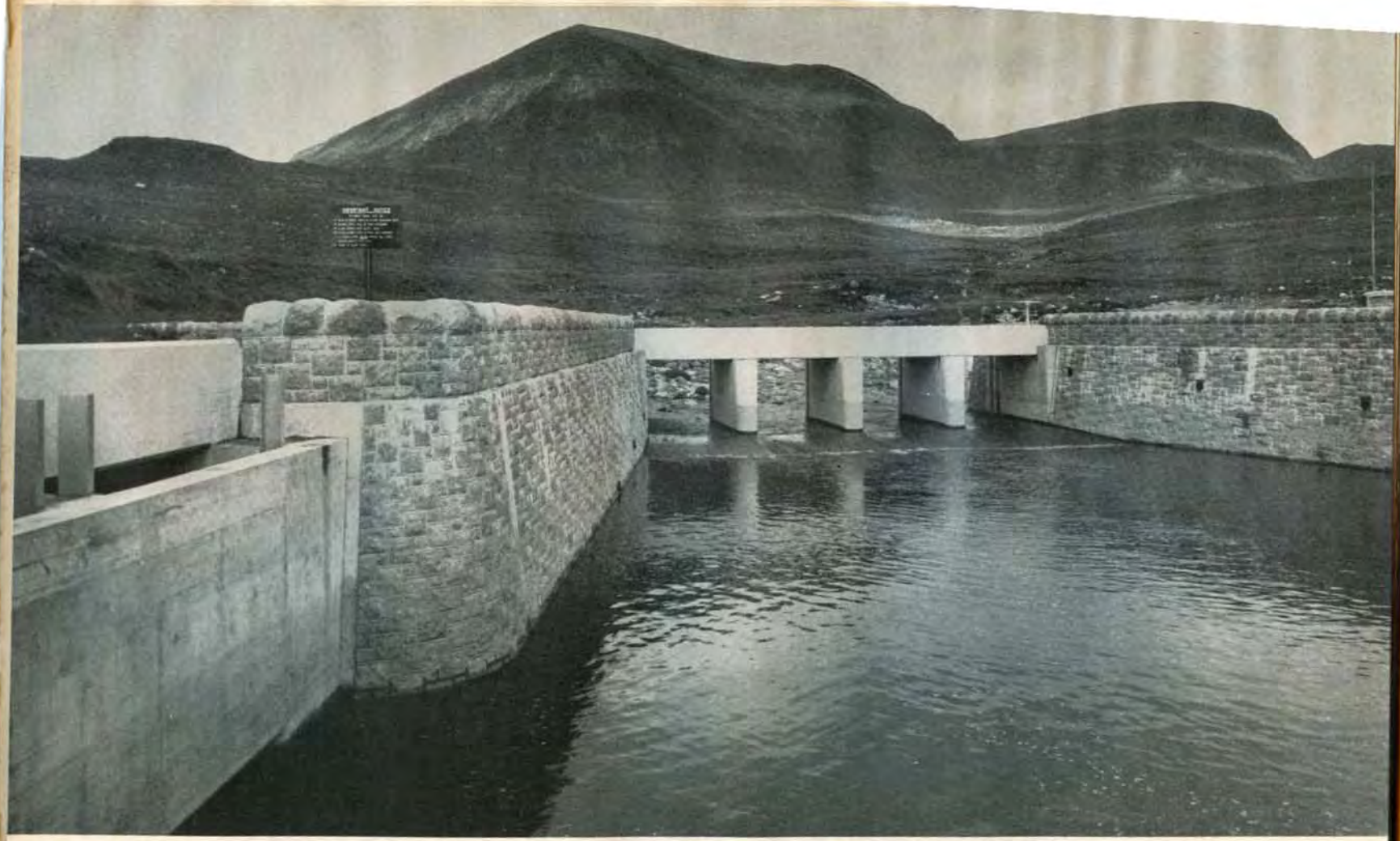
Overflow

The straight profiled concrete surface overflow weir in four sections totalling approximately 22 m in length is located at a level of 247.19 mOD centrally within the dam. The weir discharges to a tapered tailbay, into the Kilkeel River and hence into the Silent Valley reservoir 2 km downstream.



CROSS SECTION OF EMBANKMENT OF SILENT VALLEY RESERVOIR

0 50 100 200 300 Feet

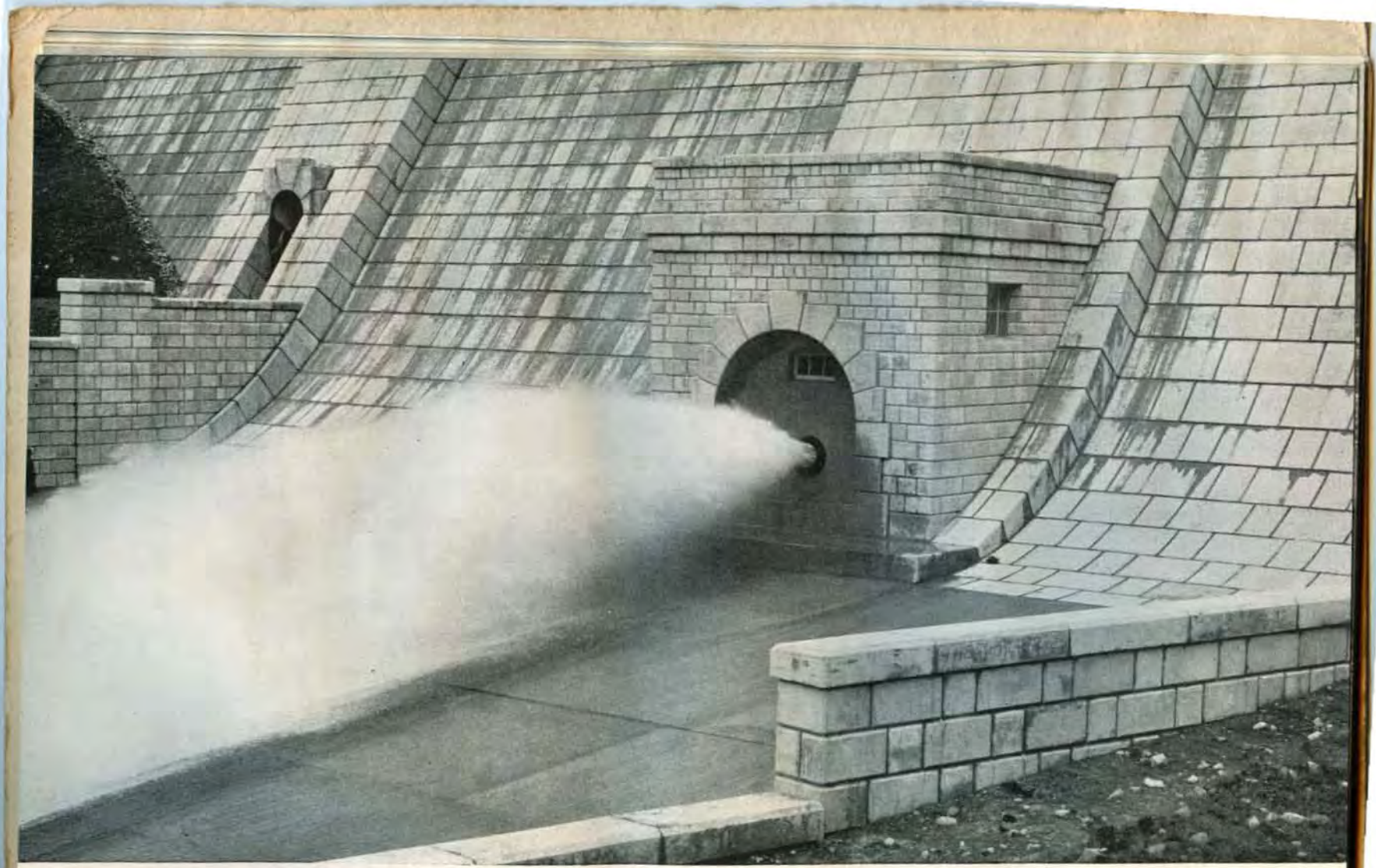


Tunnel Intake Annalong Valley

PHOTO BY J. R. RAINBRIDGE

Ben Crom Reservoir Dam

PHOTO BY J. W. L. SAVAGE, COLERAINE



Ben Crom Reservoir Outlet

PHOTO BY GERALD MCATEE, KILKEEL

Ben Crom Reservoir

PHOTO BY J. W. L. SAVAGE, COLERAINE

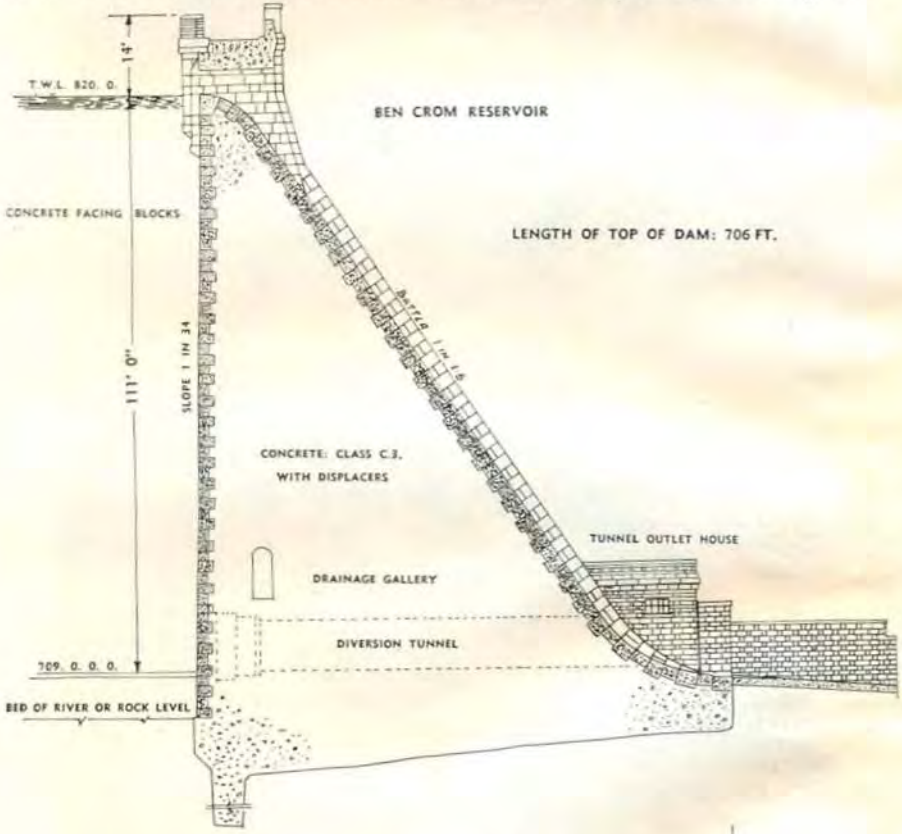
Ben Crom Reservoir

PHOTO BY J. W. L. SAVAGE, COLERAINE

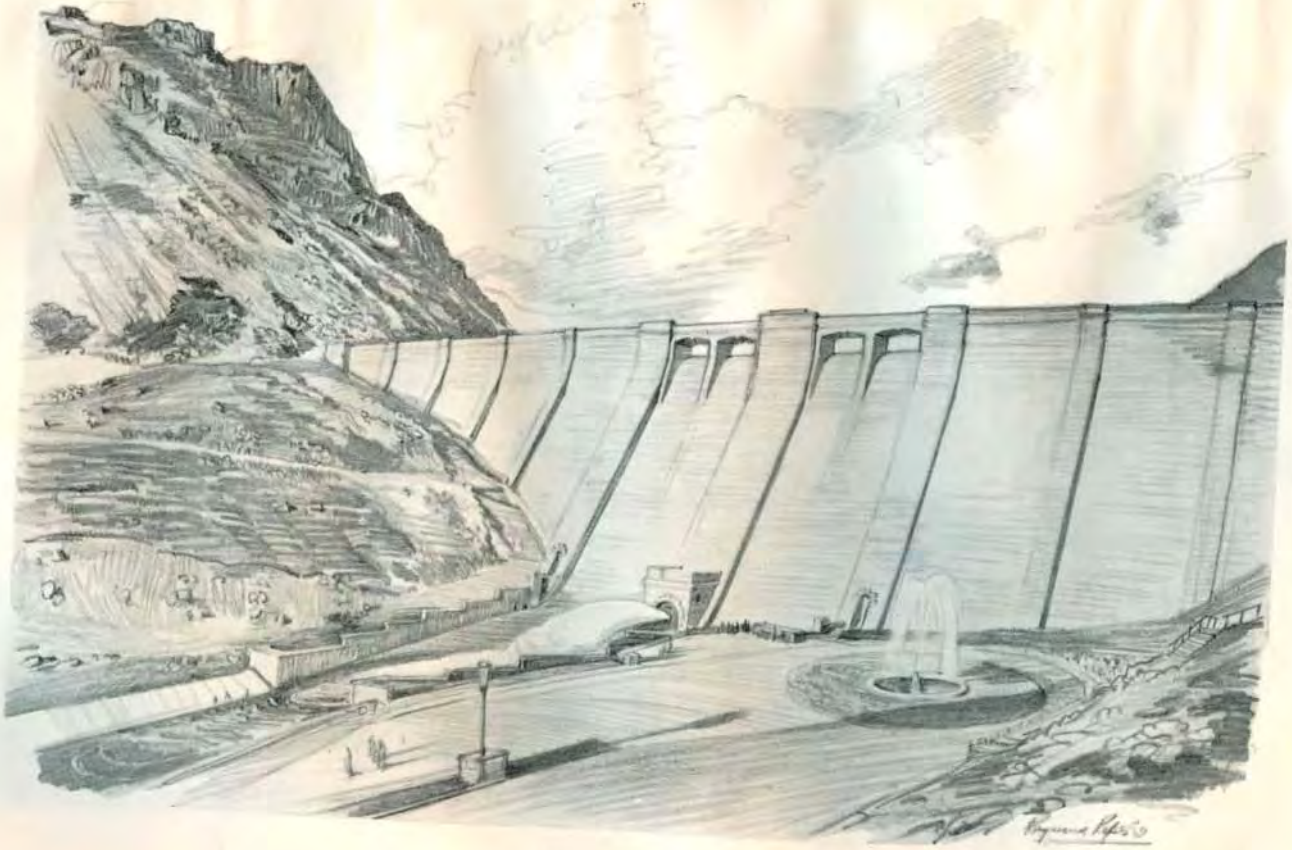
Another point of interest is the fact that inside the heart of the dam is situated a drainage gallery. The purpose of this is to provide for an outlet for water that might collect underneath the foundations of the dam. Beside the outlet pipe is situated a small generator to provide electricity to light the drainage gallery.

The work was carried out by Messrs. Charles Brand & Son Ltd., London, under the supervision of Messrs. Binnie, Deacon & Gourley, Consulting Engineers, of Westminster, London.

On the 2nd October, 1957, the opening ceremony was performed by the Chairman of the Board, Dr. Wallace Linton, in the presence of members of the Board and its chief officers, and a large company which included representatives of the Consulting Engineers and Contractors, who were afterwards entertained to luncheon by the Commissioners in the Silent Valley Reception Bungalow.



Cross Section Ben Crom

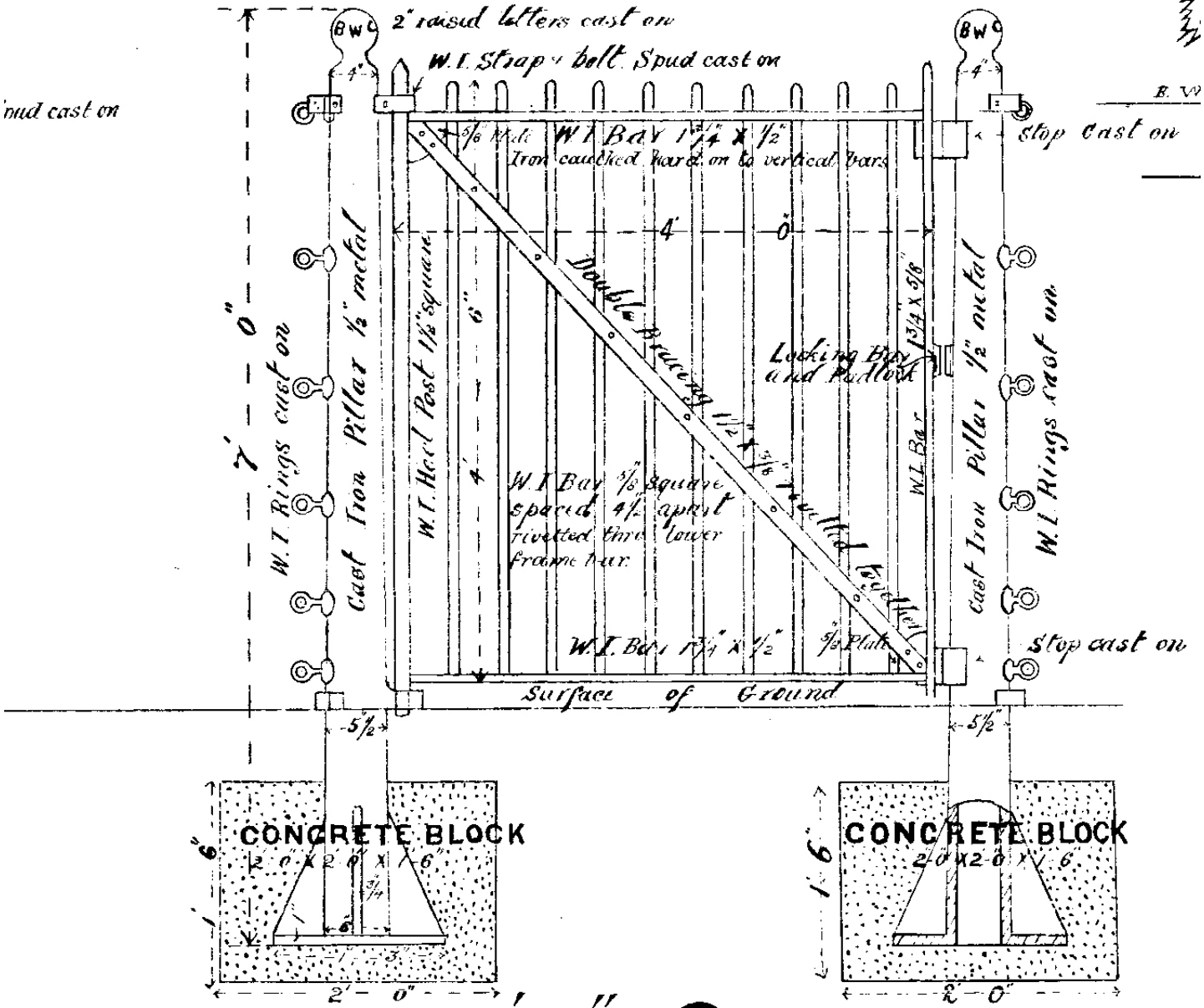


Ben Crom Dam

DRAWING BY RAYMOND PIPER

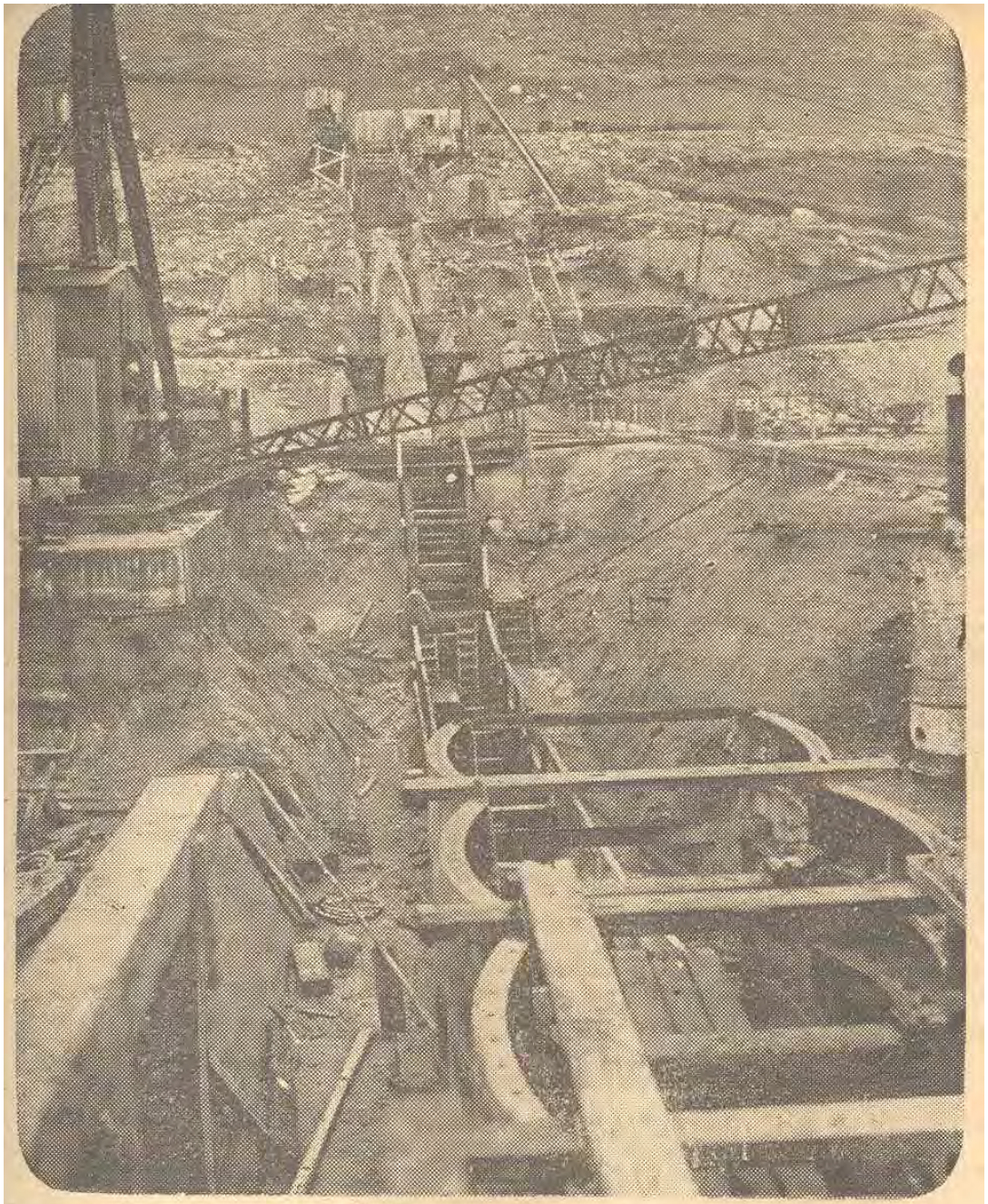
No. 1 B. W. G.

B. W.



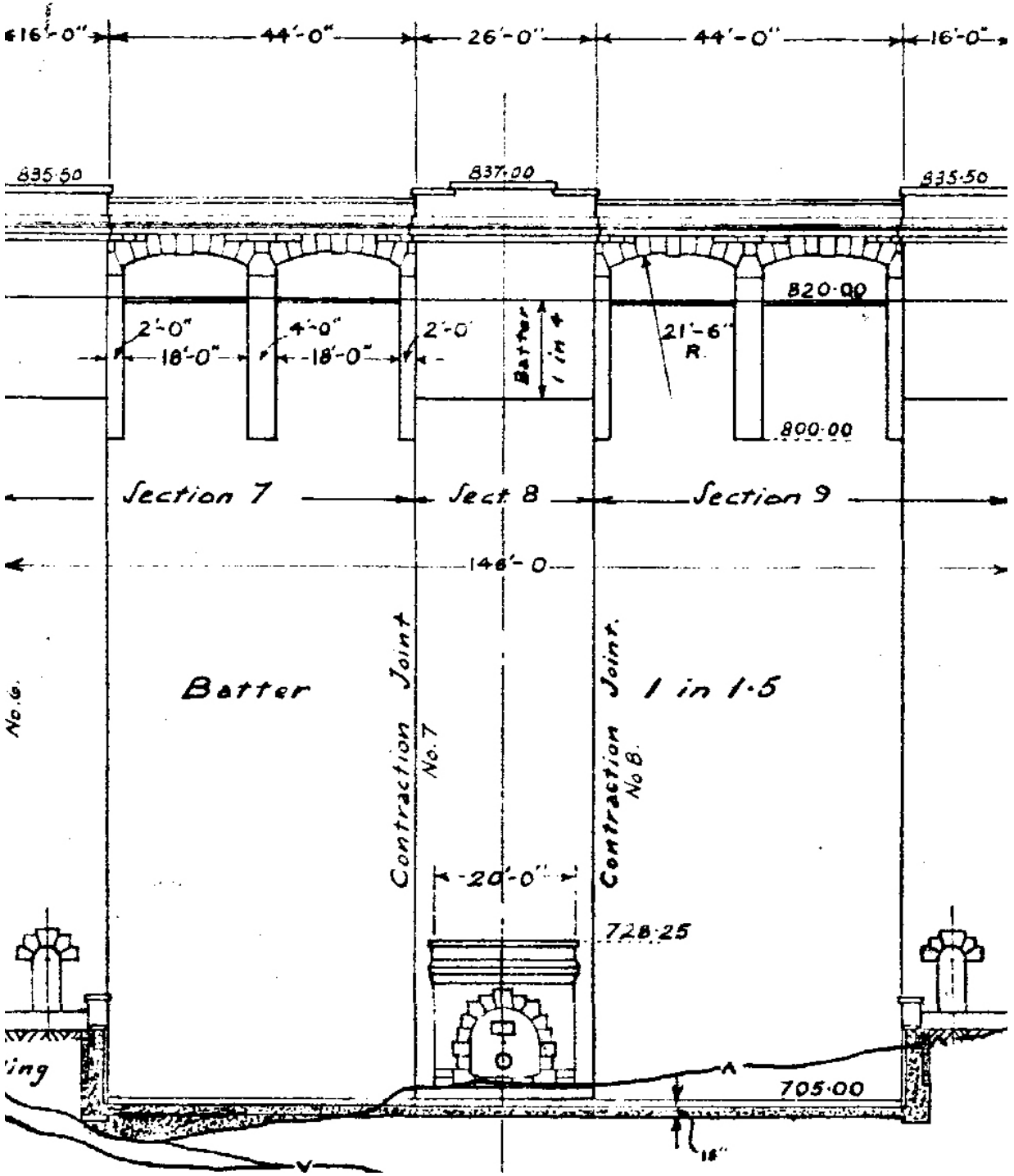
4-0" GATE

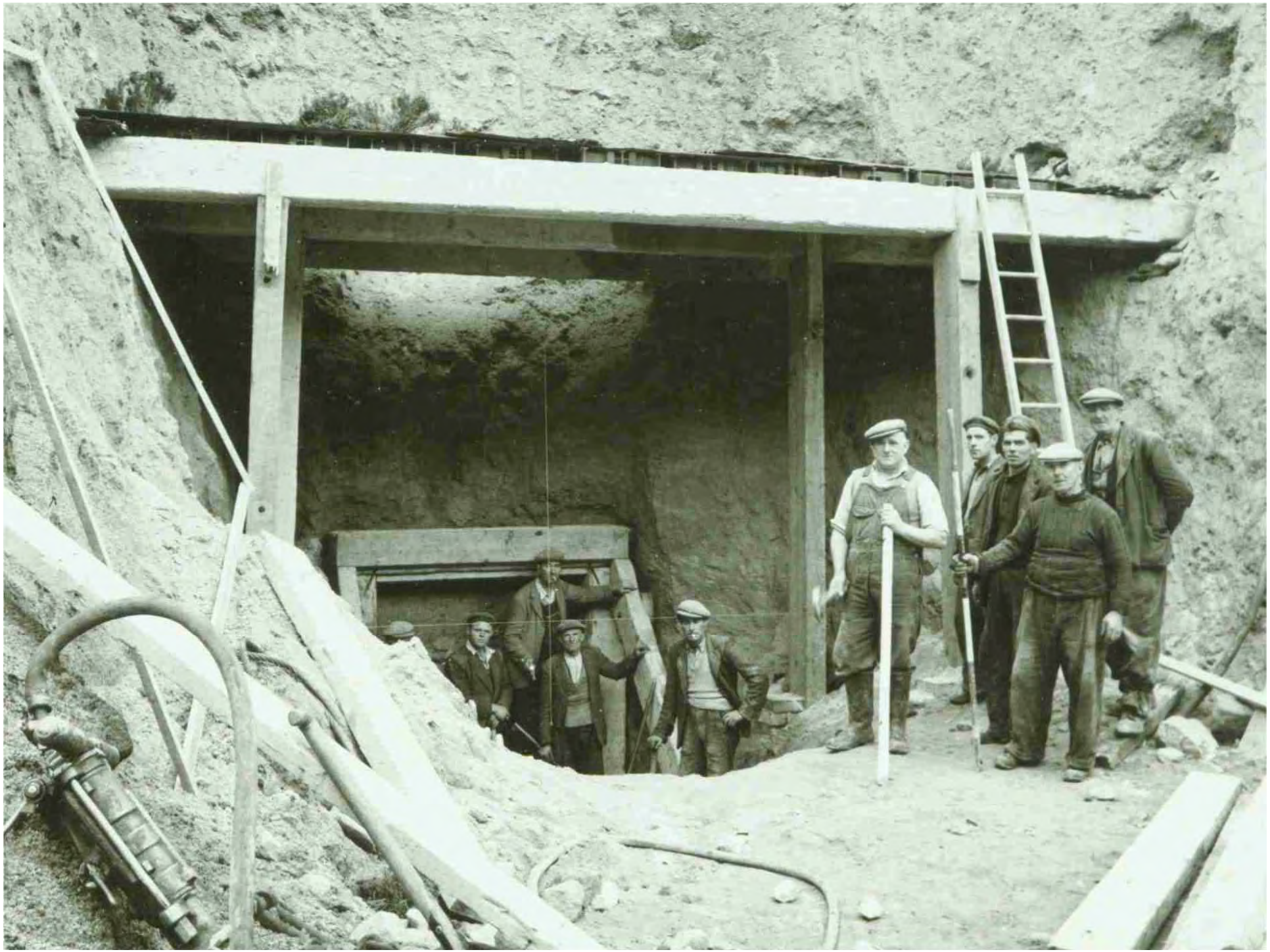
(1 REQUIRED)

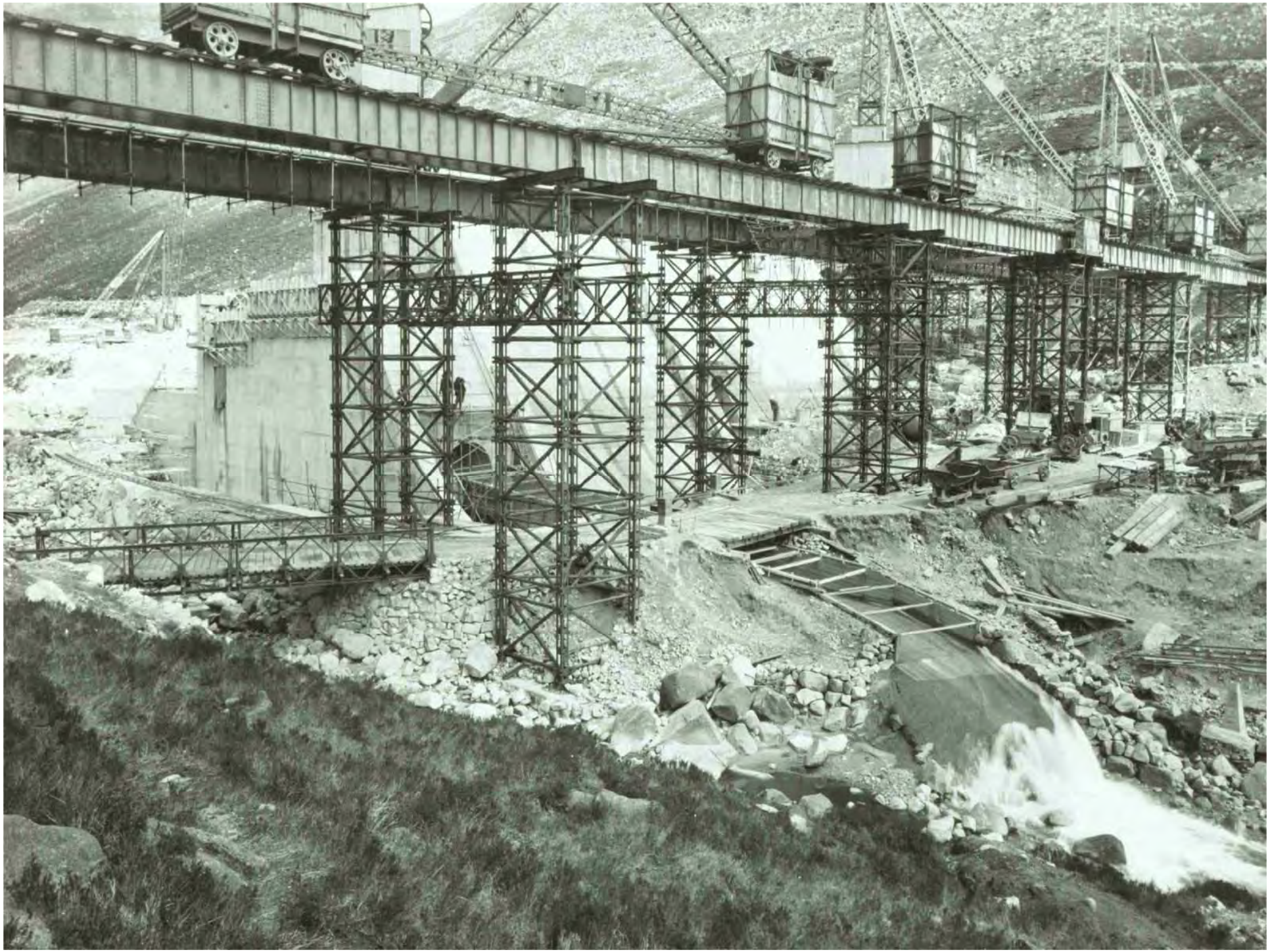


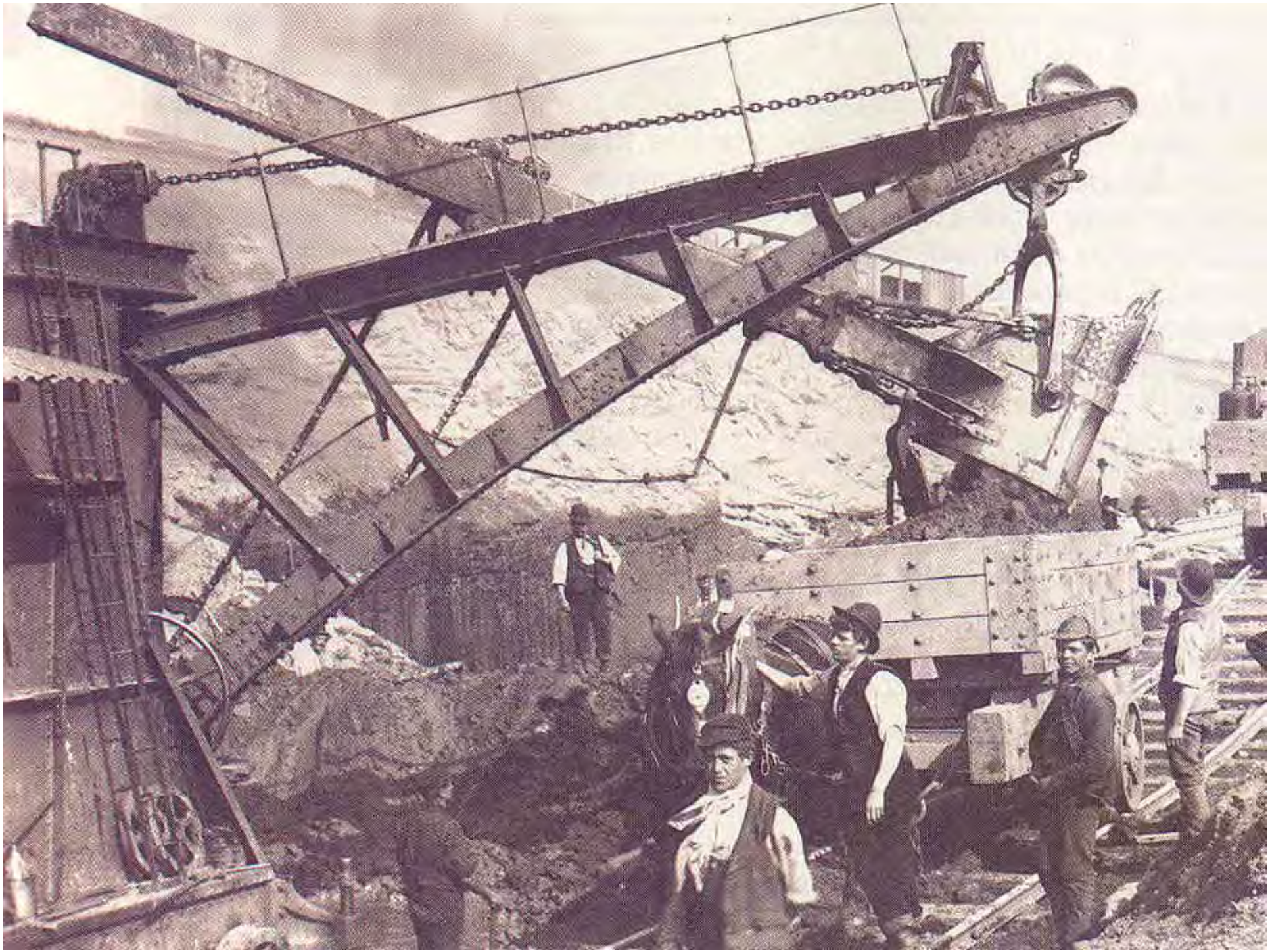
A GENERAL VIEW OF THE TRENCH EXCAVATION SHOWING THE CAST IRON LINING SEGMENTS.


Ben Crom Reservoir


16'-0"
44'-0"
26'-0"
44'-0"
16'-0"
835·50
837·00
835·50
820·00
2'-0"
18'-0"
4'-0"
18'-0"
2'-0"
Batter 1 in 4
21'-6" R.
800·00
Section 7
Sect 8
Section 9
146'-0
Batter
Contraction Joint No.7
Contraction Joint No.8
1 in 1·5
No.6
20'-0"
728·25
705·00
18"







THE MOURNE SCHEME

❖

DEVELOPMENT OF THE SILENT VALLEY AND ANNALONG VALLEY CATCHMENTS

THE

MOURNE SCHEME

DEVELOPMENT OF THE

SILENT VALLEY

AND

ANNALONG VALLEY

CATCHMENTS

Commemorative Plaques unveiled by

MR. ERNEST REA, J.P.

Chairman of the Board

WEDNESDAY, THE 27TH. MAY,

1959

Mr. Ernest Rea, J.P.

FOREWORD

THIS brief history has been compiled to afford information to the guests who accepted the invitation of the Belfast City and District Water Commissioners on the historic occasion when Plaques were formally unveiled by the Chairman of the Board, Mr. Ernest Rea, J.P., to commemorate the completion of the Mourne Development Scheme. The story is also intended to bear tribute to the late Mr. Richard Hamilton, the late Mr. W. I. Quinn, O.B.E., and Mr. Dysart McGarrigle, O.B.E., J.P., former Secretaries to the Board, and to the late Mr. F. W. McCullough, J.P., M.I.C.E., from whose design the Silent Valley Reservoir was constructed; to the Board of Engineers who succeeded Mr. McCullough and completed the work he had commenced; also to the Consulting Engineers, Messrs. Binnie, Deacon & Gourley, London, who designed and supervised the construction of the Slieve Bignian Tunnel and the Ben Crom Reservoir, and particularly to those Members of the Water Board from 1891 until the present day who, with a wisdom and courage beyond all praise, inaugurated and, in the face of many unexpected difficulties, carried the Scheme to a successful completion. Nor should we forget the skilled craftsmen and labourers, drawn mainly from the Mourne Area, who by the work of their hands made their dreams and aspirations come true. To all these the citizens owe a great debt of gratitude.

Board in Session

BELFAST CITY AND DISTRICT WATER COMMISSIONERS 1959

WARDS	*ELECTED COMMISSIONERS*
Clifton	SIR WILLIAM NEILL, D.L., J.P.
Court	JOHN N. ROBINSON, F.I.A.C.
Cromac	WILLIAM J. LAWTHER, J.P.
Dock	JOSEPH McNEILL
Duncairn	WILLIAM KEITH, F.C.A.
Falls	CRONAN F. HUGHES
Ormeau	ERNEST REA, J.P., (*Chairman*)
Pottinger	WALTER J. WHITE, J.P.
St. Anne's	WILLIAM SWEENEY, C.B.E., J.P.
St. George's	KENNEDY LEACOCK, O.B.E., J.P.
Shankill	JAMES N. W. RITCHIE, M.B., J.P.
Smithfield	PATRICK J. FLOOD
Victoria	WILLIAM COWAN, B.A., H.DIP.ED., (*Deputy Chairman*)
Windsor	H. TREVOR MONTGOMERY, F.C.A.
Woodvale	WALLACE LINTON, M.B.

Alderman The Rt. Hon. WILLIAM CECIL McKEE, E.R.D., J.P.
Lord Mayor of Belfast

Sir KENNETH SINCLAIR, D.L.
Chairman of the Belfast Harbour Commissioners

Officers

SECRETARY
NORMAN AGNEW
M.A., M.SC., PH.D., F.R.I.C.S., F.A.I., M.I.STRUCT.E., F.R.SAN.I.

CHIEF ENGINEER
R. E. D. BAIN
B.A., B.A.I., M.I.C.E., M.I.W.E., A.M.T.P.I., A.M.I.C.E.I.

ACCOUNTANT AND ASSISTANT SECRETARY
S. J. HARVEY

SOLICITOR
JAMES MACAULEY

Silent Valley at the commencement of the Mourne Development Schemes

PHOTO BY J. R. BAINBRIDGE

BELFAST WATER SUPPLY

THE Belfast City and District Water Commissioners, a Board established by Statute as the Water Authority for Belfast and District, is composed of 15 elected Commissioners—one Commissioner for each of the Wards into which the City of Belfast and District area of supply is divided—together with the Lord Mayor of the City and the Chairman of the Belfast Harbour Board.

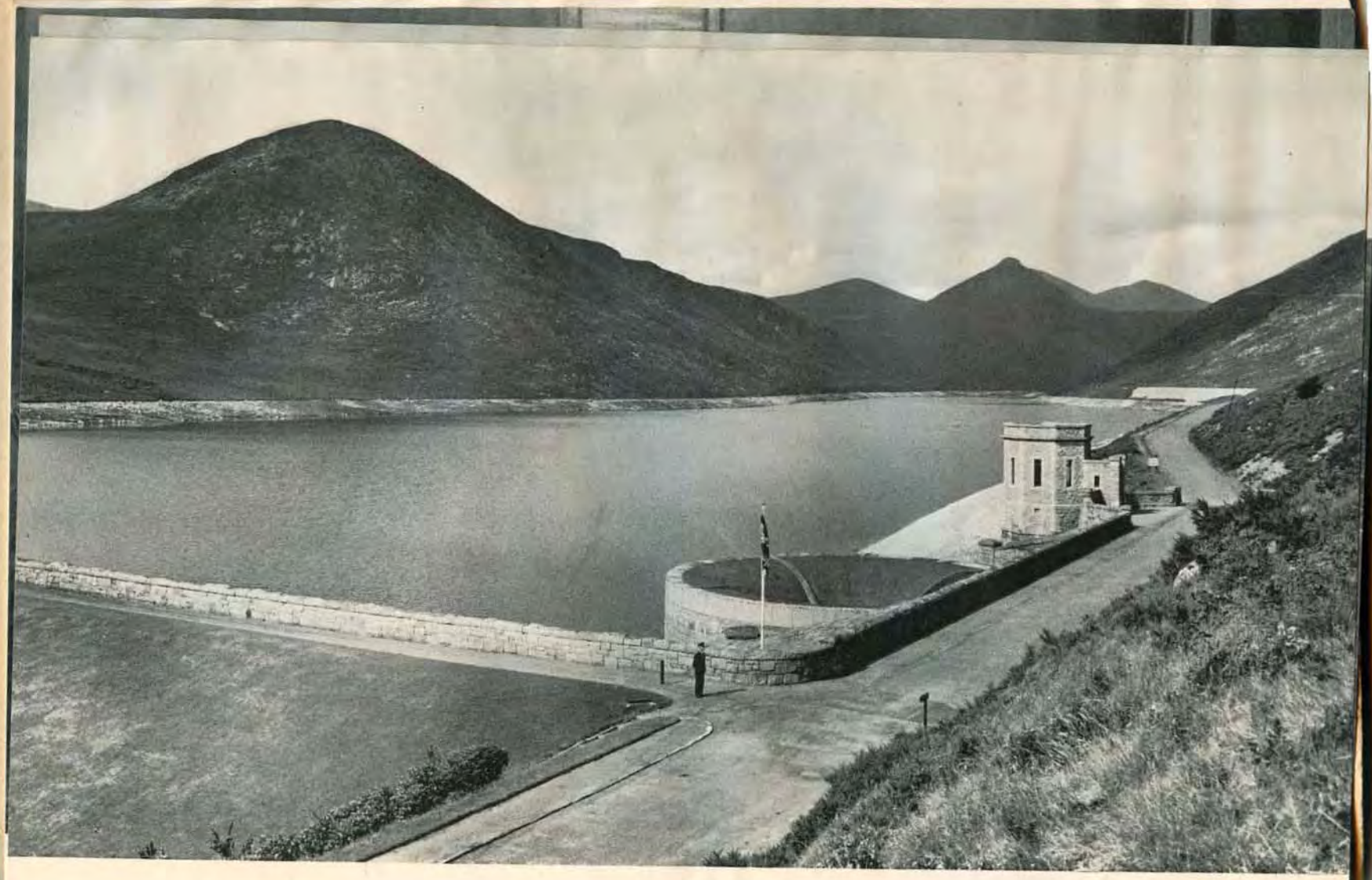
Five of the elected Commissioners go out of office each year, and vacancies so caused are filled by election for a period of three years. The Electorate is the Local Government Electors for each Ward of the Statutory area.

A casual vacancy in the Board, caused by death, resignation or otherwise is filled by a vote of the Electors in the Ward in which such vacancy occurs.

The Statute provides for the appointment, on a fixed day in each year, of a Chairman and a Deputy Chairman, to hold office for one year only.

For many years past it has been the custom of the Commissioners to appoint annually, Standing Committees of Works, Finance and Law, each of these Committees consisting of the fifteen elected Commissioners.

The business of the Commissioners is in large measure conducted by these Committees, subject to confirmation or otherwise by the Board on submitted reports.



Silent Valley Reservoir

PHOTO BY BELFAST NEWS-LETTER

INTRODUCTION

A BRIEF HISTORY OF BELFAST WATER UNDERTAKING

BELFAST was created a Municipal Borough by Charter, granted by King James the First in the year 1613, and was then controlled by a Sovereign and Twelve Burgesses.

In 1637 the Earl of Stafford, the Lord Deputy, purchased from the Corporation of the ancient Borough of Carrickfergus the right to import into, and through, the Port of Belfast, commodities at reduced rates.

Prior to the year 1678, when the population was probably about 600 to 700, there does not appear to have been any well regulated water supply for the Borough, the inhabitants having to depend on wells and water carried from the rivers, but in that year a Mr. George McCartney organised a supply which was brought in from the Tuck Mill Dam, in the Divis Street area, through wooden pipes, to the Great Bridge of the Town, near the site of the present Boyne Bridge, a distance of about 200 perches.

In 1688 the Burgesses of the Borough were increased in number from 12 to 35, and in the year 1700 the Borough contained about a dozen streets and lanes, with some 200 thatched cottages and a population not greatly exceeding 1,000.

About 30 years later a Lease was granted to William Johnston (commonly known as "Pipe Water" Johnston) of all waters, rivers brooks, wells and water streams adjacent and contiguous to the Town, except such watercourses and mill dams as were granted to George McCartney. The sources of water for this supply were wells to the south of Belfast in the Fountainville and Sandy Row areas.

This undertaking, which met difficult financial circumstances, was sub-let to James Hall, in 1762, but he, too, could not collect enough money to keep the wooden pipes in repair. By 1790 the population was about 18,000 and the Town's water supply was so poor and precarious that the Belfast Charitable Society decided to sell its own pure well water in the streets as a measure of relief at the rate of a halfpenny per measure of four gallons.

In the year 1795, the Belfast Charitable Society took over responsibility for supplying the Town with water, and, in order to further augment the existing supply, obtained a lease of certain springs. Pipes were laid in the principal streets, with the result that in the year 1800 water was distributed throughout the Town and public fountains were erected for the gratuitous supply of water to the poor. In the same year an Act was passed in the Parliament of Ireland providing for improvement in the administration of Waterworks, the regulation of expenditure and the levying of rates to meet expenditure and to provide remuneration for the Society.

In another few years leases of additional springs were obtained and between the years 1807 and 1837 such wooden pipes as had not been abandoned were lifted and replaced with metal pipes. To cope with increasing demand, the Belfast Charitable Society, in 1837, found other sources from which water could be obtained and extended the area of supply outside the Town's existing limits, but demand for water was now rising sharply and it became obvious that a public body, with no other functions than the provision of water supplies, was necessary.

So by virtue of the provisions of the Belfast Water Act 1840, a board designated The Belfast Water Commissioners was constituted to control and administer the water supply. Under this Act all the existing Waterworks, leases and rights, owned by the Charitable Society, passed from that Society into the hands of the new Commissioners. For this transfer of property and rights the Society was compensated by a lump sum payment and an annual amount of £800 payable for ever by the Commissioners, together with a supply of water free of charge for all time.

Demands for new and increased supplies of water were greater than ever. The Commissioners were obliged to discover new sources from which additional water could be obtained. To give an indication of the state of affairs pertaining in 1854, it may be stated that water had to be pumped from the River Lagan, as a temporary expedient, to meet the prevailing shortage.

In the year 1855 Mr. J. F. Bateman, a well-known Engineer, reported to the Commissioners on a number of sources from which an increased and abundant supply might be obtained, and he recommended the Woodburn Catchment, near Carrickfergus, as being the most suitable.

Under the powers conferred by an Act passed in 1865, Mr. Bateman's recommendation was given effect to and, between that year and 1890, the Woodburn Catchment was gradually developed by the construction of seven Storage Reservoirs and a Service Reservoir for these waters in the Borough at Oldpark, with a top water level of 180 feet O.D.

In the year 1880, the Town had greatly extended, and buildings were being erected on lands at higher levels than could be supplied by gravitation from the Service Reservoir at Oldpark.

In 1883 further Catchments were acquired at Stonyford and Leathemstown, in the County of Antrim, and a Storage Reservoir was constructed in each of these Catchments with a Service Reservoir at Lagmore, the top water level of the latter being 340 feet O.D. The supply from these Catchments was first introduced to the Town in 1890.

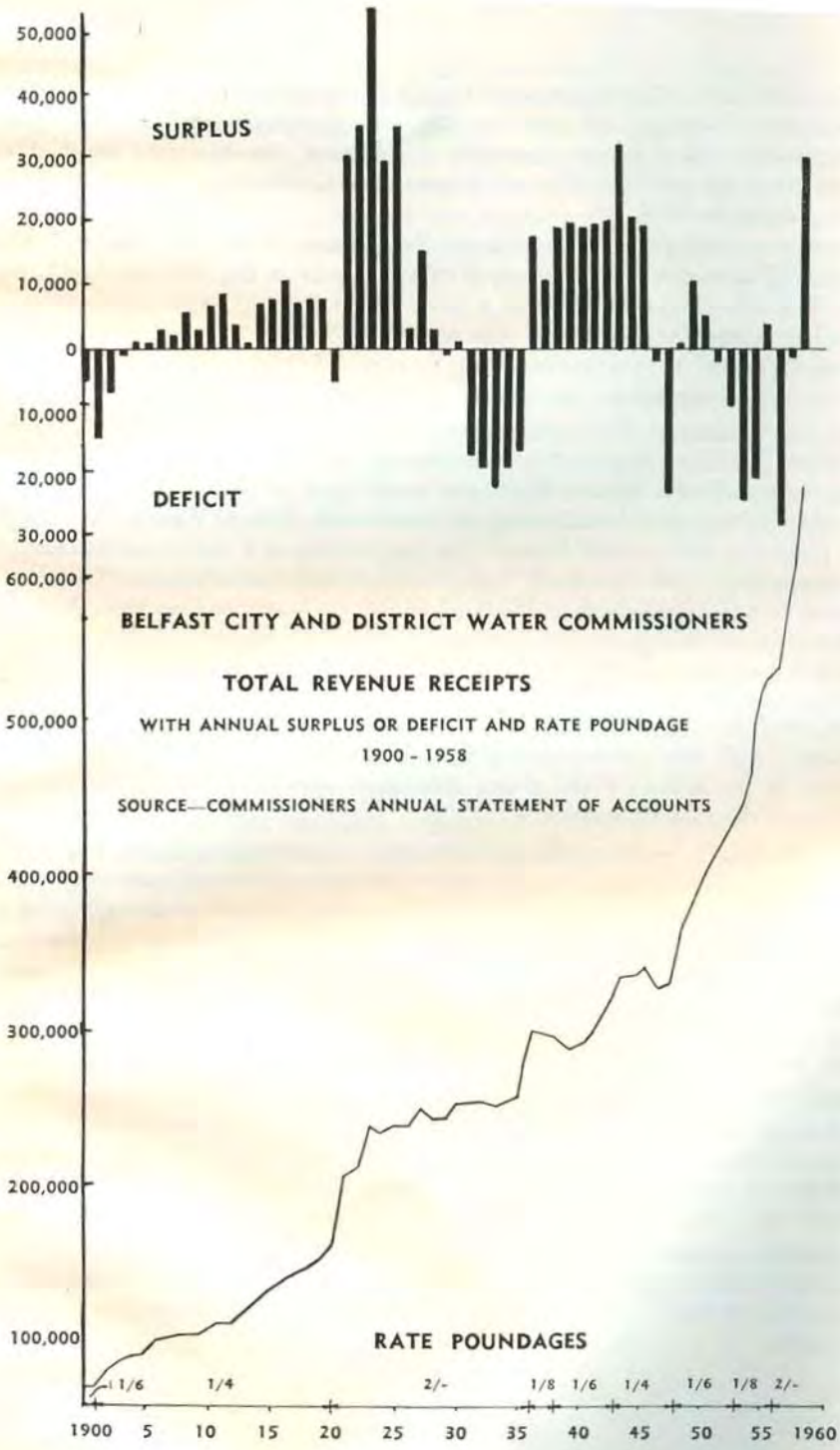
The year 1888 was a memorable one for Belfast. In that year Queen Victoria conferred on the Borough the title of "City" due to its importance as an industrial and commercial centre and a port. The following year, the designation "Belfast Water Commissioners" was altered to "Belfast City and District Water Commissioners" in consequence of the area, which was then being supplied with water, having extended to several districts outside the boundary of the City.

It was evident to the Commissioners that further greatly increased supplies would be necessary. Exhaustive investigations revealed that the Kilkeel and Annalong Valleys in the Mourne Mountains would give an abundant yield of highly satisfactory water, and accordingly the catchments of these Valleys were acquired. Contracts were entered into for the construction of a main conduit from the southern end of the Annalong Valley, with branch connections to take in the waters from the Annalong and Kilkeel Rivers, to a service reservoir at Knockbreckan, near Belfast, the construction of which was started at the same time. On the completion of this work in 1901 the waters from the Kilkeel and Annalong Rivers were introduced to the supply. The question of water storage at Mourne had still to be dealt with, but the 1914-18 War caused a major delay. However, in 1923 work was commenced on the Silent Valley Reservoir to impound the waters of the Kilkeel River. Great difficulties were encountered, but the year 1932 saw the task completed.

Originally, in order to take full advantage of the catchments in the Kilkeel and Annalong Valleys, it was planned to construct a storage reservoir in each Valley. Later an effective alternative to the construction of a storage reservoir in the Annalong Valley was decided upon—namely, a diversion of the water from the Annalong River into the Silent Valley Reservoir by means of a tunnel about 2¼ miles in length through Slieve Bignian. This project was completed in 1953. A necessary adjunct to the scheme—duplication of the branch aqueduct between the Silent Valley and the Annalong Valley, about five miles in length—was completed in 1950.

A third and final phase of this scheme to be put in hand was the construction of an additional storage reservoir in the Upper Silent Valley, slightly more than a half-mile above the tail end of the existing Silent Valley Reservoir. This reservoir was completed in 1957.

Boundary extensions of Belfast took effect in 1853 and 1896 as a result of which the area of the County Borough of Belfast is now some 23 square miles, exclusive of tidal waters, and the population in this area is approximately 455,000.


50,000
40,000
SURPLUS
30,000
20,000
10,000
0
10,000
20,000
DEFICIT
30,000
600,000
BELFAST CITY AND DISTRICT WATER COMMISSIONERS
TOTAL REVENUE RECEIPTS
WITH ANNUAL SURPLUS OR DEFICIT AND RATE POUNDAGE
1900 - 1958
SOURCE—COMMISSIONERS ANNUAL STATEMENT OF ACCOUNTS
500,000
400,000
300,000
200,000
100,000
RATE POUNDAGES
1/6
1/4
2/-
1/8
1/6
1/4
1/6
1/8
2/-
1900
5
10
15
20
25
30
35
40
45
50
55
1960

Since 1896, due to the influence of the City and the availability of services, large areas outside, but convenient to the City boundary, have been developed until we have now what might be termed a Greater Belfast. Under the Belfast Water Act 1938, there was a large extension of the Belfast water boundary, the line of which now surrounds an area of about 64 square miles and includes and extends beyond what has been referred to as Greater Belfast. In addition to the City of Belfast, areas which are within the statutory district of supply of the Belfast City and District Water Commissioners are lands between the City boundary and Holywood, and districts at Dundonald, Gilnahirk, Castlereagh, Cregagh, Newtownbreda, Upper Malone, Finaghy, Dunmurry, Derriaghy, Lambeg, and the complete Urban District of Newtownabbey.

Partly arising from conditions imposed and agreements made when certain water rights were acquired and partly because of the readiness of the Commissioners to share their supplies, which were abundant on completion of the Silent Valley Reservoir, water in bulk is supplied outside the statutory area. The chief supplies are to local and other authorities in respect of the districts and towns of Ballycarry, Carrickfergus, Greenisland, Saintfield, Ballynahinch, Newcastle, Annalong, Kilkeel, North Down and the Rural Districts of Downpatrick, Hillsborough and Lisburn. As a result of the agreement with the North Down Waterworks Joint Board, the supply of water for the Borough of Newtownards has been considerably augmented, and large areas in the Rural Districts of Newtownards and Castlereagh, including most of the Ards Peninsula and Comber, and the area along the south side of Belfast Lough have now a regulated supply for the first time.

Mention should also be made of the arrangement for a supply to Messrs. Courtaulds Ltd., who have very extensive industrial premises at Carrickfergus.

Another important service of the Commissioners is the supply of water to the shipping using the port and harbour of Belfast.

The total capital expenditure on works and properties of the Belfast City and District Water Commissioners now approaches seven million pounds. The revenue income of the Commissioners for the year ended 31st October, 1958, derived from rates (domestic rate 2/0d. and public rate 6d. in the pound) amounted to approximately £343,000; from sales of water for trade and shipping about £244,000; from interest on invested sums £53,000 and from sundry other sources about £16,000 making up an approximate total of £656,000.

Silent Valley Reservoir

PHOTO BY NORTHERN WHIG

SILENT VALLEY RESERVOIR

IN the year 1891 the late Mr. L. L. Macassey, M.I.C.E., was the Board's Consulting Engineer and, acting on his advice, it was decided that immediate investigations should be made with the object of discovering a new and suitable area from which a plentiful additional supply of good and pure water might be obtained at a cost which would not be prohibitive. Exhaustive searches having been made, several areas were found with catchments at reasonable distances from the town, all with one exception situate at levels suitable for a gravitation supply.

After ascertaining the approximate quantity, as well as the quality of the water obtainable from each of these areas, the Commissioners had no difficulty in deciding that the catchments of two deep valleys in the southern section of the Mourne Mountains, which were drained by rivers flowing into the sea at the towns of Kilkeel and Annalong, were without question the most favourable, the waters from which were of a high degree of purity and excellence, and sufficient in quantity to satisfy the greatest demand likely to arise for many years. The distance of these two catchments from the town, although considerable, was not regarded as prohibitive, whilst the cost of acquiring full control over the lands and waters, and providing all necessary works, was considered to be well within the Board's resources. Surveys were made and an estimate prepared by Mr. Macassey of the probable cost of constructing suitable works and acquiring the ownership of these lands and waters. Steps were also taken to obtain Parliamentary powers to effect these objects.

In the years 1893, 1897 and 1899 Acts were passed by the Imperial Parliament, under which the Board was empowered to acquire by purchase the owners' rights in the lands and waters of these valleys, the acquisition of way-leaves, and to construct reservoirs and other necessary works.

The Board found no difficulty in deciding that a reservoir, in one or other of these valleys, would afford sufficient storage for years to come, and that its construction could be deferred for a considerable time, as the flow from the two rivers, diverted by weirs into a conduit, and conveyed to the city, would provide sufficient water to meet immediate requirements. Plans were prepared by Mr. Macassey, and contracts entered into for the construction of a main conduit, commencing in the Silent Valley, the more distant of the two, passing thence towards the city through the mountain slope in the townland of Brackney by a tunnel, three-quarters of a mile in length, thence by syphon to within a short distance from the entrance to Annalong Valley, the conduit being designed

at a point to admit into it the water from the river which flowed from that valley.

This conduit is constructed in cut-and-cover, from the point where the water from the Annalong River enters into it, for about 4¼ miles, where it becomes a tunnel 2 miles in length, constructed through the base of Slieve Donard, directly above the town of Newcastle, proceeding thence, partly in cut-and-cover and partly in pipes, to the entrance of another tunnel, 3 miles in length, which commences about 4 miles south of the service reservoir at Knockbreckan, into which the water is discharged. This reservoir is situate roughly about 5 miles south of the city boundary. The conduit is 35 miles in length, of which 15⅔ miles is in cut-and-cover, 6⅔ miles in tunnelling, and originally 12⅔ miles in a single line of 36 inch steel and cast iron pipes.

The cut-and-cover and tunnel portions of the conduit between Annalong Valley and Knockbreckan were of sufficient size to convey thirty million gallons of water per day and between Silent and Annalong Valleys twenty million gallons of water per day and the single line of pipes ten million gallons of water per day. The plans for the construction of the service reservoir at Knockbreckan were also prepared by Mr. Macassey. This reservoir is constructed with an earthen embankment and is capable of containing one hundred million gallons of water.

On completion, in the year 1901, of the conduit and this service reservoir the waters from the Silent Valley and Annalong Valley rivers were diverted into the conduit, and Belfast obtained an additional supply from these new catchments, which enabled the city to be well supplied, except during a few short periods of exceptional summer drought.

In the year 1910 it became apparent that, with the continually increasing demands for water, a time was again not far distant when provision must be made for a more uniformly constant supply than was being afforded by the varying flow from the rivers by the construction of a suitable reservoir in one or other of the valleys.

At this period, the services of Mr Macassey being no longer available, Mr. F. W. McCullough, M.I.C.E, the Board's Chief Engineer, was instructed to report generally on the probable cost of constructing a reservoir of sufficient capacity in one or other of the valleys, and in due course he submitted a report on the estimated cost of constructing a reservoir in the Silent Valley, and alternatively of one in Annalong Valley. After prolonged consideration by the Commissioners they eventually decided on the construction of a reservoir in the Silent Valley to impound the waters of that catchment. Mr. McCullough was thereupon instructed to prepare plans and estimates accordingly, and the preparation of these plans was in a forward condition when war broke out in 1914. In consequence of the difficulties, which at that time existed, in respect of expending money on large works, other than those which were considered to be immediately necessary, further action was deferred and, as a result of this delay, the plans were not completed until the year 1922. The plans and specification for a reservoir capable of storing three thousand million gallons of water, and the Engineer's

estimate of the cost having been approved, tenders were invited for its construction.

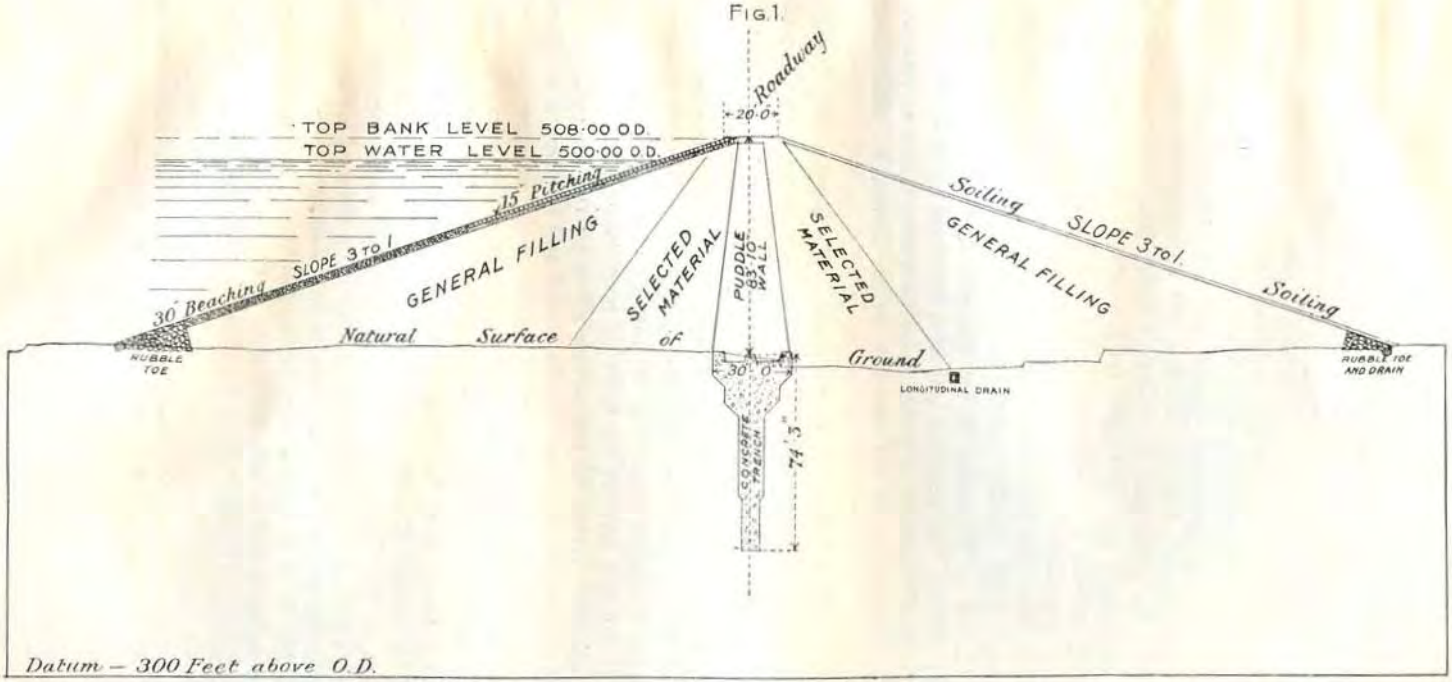
Several tenders for carrying out this work were received, but owing to the large sum required by some of the contracting firms who submitted offers, and to various suggestions by others for modifications of the plans and specification, the placing of a contract was delayed until May, 1923. In that month terms were finally arranged and an agreement entered into with Messrs. S. Pearson & Son (Contracting Department), Ltd., of London, for carrying out the work in strict accordance with the plans and specification which had been prepared by the Engineer. The agreement provided for a lump sum payment to the Contractors, such sum being subject to adjustment according to the amount of work actually carried out, calculated at the prices contained in a schedule to the agreement. Contracts were also placed with other firms for certain ironwork.

On the 10th October, 1923, the first sod for the foundation of the embankment was cut by Lord Carson of Duncairn in the presence of the members of the Board and its chief officers. The function was also favoured by the presence of a large and distinguished company of guests, who were entertained to luncheon by the Contractors, represented on the occasion by Sir Ernest W. Moir, Bart., M.I.C.E.

In June of that year the Contractors had commenced operations, and within a short time the work of construction was in full swing, and continued to make rapid progress until the year 1925, when they began to complain that they were finding it impracticable to de-water the ground to enable a trench to be excavated for the construction of a concrete cut-off wall, in the manner provided by the plans and specification. Early in 1926 the Contractors definitely informed the Engineer and the Commissioners that it was impossible to open up that trench and to carry out this part of the work in accordance with the contract plans. The Commissioners, acting on the advice given by the Engineer that it was not impossible to open up the trench as intended and relying on the terms of the agreement, insisted on the Contractors fulfilling the contract they had entered into. The Contractors thereupon lodged formal notice requiring arbitration in respect of the dispute which had thus arisen.

Arbitration having been called for, the Commissioners, (their Chairman at that time being Mr. George Condell, J.P.), found themselves in considerable difficulty, by reason of Mr. McCullough being laid aside with a serious, and what soon afterwards proved a fatal illness, thus depriving them of his assistance and technical knowledge at the arbitration, which followed in December of that year, and in which Mr. W. J. E. Binnie, M.I.C.E., an Engineer of great experience in reservoir construction, acted as sole arbitrator.

The arbitration was held in the Slieve Donard Hotel, Newcastle, and after an opening statement by Sir Lynden Macassey, K.C., Senior Counsel for the Contractors, the parties, acting on a suggestion made by the Arbitrator, entered into negotiations. On the advice of Sir Lynden and the Attorney-General for



CROSS SECTION OF EMBANKMENT OF SILENT VALLEY RESERVOIR

0 50 100 200 300 Feet

Northern Ireland (Mr. A. B. Babington, K.C., M.P.), leading Counsel for the Commissioners, the existing contract was annulled and a new agreement made whereby terms were settled. Under these the Contractors were to do work of an exploratory nature for the purpose of ascertaining whether a suitable trench could be excavated to enable a cut-off wall to be constructed in the ground under the embankment of sufficient depth to enable its foundation to be embedded in solid rock.

The Arbitrator's award, in which were embodied the terms of this agreement, also provided for the appointment of a Board of Engineers, consisting of three members, to take over the engineering control of this work, Mr. Binnie to act as Chairman of such Board, the other members being Mr. Edward Sandeman, M.I.C.E., of London, and Mr. H. P. Hill, M.I.C.E., of Manchester, both being Engineers of considerable experience in waterworks construction.

In accordance with this agreement the Contractors at once commenced and, with commendable energy, proceeded with this investigatory work, in the course of which many serious engineering difficulties were encountered and overcome.

The embankment rests on an ancient moraine in the lower part of the valley, which is filled by glacial deposits consisting of silt, running sand, gravel and boulders, many of the latter being of immense size.

Borings, which were made prior to the placing of the original contract, indicated that underlying rock would be found at a depth of about 50 feet below the valley surface, but later on, and after the work of construction had been commenced, it was found from the sinking of additional bore holes that across the entrance to the valley, under the site of the embankment, the surface of the underlying rock sloped downwards from the hills on both sides more rapidly than was disclosed by the original borings, and that in the deepest part the rock surface was not less than 180 feet below the valley surface. These additional borings were sunk with difficulty and at considerable expense owing to the numerous boulders which were encountered. It is probable that the original bore holes, which there was reason to believe had penetrated well into the rock, must have terminated in some of these immense boulders.

To overcome the inflow of water and silt in the excavating of this trench an endeavour was made to sink a timber-lined shaft, for the purpose of de-watering the ground by pumping, but it was found impossible to do so owing to the material penetrated being of such nature as to mix and run freely with the water which entered into the shaft as rapidly as it was excavated, consequently this work had to be abandoned. An attempt was then made to drive down a circular ring of interlocking steel piles, to form a sump from which the water could be pumped, but this work also had to be abandoned, as owing to the boulders which were encountered the piles could not be driven.

At this stage it became evident that the sinking of the trench to such a depth, through water-charged material, presented difficulties which could not be overcome by the methods provided by the original plans. The construction of an

embankment and ancillary works presented no special problems, but it was impossible to construct a reservoir which would be watertight unless the percolation of the water through such permeable material as underlay the embankment could be prevented. To effect this object it was imperative to excavate a trench, within which there could be constructed a concrete cut-off wall, with a foundation resting in the solid rock, rising upwards through the heavily water-charged silt and boulders to some feet above the valley surface, and projecting into the base of the embankment, and it was believed that if the silt and silty sand material, which ran so freely when mixed with the water, could be made to part with some of its moisture, that material would become sufficiently stable to be excavated.

To attain this object drainage shafts, lined with cast iron, were sunk under compressed air, with an air pressure sufficient to drive the moisture out of the silt and silty sand, thereby preventing a run of the material into the shaft. As it was not advisable or, indeed, practicable for men to work under compressed air at a greater pressure than 30 to 35 lbs. per square inch above that of the atmosphere, when the first shaft had been sunk to a depth limited by the air pressure, the work of sinking it was suspended and a strainer fixed in the bottom of the shaft to minimise the entry of sand with the water. Pumping from the shaft was then commenced, and by that means a large quantity of water was withdrawn from the surrounding strata. An adjacent shaft was then sunk by similar means to a level considerably lower than the bottom of the first one until the air pressure became too great for the workmen. When the greatest attainable depth had been similarly reached in this second shaft, and a strainer fitted to the bottom, the pumps were transferred to it from the first shaft, and by this means the water was drawn at still greater depth from the surrounding ground.

By the adoption of this means it was found that the ground could be dewatered to a sufficient extent to enable the trench to be excavated, and six more of these shafts, eleven to twelve feet in diameter, were sunk on the line of the trench in suitable positions to form part of the excavation for the cut-off wall. A portion of the cast iron lining of the shafts was afterwards removed to enable the concrete, with which the shafts were afterwards filled, to become a continuous part of the cut-off wall. The pressure of the surrounding silty material was so great that it was necessary to line the trench, where it is over 100 feet in depth, with strong cast iron segmental plates, which were connected in due course to the lining of the shafts at each end, thus providing for the formation of a continuous wall.

The work of sinking these shafts was completed in June, 1929, the last and deepest shaft having been sunk to a depth of 211 feet, the last 30 feet of which penetrated into sound and solid rock. Meanwhile the work of sinking the trench proceeded, and was completed in October, 1929, a good rock foundation for the cut-off wall having been secured right across the valley.

On the 11th December, 1929, the first bucketful of concrete for the foundation of the cut-off wall was laid in position by Mr. Robert Scott, J.P., the Deputy Chairman of the Board, in the absence, through illness, of Mr. William Courtney, the Chairman, after which the filling of the trench with concrete to form the cut-off wall was proceeded with and carried out expeditiously.

Ample precautions of a special nature were taken for the safety of the workmen who were engaged in the air shafts. All the men engaged in this work were passed through an air lock for the purpose of gradual compression before entering, and de-compression before leaving, the shafts. It was entirely due to the precautionary measures adopted by the Contractors and the personal attention of Sir Ernest W. Moir for the protection of the workmen that no accident or injury occurred during this dangerous portion of the work.

In June, 1930, for family reasons connected with the death of Lord Cowdray, Messrs. S. Pearson & Son (Contracting Department), Limited, were, at their request, relieved from their agreement, and the completion of the work was taken over by Sir Ernest W. Moir & Co., Ltd., under an agreement, the terms of which were similar to those contained in the agreement with the previous Contractors. In view of the fact that Sir Ernest W. Moir had been in personal control of the work from its commencement by Messrs. Pearson, and had continued to control the work by his new firm, no delay occurred in consequence of this change of Contractors.

As the work of filling and pitching of the embankment progressed water was allowed to accumulate gradually in the reservoir to such an extent that, at seven o'clock on the morning of the 8th of September, 1932, top water had been reached, and for the first time was found to be overflowing into the waste channel. The construction of the reservoir and ancilliary works was, for all practical purposes, completed in the late autumn of 1932.

The reservoir, almost surrounded as it is by heather-clad hills, forms a beautiful mountain lake, in extent capable of storing three thousand million gallons. The embankment is about 1,500 feet long, tied at both ends into the rock slopes of the mountains east and west of the narrow entrance to the valley. The height of the embankment is 88 feet above the level of the old river bed and about 700 feet wide at the base, gradually sloping on both sides to 15 feet in width on top. Under the base, and for the full length of the embankment, the cut-off wall, some six feet six inches in thickness, is projected down into the solid rock, the deepest part of which is 211 feet below the old river bed. This wall prevents water from percolating under the structure of the embankment. Running through the centre of the embankment, from its base on the valley surface to its top, a core of varying thicknesses, formed of carefully prepared clay puddle, is inserted to prevent any percolation of water through the structure of the embankment, thus ensuring a perfectly watertight reservoir. The reservoir is roughly a half mile wide and two and a quarter miles long. An

excellent roadway, suitable for motor traffic, runs all the way along the eastern side of the reservoir.

The heavy part of the work having been completed, and only "touching up" required, a request was made by Messrs. Sir Ernest W. Moir & Co., Ltd., to be released from their agreement on 31st January, 1933, and this request having been granted, the works were placed in the hands of Mr. C. F. Wheeler, A.M.I.C.E., the Board's Engineer, for completion and future administration.

On the 24th May, 1933, the opening ceremony was performed by His Grace The Duke of Abercorn, K.G., K.P., Governor of Northern Ireland, in the presence of members of the Board and its chief officials.

The opening ceremony was preceded by a religious service in which the Right Rev. J. J. Macaulay, D.D., Moderator of the General Assembly of the Presbyterian Church in Ireland; the Bishop of Down and Connor and Dromore; the Rev. John A. Duke, President of the Methodist Church in Ireland and the Rev. Alexander Cairns, M.A., Chairman of the Congregational Union of Ireland participated.

A large and representative company of guests was present and they were later entertained to luncheon at the Valley by the Board.

FORESTRY

ABOUT the year 1925 the Commissioners decided to carry out some afforestation in the Annalong Valley and at that time some fifty five acres were planted out with mixed conifers. This planting was done for amenity purposes and the area was mainly restricted to the margins along the entrance road. An approach was made by the Ministry of Agriculture to the Commissioners in 1954 suggesting that the Mourne area was a suitable one for further afforestattion. In view of the successful extensive planting out of the Woodburn area from 1944 to the present time and to the considerable planting grants offered by the Ministry of Agriculture, interest was renewed in the possibilities of more extensive planting in the Annalong Valley.

A programme was drawn up with the help of the Ministry's technical officers for planting some 485 acres, with a possibility of extending this to approximately 700 acres. At the same time, a programme of maintenance for the existing forests was arranged to work in with a planting rate of some 50 acres per year, so as to give continuous work for a forestry squad. An integral part of this programme was the extension of the nursery where young plants are brought on from seed. The work has been proceeding smoothly over the past few years and some 170 acres have now been planted.

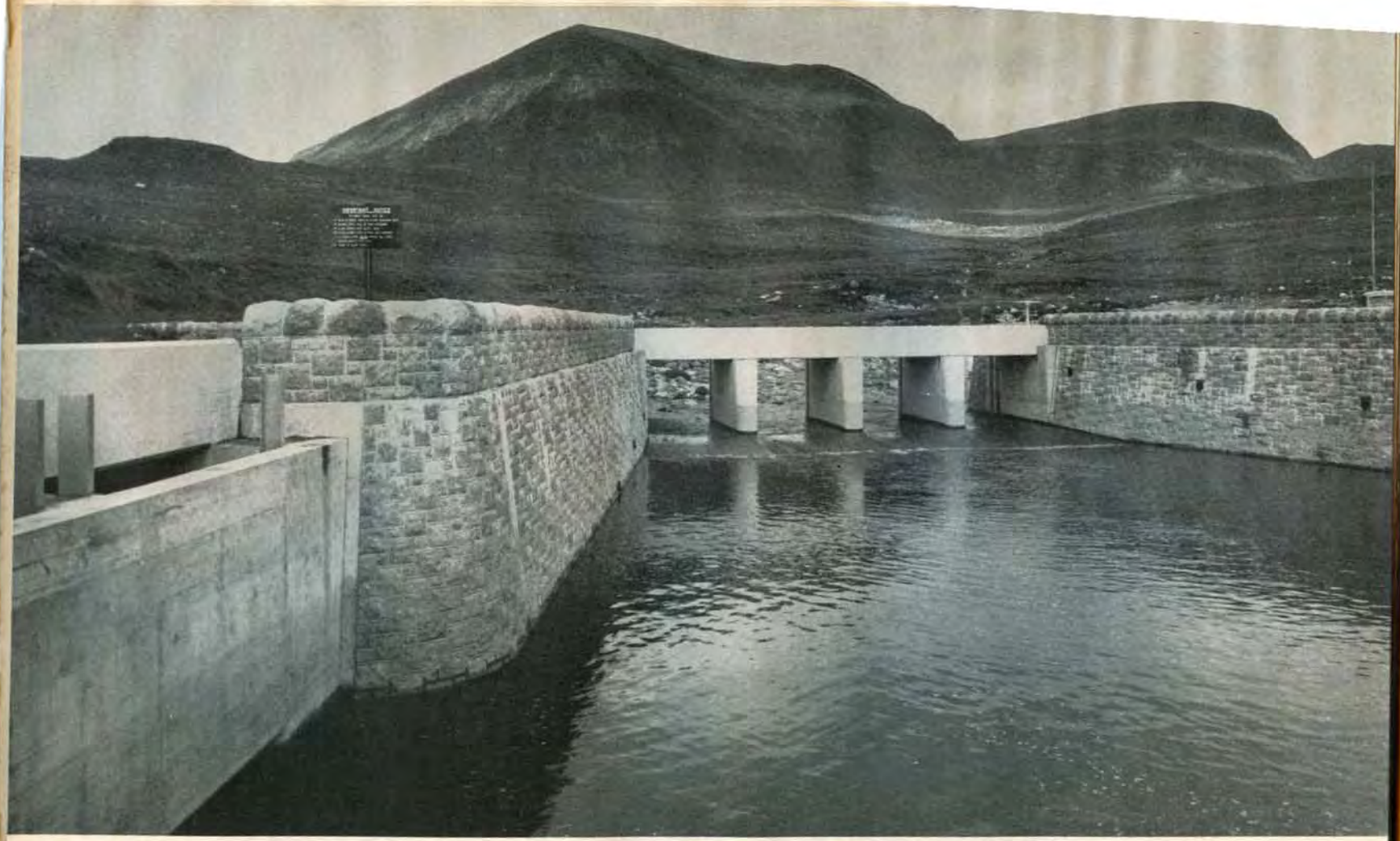
DUPLICATION OF MOURNE SYPHON PIPES

MORE water now being available at the Silent Valley the next step in the development scheme as envisaged by Mr. Macassey was to increase the carrying capacity of the conduit to Belfast. As mentioned earlier in this account, the tunnel and cut-and-cover section had been constructed to carry 30 million gallons of water per day, but the portions of the conduit which consisted of cast iron steel pipes were made to carry only one-third of this amount.

The decision to start work on the duplication of the 12⅔ miles of syphon pipes was influenced not only by the City's growing need for more water, but also by the unfortunately high incidence of unemployment at this period.

It was decided to use direct labour methods for the shorter lengths and staff was recruited and work began in 1934 under the direction of the Chief Engineer, Mr. C. F. Wheeler, A.M.I.C.E. By 1935 three sections were under way, at Ballynahinch, Bow Lough and Knockbreckan.

About this time bitumen-lined and sheathed steel pipes were being introduced for large diameter mains and it is interesting to note that the Commissioners were among the first of the Water Authorities to adopt this type of pipe on a



Tunnel Intake Annalong Valley

PHOTO BY J. R. RAINBRIDGE

large scale. The contract for the supply of the 38 inch diameter pipes was placed with the South Durham Steel & Iron Co. Ltd. and laying began at Ballynahinch under Mr. George McIldowie, A.M.I.C.E., and at Bow Lough and Knockbreckan under Mr. J. S. Jackson, A.M.I.C.E.

It was not possible to do the complete job by direct labour so a contract was made with the Holborn Construction Co. Ltd. in 1935 for the work involved in the 7½ mile long Newcastle section. Mr. McIldowie was transferred to supervise this work and his place at Ballynahinch was taken over by Mr. R. D. Duncan, B.SC., M.I.C.E.

The original scheme envisaged a supply of twenty million gallons per day from Silent Valley and two million gallons per day from Annalong Valley. Thus the cut-and-cover aqueduct between the Valleys was constructed to carry twenty million gallons per day. However, the three quarter mile long Annalong syphon and one other short length, as in the case of Newcastle, Ballynahinch and Bow Lough, consisted of single 36 inch diameter syphon pipes.

It was therefore necessary to duplicate these and this work was undertaken by the direct labour force under Mr. R. H. McCullough, B.SC., A.M.I.C.E., as soon as the duplication at Ballynahinch was finished.

The duplication work was completed in the autumn of 1937.

SLIEVE BIGNIAN TUNNEL

ON completion of the Silent Valley Reservoir in the late autumn of 1932 it was intended, in accordance with the original plans for the development of the Mourne catchment areas, to follow with the construction of an impounding reservoir in the Annalong Valley. In 1945, however, after consideration of past reports in conjunction with the results of more recent geological investigations, the Commissioners were advised that the embankment to form the proposed reservoir could only be constructed at very heavy and yet problematical cost. In consequence, it was decided, as part of an alternative scheme, that the water from the Annalong River should be diverted into the Silent Valley Reservoir by means of a tunnel through Slieve Bignian.

To effect this diversion of water from the Annalong River it was necessary in addition to making the tunnel, to construct two intakes in the Annalong Valley, a small one to turn the flow of one of the streams through the Valley into the main Annalong River, at a point higher up the Valley than its natural junction, and a large one to divert the water of the River into the tunnel. These and other ancillary works took over four years to complete. In driving the tunnel, which was worked simultaneously from both ends, a delay of some seven months was caused by encountering in the rock a fissure filled with water-logged gravel, sand and silt, the product of decomposed granite. The difficulty was overcome by pressure cement grouting.

Ben Crom Reservoir Dam

PHOTO BY J. W. L. SAVAGE, COLERAINE

The tunnel is some 3,700 yards in length, about 7 feet 6 inches high and approximately 8 feet in width. In places where the roof is weak steel ribs embedded in concrete were used to provide the necessary support. The water channel in the tunnel has a concrete invert with prefabricated concrete post and slab side walls 6 feet 6 inches apart carried up to a height of 4 feet. The invert of the water channel has a fall from the Annalong Valley of about 18 feet over its full length. The channel is designed to take a maximum flow of 90 million gallons per day and it is estimated that even in the driest years an average of five million gallons per day will flow through the tunnel from the Annalong Valley catchment to add to the 17 million gallons or thereabouts available from the Silent Valley Reservoir.

The intakes or diversion works in the Annalong Valley are such that all flows up to tunnel capacity are diverted and those in excess pass over a weir at one or other of the intakes. Recorders are provided for measuring both the flow into the tunnel and the flow passing the main intake.

At the Silent Valley end, the water discharged is carried under the high level road through a 6 feet 6 inches diameter culvert to enter the reservoir approximately 1,100 yards upstream of the embankment.

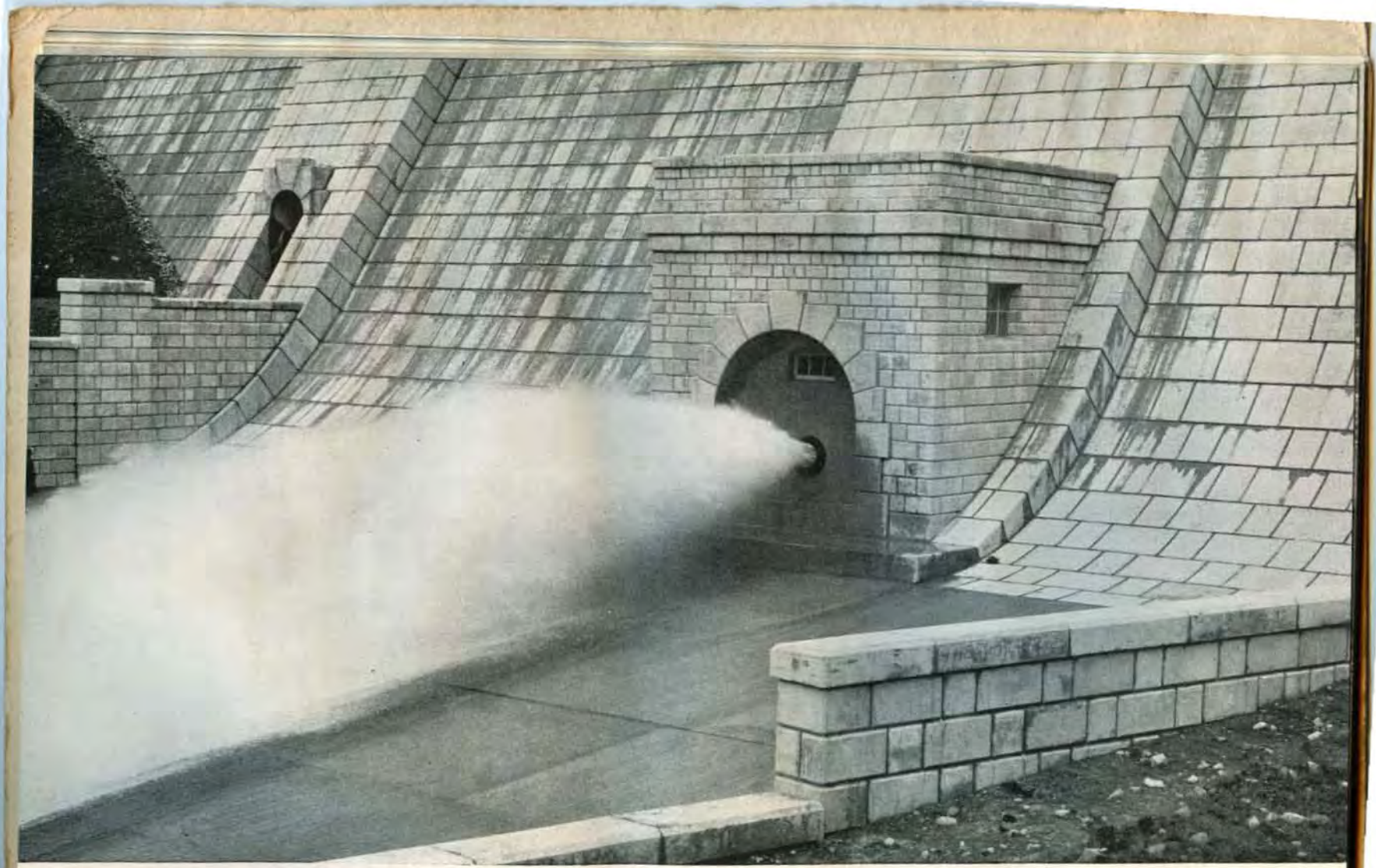
The work was carried out by Messrs. A. M. Carmichael, Ltd., of Edinburgh, under the supervision of Messrs. Binnie, Deacon & Gourley, Consulting Engineers, of Westminster, London.

INCREASE IN CAPACITY OF CONDUIT BETWEEN SILENT VALLEY AND ANNALONG VALLEY

As stated earlier, the original plans envisaged ten million gallons of water per day entering the conduit at Annalong Valley but, in view of the alterations in the scheme by the construction of the Slieve Bignian tunnel, it was necessary to increase the carrying capacity of the conduit between the Silent and Annalong Valleys. In 1950 the conduit on this line consisted of tunnel, cut-and-cover sections and duplicate pressure pipes.

The desired increase in capacity of the conduit was achieved by adopting a novel type of construction. 54 inch diameter thin steel shells, fabricated by Messrs. Harland & Wolff, Ltd., Belfast, were lined with cement mortar on the site. These were then laid in a trench and surrounded with concrete. This work was carried out by Messrs. McLaughlin & Harvey, Limited, under the supervision of Messrs. Binnie, Deacon & Gourley.

On the 28th August, 1952, the opening ceremony of the tunnel was performed by the Prime Minister of Northern Ireland, Captain The Right Honourable The



Ben Crom Reservoir Outlet

PHOTO BY GERALD MCATEE, KILKEEL

Viscount Brookeborough of Colebrooke, C.B.E., M.C., D.L., M.P., in the presence of the members of the Board and its chief officers.

The function was also attended by a large number of guests including representatives of the Consulting Engineers and the Contractors, who were afterwards entertained to luncheon by the Commissioners in the Silent Valley.

TRIPLICATION OF MOURNE SYPHON PIPES

BY 1949 it was evident, due to the increasing demand for water in Belfast, that the time had come for the syphon pipe sections of the Mourne Conduit to be triplicated to bring them up to the full carrying capacity of the tunnel and cut-and-cover sections.

It is rather interesting to note the various changes in design and methods of construction which were adopted for the triplication work. Although only a comparatively short number of years had elapsed since the duplication had been completed, a major war had intervened and had introduced important changes. The duplication work could be considered as the last of the "pick and shovel" jobs, whereas the triplication work made great use of machinery—excavators, bulldozers, dumpers and tractors were now in vogue. Basic labour rates had rocketed from 9d. per hour in 1934 to 2/3½d. in 1951. Even the pipes had altered slightly. Bitumen-lined steel was no longer an innovation but standards had been introduced and 39 inch diameter pipes were used as 38 inch (similar to those used in the duplication work) would have been non-standard and much more costly.

In view of the introduction of mechanical plant it was more economical to have all the work done by contractors. The design was carried out in the Commissioners' Drawing Office mainly by Mr. M. C. Sloane, B.Sc., A.M.I.C.E. and the contract for the Bow Lough and Ballynahinch sections was let to Messrs. McLaughlin & Harvey, Ltd., and on completion of these, the Newcastle Sections were ready to commence and the contracts were awarded to Messrs. Farrans, Ltd., of Dunmurry. This work was successfully completed in 1956.

BEN CROM RESERVOIR

TO make up the storage capacity necessary to take advantage of the full yield of the Silent and Annalong Valley catchments, and in lieu of the impounding reservoir originally planned for construction in the Annalong Valley, it was decided to provide a new storage reservoir in the Upper Silent Valley.

Ben Crom Reservoir

PHOTO BY J. W. L. SAVAGE, COLERAINE

On the 8th October, 1954, the ceremony of laying the Foundation Stone of the new dam was carried out by His Excellency The Lord Wakehurst, K.C.M.G., Governor of Northern Ireland, in the presence of members of the Board, chief officials and a large and distinguished company, who were afterwards entertained to luncheon in the Slieve Donard Hotel, Newcastle, by the Commissioners.

The new reservoir, known as Ben Crom, with a capacity of 1,700 million gallons, increases the yield of the Mourne scheme by about 5 million gallons per day, giving a total average supply throughout the year of approximately thirty million gallons per day.

The question as to whether an earth embankment or a concrete dam is the more economic at any particular site is decided, primarily, by the depth of the bedrock below the surface of the ground. A concrete dam has to be founded, over its whole base in rock, therefore its costs increase greatly as the depth to rock increases.

At the Ben Crom Reservoir site the rock was exposed in the river bed in contrast to the great depth at which it was found at the lower Silent Valley Reservoir.

The dam itself is what is known as a "Gravity Section," that is, it depends on its weight for stability. The mode of construction differs from the lower reservoir for various reasons. It is higher than the original reservoir bank, and the quantity of earth which would have been required if the same method of construction had been chosen would have been excessive and would have been difficult to procure.

The dam is faced with pre-cast concrete blocks with a hearting of mass concrete containing "plums" of granite, some of which are over 5 tons in weight. These were cheaper than concrete and, at the same time, were an advantage inasmuch as they cut down the heat developed in the setting of the cement. Underneath the dam there is a cut-off trench which goes down to rock level and into the rock varying distances up to 30 feet. In addition, and below this cut-off trench, holes were drilled for a further 20 feet and pressures were applied to test the watertightness of the rock.

In view of the fact that as the water discharged from Ben Crom Reservoir must flow into the Silent Valley Reservoir, it is unnecessary to draw off water at different levels, hence the absence of a valve tower as incorporated in the Silent Valley Reservoir. A single outlet pipe fitted with control valves is therefore all that is required. This pipe is 27 inches in diameter and at its downstream side a jet disperser is inserted to break the velocity of the water being discharged and causing it to be discharged in the form of a spray, dissipating its energy, and so preventing the scouring of the overflow channel.

The top water level of the dam is 820 feet O.D. When the water reaches this level it overflows through four outlets at the top of the dam and discharges into the overflow channel to the lower reservoir.

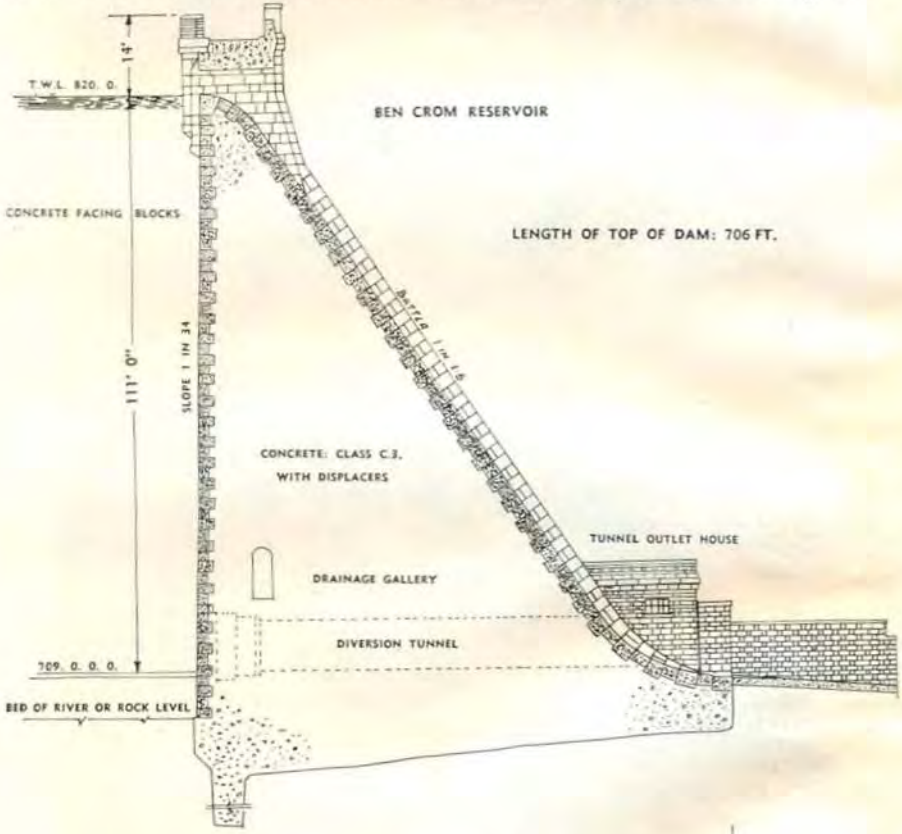
Ben Crom Reservoir

PHOTO BY J. W. L. SAVAGE, COLERAINE

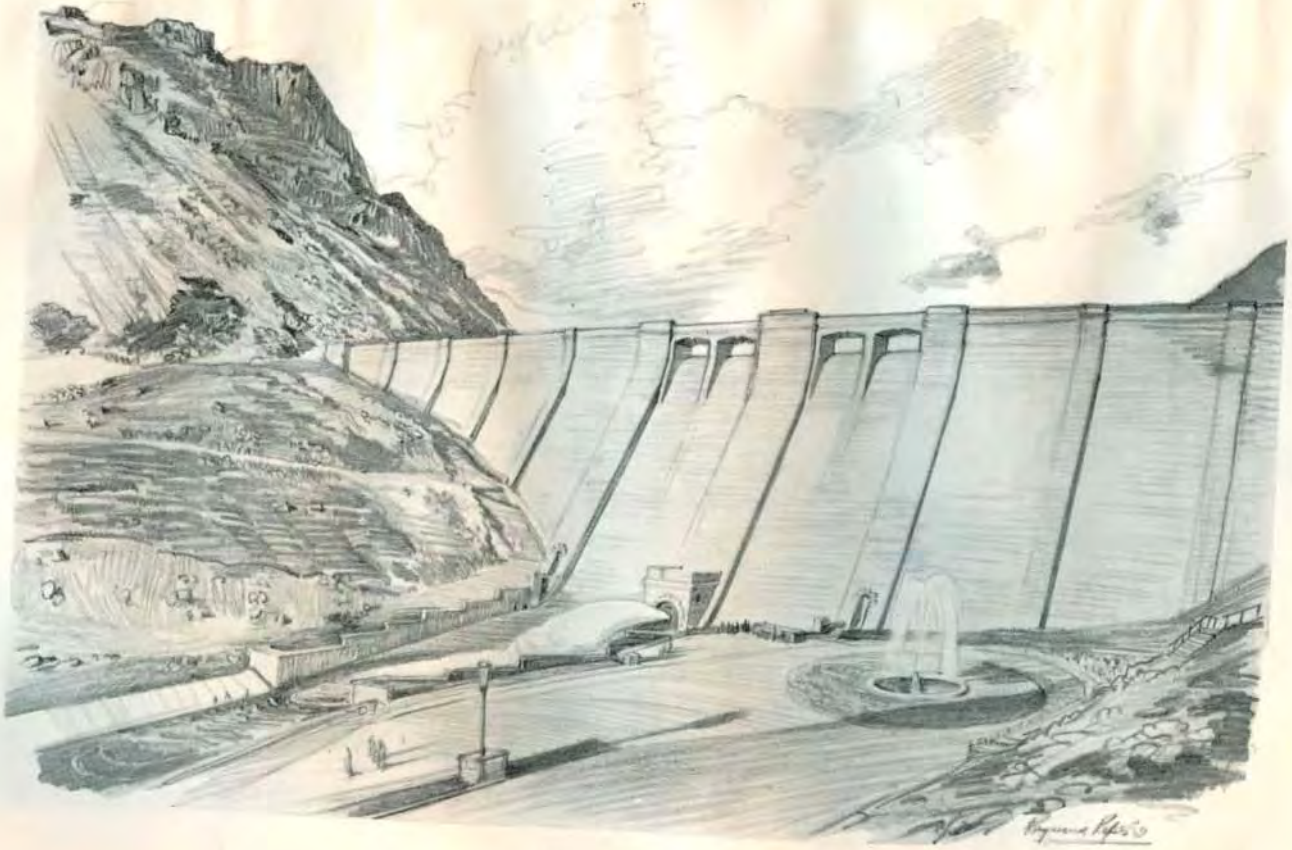
Another point of interest is the fact that inside the heart of the dam is situated a drainage gallery. The purpose of this is to provide for an outlet for water that might collect underneath the foundations of the dam. Beside the outlet pipe is situated a small generator to provide electricity to light the drainage gallery.

The work was carried out by Messrs. Charles Brand & Son Ltd., London, under the supervision of Messrs. Binnie, Deacon & Gourley, Consulting Engineers, of Westminster, London.

On the 2nd October, 1957, the opening ceremony was performed by the Chairman of the Board, Dr. Wallace Linton, in the presence of members of the Board and its chief officers, and a large company which included representatives of the Consulting Engineers and Contractors, who were afterwards entertained to luncheon by the Commissioners in the Silent Valley Reception Bungalow.



Cross Section Ben Crom



Ben Crom Dam

DRAWING BY RAYMOND PIPER

STRAINING EQUIPMENT

THE Mourne water carries such a small quantity of suspended solids that it does not require filtration, but in order to remove heavy particles, leaves, etc., it is passed through screens before entering the conduit to Belfast. These screens were of copper mesh on timber frames and had to be cleaned by hand.

When the water was diverted into the Silent Valley from the Annalong Valley it was necessary to construct a second aqueduct to provide for the additional flow. Rotary straining equipment manufactured by Messrs. Glenfield & Kennedy Ltd., Kilmarnock, was installed in the new screening chamber. The civil engineering work was carried out by Messrs. McLaughlin & Harvey, Ltd., Belfast, and completed in 1952.

The equipment consists of cylindrical drums covered with a stainless steel-woven fabric with a mesh of 6,400 apertures to a square inch. As the drums revolve they are washed by a series of jets of water impinging on the surface of the mesh which automatically cleanses them at each revolution. The motive power to drive the equipment is provided by Pelton Wheels operated by water drawn from the reservoir itself.

In 1957 a contract was placed with Messrs. D. R. Martin & Sons Ltd. for the renovation of the old screening chamber and for the installation of new Rotary screens in place of the existing hand-operated screens. These screens are similar to those installed in 1952 and referred to above, except that the fabric used is of a finer weave and has 100,000 apertures per square inch.

MOURNE SCHEME

Capital Cost Since Inception.

The cost of the Mourne Scheme including the purchase of a catchment area of approximately 9,000 acres and lands in fee; legal fees; compensation for easements; development of afforestation area; construction of roads, buildings (Superintendent's House, lodges, valve and screening chambers); Silent Valley Reservoir; Slieve Bignian Tunnel and intake works; Ben Crom Reservoir and aqueducts between Annalong Valley, Silent Valley and Belfast; the installation in triplicate of the syphon pipes between the Mournes and Belfast and of rotary screens, amounted to approximately £4,000,000.

This Plaque was unveiled by Mr. ERNEST REA, J.P., Chairman of the Board, on 27th May, 1959, to commemorate the completion of the Mourne Scheme.

The completion of the Ben Crom Reservoir marks the final stage in the development of the Mourne catchment of approximately 9,000 acres acquired under the Belfast Water Act of 1893. The various steps involved in the entire scheme were as follows: —

SECTION I: 1893 — 1901.

The construction of intercepting weirs across the Annalong and Kilkeel Rivers; an aqueduct tunnelled through the mountain-side between the two valleys connecting the waters of these rivers; a conduit 35 miles in length conveying the water into a service reservoir with a capacity of 100 million gallons constructed at Knockbreckan, about 5 miles from Belfast, and the laying of pressure mains from this reservoir into the city.

SECTION II: 1923 — 1938.

The construction of a storage reservoir, with a capacity of 3,000 million gallons, on the Kilkeel River in the Silent Valley and the laying of a second line of 38 inch syphon pipes in the Valleys along the route of the conduit to Knockbreckan. After unforeseen difficulties had been overcome, the Silent Valley Reservoir was completed and officially opened in 1933.

SECTION III: 1949 — 1958.

The original plans envisaged another storage reservoir in the Annalong Valley, but, in view of the difficulties experienced in the Silent Valley, it was decided to drive a tunnel 2¼ miles in length through Slieve Bignian to divert the water of the Annalong River into the Silent Valley Reservoir. Commenced in 1950, this tunnel was completed in 1952.

A second storage reservoir of 1,700 million gallons capacity was constructed in the Upper Silent Valley and this reservoir, named Ben Crom, commenced in 1953, was officially opened in 1957. The duplication of the aqueduct between the two valleys and the triplication of the syphon pipes along the conduit to Knockbreckan were carried out concurrently with the construction of the reservoir, providing for a supply of 30 million gallons of water per day to the City of Belfast and surrounding district.

SILENT VALLEY RESERVOIR

CUTTING OF THE FIRST SOD FOR THE FOUNDATION OF THE EMBANKMENT BY LORD CARSON OF DUNCAIRN 10th OCTOBER 1923

MEMBERS OF THE BOARD

WILLIAM J. SCARLETT, J.P., (*Chairman*)

EBENEZER McILROY, (*Deputy Chairman*).

DAVID ADAMS, J.P.	ROBERT ARMSTRONG
GEORGE CONDELL	WILLIAM COURTNEY
ALEXANDER P. DALZELL, J.P.	WILLIAM DOWLING
JAMES MISKIMMIN, J.P.	HUGH McALEAVEY
WILLIAM McCALLA	SAMUEL REA, J.P.
ROBERT SCOTT, J.P.	JOSEPH SHAW, J.P.

AND

Capt. A. G. McKENNA, J.P., R.A.M.C.

Chief Officials

SECRETARY

W. I. QUINN

ENGINEER FOR THE SCHEME

F. W. McCULLOUGH, J.P., M.I.C.E.

WATERWORKS ENGINEER

C. F. WHEELER, B.E., A.M.I.C.E.

ACCOUNTANT

D. McGARRIGLE

SOLICITOR

Major R. E. McLEAN

SILENT VALLEY RESERVOIR

OPENING CEREMONY

BY

HIS GRACE THE DUKE OF ABERCORN, K.G., K.P.
GOVERNOR OF NORTHERN IRELAND

24th MAY

1933

MEMBERS OF THE BOARD

SAMUEL REA, J.P., *(Chairman)*

J. GERALD KENNEDY, *(Deputy Chairman)*

DAVID ADAMS, J.P.
ALEXANDER DALZELL
WALLACE LINTON
W. J. SCARLETT, J.P.
ROBERT SCOTT, J.P.
HUGH R. WALSH
GEORGE CONDELL, J.P.
WILLIAM DOWLING
HUGH McALEAVEY
JOSEPH SHAW, J.P.
JOHN WILSON, J.P.
J. WHITEFORD RITCHIE, M.B., J.P.

AND

Capt. R. LILBURN HENDERSON

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W. I. QUINN, O.B.E.

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ACCOUNTANT

D. McGARRIGLE

SOLICITOR

Major R. E. McLEAN

WATER EXAMINER

Professor W. JAMES WILSON, M.D.

SLIEVE BIGNIAN TUNNEL

OPENING CEREMONY

BY

CAPTAIN THE RIGHT HONOURABLE
THE VISCOUNT BROOKEBOROUGH OF COLEBROOKE

C.B.E., M.C., D.L., M.P.

PRIME MINISTER OF NORTHERN IRELAND

28th AUGUST

1952

MEMBERS OF THE BOARD

WILLIAM SWEENEY, J.P., (*Chairman*)

JAMES N. W. RITCHIE, M.B., J.P., (*Deputy Chairman*)

WILLIAM COWAN, B.A., H.DIP.ED. — W. K. FITZSIMMONS, J.P., M.R.SAN.I.

WILLIAM GIRVAN — CRONAN F. HUGHES

T. COURTLAND HUNTER, J.P. — KENNEDY LEACOCK, O.B.E., J.P.

MALCOLM MERCER — H. TREVOR MONTGOMERY, F.C.A.

PATRICK McKEEFREY — ERNEST REA

JOHN WILKINSON — WALLACE LINTON M.B.

AND

Sir WILLIAM NEILL, D.L., J.P.

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SECRETARY

D. McGARRIGLE, O.B.E., J.P.

DEPUTY SECRETARY

NORMAN AGNEW

M.A., M.SC., PH.D., F.R.I.C.S., F.A.I., M.I.STRUCT.E., F.R.SAN.I.

CHIEF ENGINEER

R. E. D. BAIN

B.A., B.A.I., M.I.C.E., M.I.W.E.

ACCOUNTANT

JOHN L. PIRRET, A.C.I.S.

SOLICITOR

JAMES MACAULAY

BEN CROM RESERVOIR

LAYING OF THE FOUNDATION STONE

BY

HIS EXCELLENCY THE LORD WAKEHURST, K.C.M.G.
GOVERNOR OF NORTHERN IRELAND
8th OCTOBER
1954

MEMBERS OF THE BOARD

WILLIAM K. FITZSIMMONS, J.P., M.R.SAN.I., (*Chairman*)

ERNEST REA, (*Deputy Chairman*)

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WILLIAM GIRVAN	CRONAN F. HUGHES
WILLIAM J. LAWTHER, J.P.	KENNEDY LEACOCK, O.B.E., J.P.
MALCOLM MERCER	H. TREVOR MONTGOMERY, F.C.A.
WILLIAM SWEENEY, J.P.	JOHN WILKINSON, J.P.
WALLACE LINTON, M.B.	JAMES N. W. RITCHIE, M.B., J.P.

AND

Sir WILLIAM NEILL, D.L., J.P.

Chief Officials

SECRETARY

NORMAN AGNEW

M.A., M.SC., PH.D., F.R.I.C.S., F.A.I., M.I.STRUCT.E., F.R.SAN.I.

CHIEF ENGINEER

R. E. D. BAIN

B.A., B.A.I., M.I.C.E., M.I.W.E., A.M.T.P.I., A.M.I.C.E.I.

ACCOUNTANT

JOHN L. PIRRET, A.C.I.S.

SOLICITOR

JAMES MACAULAY

BEN CROM RESERVOIR

OPENING CEREMONY

BY

Dr. WALLACE LINTON

CHAIRMAN OF THE BOARD

2nd OCTOBER

1957

MEMBERS OF THE BOARD

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THOMAS A. CARRAGHER — WILLIAM COWAN, B.A., H.DIP.ED.

WILLIAM GIRVAN — CRONAN F. HUGHES

WILLIAM KEITH, F.S.A.A. — WILLIAM J. LAWTHER, J.P.

KENNEDY LEACOCK, O.B.E., J.P. — H. TREVOR MONTGOMERY, F.C.A.

JOHN N. ROBINSON, F.I.A.C. — WILLIAM SWEENEY, C.B.E. J.P.

WALTER J. WHITE, J.P. — JAMES N. W. RITCHIE, M.B., J.P.

AND

Sir WILLIAM NEILL, D.L., J.P.

Chief Officials

SECRETARY

NORMAN AGNEW

M.A., M.SC., PH.D., F.R.I.C.S., F.A.I., M.I.STRUCT.E., F.R.SAN.I.

CHIEF ENGINEER

R. E. D. BAIN

B.A., B.A.I. M.I.C.E., M.I.W.E., A.M.T.P.I., A.M.I.C.E.I.

ACCOUNTANT AND ASSISTANT SECRETARY

S. J. HARVEY

SOLICITOR

JAMES MACAULAY

CHAIRMEN OF THE BELFAST CITY AND DISTRICT WATER COMMISSIONERS SINCE THE APPOINTMENT OF THE FIRST ANNUAL CHAIRMAN UNDER SECTION 19 OF THE BELFAST WATER ACT, 1865.

1865	Robert Lindsay appointed Chairman on 3rd August, 1865.
1866	Robert Lindsay
1867	Joseph J. Murphy
1868	R. T. McGeagh
1869	Baldwin M. Mulligan
1870	Joseph G. Bigger
1871	Joseph G. Bigger
1872	John Moffett
1873	John Moffett
1874	John Moffett
1875	John Moffett
1876	Robert Dunlop
1877	Robert Dunlop
1878	Robert Carswell
1879	John Suffern
1880	Thomas Gaffikin
1881	Thomas Gaffikin
1882	William McCammond, J.P.
1883	William McCammond, J.P.
1884	William McCammond, J.P.
1885	William Trelford Coates
1886	William Trelford Coates
1887	Samuel Keatley
1888	Samuel Keatley
1889	William S. Carlile
1890	William S. Carlile
1891	Robert Corry
1892	Robert Corry
1893	Robert J. McConnell
1894	Robert J. McConnell
1895	Robert J. McConnell
1896	Robert J. McConnell
1897	John Laird
1898	E. Wakefield Pim, J.P.
1899	E. Wakefield Pim, J.P.
1900	E. Wakefield Pim, J.P.
1901	William Ross
1902	William Ross
1903	Alexander P. Dalzell
1904	Alexander P. Dalzell
1905	John H. Gault
1906	John H. Gault
1907	William Kerr
1908	Samuel Rea
1909	Samuel Rea
1910	James Hollywood
1911	James Hollywood
1912	James Hollywood
1913	William T. Braithwaite
1914	William T. Braithwaite
1915	Robert Wilson
1916	Robert Wilson
1917	John Courtney
1918	John Courtney
1919	James Miskimmin
1920	James Miskimmin
1921	William McCalla
1922	William McCalla
1923	William J. Scarlett
1924	Wiliam J. Scarlett
1925	Ebenezer McIlroy
1926	George Condell
1927	Joseph Shaw
1928	William Dowling
1929	William Courtney
1930	Robert Scott
1931	David Adams
1932	Wallace Linton
1933	Samuel Rea
1934	Alexander Dalzell
1935	John Wilson
1936	Hugh R. Walsh
1937	Samuel W. Allworthy, M.B.
1938	T. Courtland Hunter
1939	William F. Neill
1940	William F. Neill
1941	William F. Neill
1942	Herbert A. Porter
1943	William J. Chambers (died 30th May,1943).
1943	Thaddeus Lynch, J.P. (from 10th June for remainder of year).
1944	James N. W. Ritchie, M.B.
1945	Edward Purvis
1946	Thomas Hendron
1947	H. Trevor Montgomery, F.C.A.
1948	H. Trevor Montgomery, F.C.A.
1949	Thaddeus Lynch, J.P.
1950	Thaddeus Lynch, J.P.
1951	William Sweeney, J.P.
1952	William Sweeney, J.P.
1953	James N. W. Ritchie, M.B.
1954	William K. Fitzsimmons, J.P., M.R.SAN.I.
1955	William K. Fitzsimmons, J.P., M.R.SAN.I.
1956	Wallace Linton, M.B.
1957	Wallace Linton, M.B.
1958	Ernest Rea, J.P.
1959	Ernest Rea, J.P.


GRAPHS RELATE TO COMMISSIONERS' STATUTORY AREA OF SUPPLY ONLY
GALLS/HEAD/DAY
MILLION GALLONS
POPULATION IN THOUSANDS
POPULATION
GALLS/HEAD/DAY
AVERAGE DAILY CONSUMPTION
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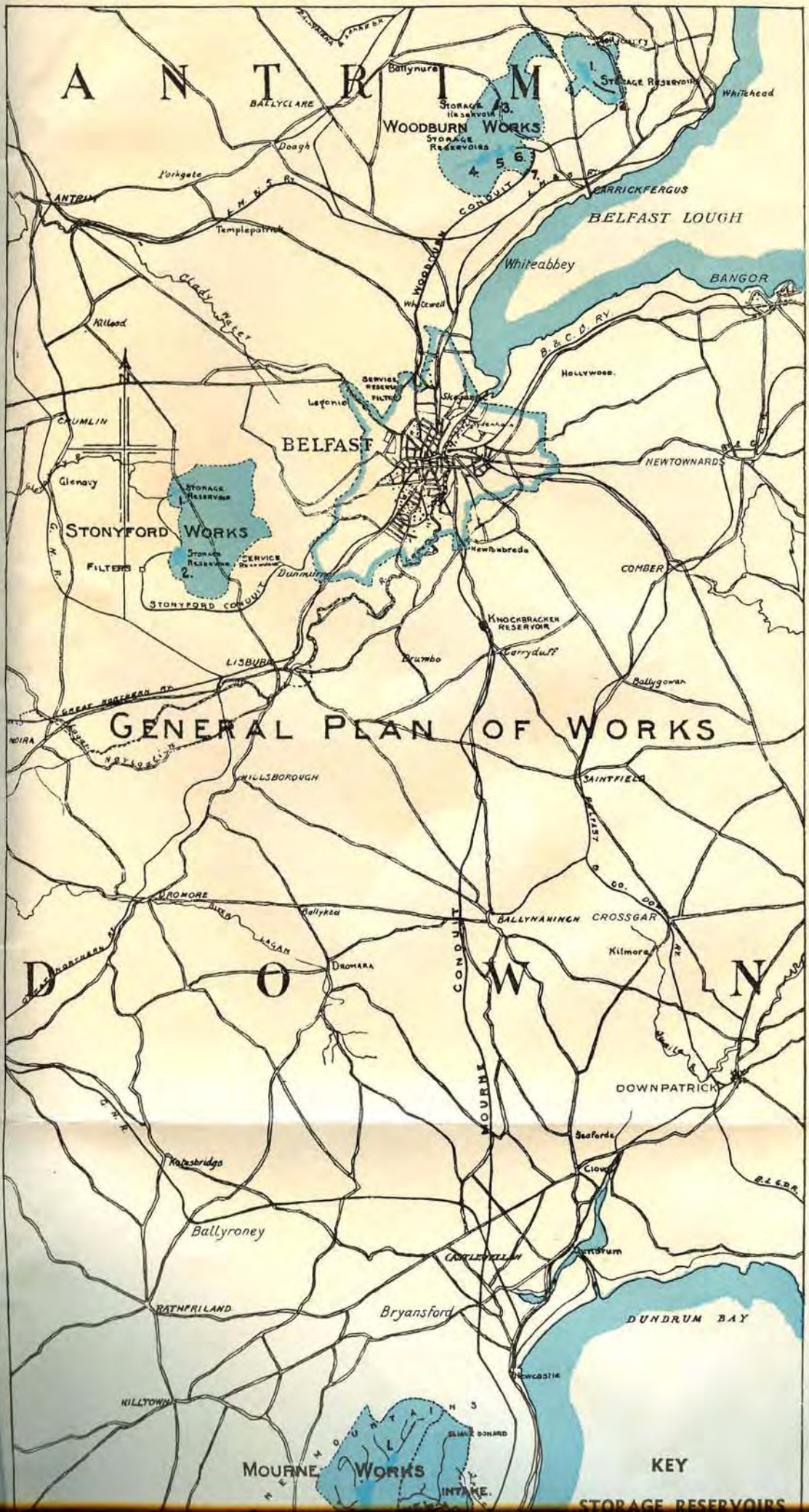
PRINTED AT BELFAST
by
NICHOLSON & BASS LTD

BELFAST WATER WORKS



2 COPELAND
3 NORTH WOODBURN
4 UPPER SOUTH WOODBURN
5 MIDDLE SOUTH WOODBURN
6 LOWER SOUTH WOODBURN
7 DORISLAND

STONYFORD WORKS

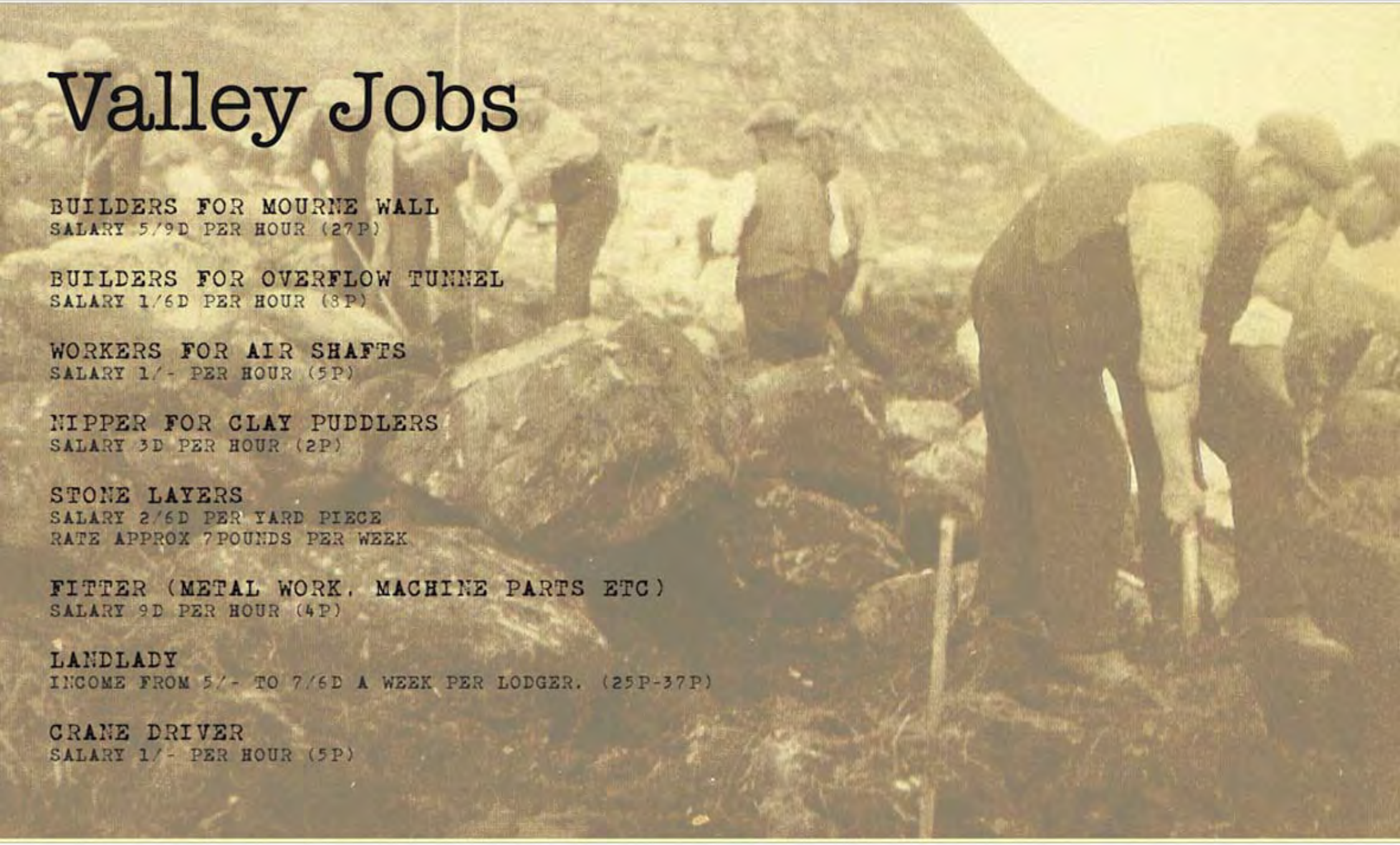
1 LEATHEMSTOWN
2 STONYFORD

MOURNE WORKS

1 BEN CROM
2 SILENT VALLEY

Scale of Four Miles to One Inch.

0 5 10 Miles



Valley Jobs

BUILDERS FOR MOURNE WALL
SALARY 5/9D PER HOUR (27P)

BUILDERS FOR OVERFLOW TUNNEL
SALARY 1/6D PER HOUR (8P)

WORKERS FOR AIR SHAFTS
SALARY 1/- PER HOUR (5P)

NIPPER FOR CLAY PUDDLERS
SALARY 3D PER HOUR (2P)

STONE LAYERS
SALARY 2/6D PER YARD PIECE
RATE APPROX 7 POUNDS PER WEEK

FITTER (METAL WORK, MACHINE PARTS ETC)
SALARY 9D PER HOUR (4P)

LANDLADY
INCOME FROM 5/- TO 7/6D A WEEK PER LODGER. (25P-37P)

CRANE DRIVER
SALARY 1/- PER HOUR (5P)

Types of Jobs

SITUATIONS VACANT

Builders for Mourne Wall

Job Title: To build 22 miles of wall over mountainous terrain. Work involves carrying heavy sacks of sand or cement up into the mountains and building the stone wall. The walk to work could be up to 8 miles alternatively workers can stay on the mountain during the week. Bring your own accommodation.
Suitable Applicant: Must be strong and very fit. Previous experience in dry stone wall building would be an advantage.
Salary: 5/9d per hour (27p).

Builders for Overflow Tunnel

Job Title: To build brick lined tunnel with 10lb bricks. Conditions in tunnel are cramped.
Suitable Applicant: Should have experience in bricklaying. Should not suffer from claustrophobia.
Salary: 1/6d per hour (8p).

Workers for Air Shafts

Job Title: To work in air shafts to depths of 180 ft. Air shafts are under pressure. Work involves excavation of shafts often working knee deep in water. 8 hour shifts.
Suitable Applicant: Only very fit healthy persons, under age of 40. Applicants will be subject to a full medical examination.
Salary: 1/ - per hour. (5p).

Nipper for Clay Puddlers

Job Title: To take orders from clay puddlers and to heel in the clay by continuously walking over it. Work is fairly strenuous as clay is very heavy and sticky. Boots are provided.
Suitable Applicant: Young fit persons. No previous experience required. Must be able to take orders!
Salary: 3d per hour. (2p).

SITUATIONS VACANT

Stone Layers

Job Title: To lay granite blocks on reservoir embankment.
Suitable Applicant: Should have prior experience in stone masonry and brick laying.
Salary: 2/6d per yard piece rate approx. £7 per week.

Fitter

Job Title: To work as a fitter in the site workshop. Work involves metal work, making parts for machines.
Suitable Applicant: Experience in metal working would be advantageous.
Salary: 9d per hour. (4p).

Landlady

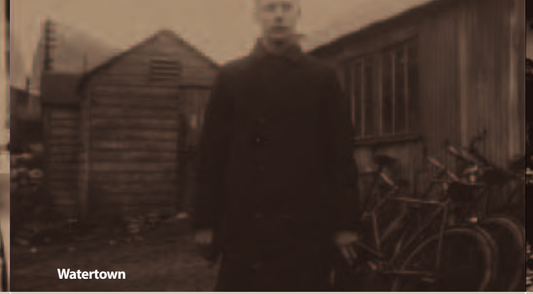
Job Title: Provide lodgings and meals for Silent Vally workers. Will require to rise about 4 am to make cooked breakfast and packed lunches, cooked evening meal must also be provided.
Suitable Applicant: Housewives with room in their homes for lodgers.
Salary: Income from 5/- to 7/6d a week per lodger. (25p-37p)

Crane Driver

Job Title: To operate a No.10 Ruston Excavator for the excavation of the reservoir bed. The current record is for filling 500 wagons a day.
Suitable Applicant: Experience in working excavators would be an advantage.
Salary: 1/ - per hour. (5p).

Mourne Wall

Power Station



Watertown

Cut off trench shafts

The Silent Valley Scheme

Mr. Luke Livingston Macassey, Consultant Civil Engineer, who was local to Northern Ireland, was asked in 1891 by the Belfast City and District Water Commissioners (BCDWC) to find a future source of water for Belfast. He recommended the Mournes with a supply drawn from the Kilkeel and Annalong Rivers and a storage reservoir to be built later in the Silent Valley. The Mournes were chosen because of the quantity of water available and its purity.

Mr. Frederick William McCullough, Chief Engineer to BCDWC, drew up the design for Silent Valley Reservoir, but died before it was completed. Later Mr. McCullough's son, **Mr. Richard Hamilton McCullough**, also became Chief Engineer to the BCDWC.

Stage 01 **1893-1905**

Purchase 9,000 acres (3,600 ha) of "water catchment area" in the Mourne Mountains and build a 22 mile (35km) boundary wall.

Divert water from Kilkeel and Annalong Rivers and convey it 35 miles (57km), via conduits, tunnels and pipelines to a new holding reservoir at Knockbrekan, near Belfast.

The Mourne Wall

In 1904 work began on the building of the famous Mourne Wall to define the boundary of the 9,000 acres (3,600 ha) catchment area. It stands 3m high and 1m wide, stretching for 22 miles (35km) and runs over the 17 peaks in the Mourne mountains.

- Work was carried out during April to October providing employment to men in the area skilled in the granite cutting craft.
- Work finished in 1922, taking 18 years to build. It is said to be, "a monument to the skill of the men who built it."
- The wall is a listed building.

Map of Watertown

1. Quarry
2. Steam Turbines (Electricity Generators)
3. Inspection Pits for Steam Engines
4. Pug Mill where puddling clay was ground-up
5. Platforms for trains
6. Workshops
7. Narrow Gauge Railway up to Quarry
8. Offices
9. Narrow Gauge Railway line to Annalong
10. Workers' Houses
11. Tennis Court
12. Shops
13. Recreation Hall
14. Original Entrance

Watertown

- Built on the western side of the valley along the "Back Road".
- Many workers were local - carpenters, electricians, plumbers, engineers.
- Home to 600-700 people, it developed into a well planned small pioneering town.
- A total of 2,000 people lived here over the completion period.
- Wooden houses held accommodation - houses for families, foremen and dormitories for single men. At the end of the construction the houses in 'Watertown' were sold off.
- Women kept lodgers, eg **Mrs Collins** housed 12 men who slept in one room.
- Women made porridge, left it outside overnight and cut it into slices for the workers' lunch or "piece" as it was known.
- A small hospital with a doctor and a nurse catered for the sick.
- A recreation hall accommodated dances, boxing, snooker competitions and acted as a "silent movie" cinema.
- **Hugh Fitzsimons** was the manager of the social club in Watertown and his son Benny grew up there with most of his brothers and his sister.
- Shops ranged from grocery and hardware to boot mender.
- A blue van, the "Tin Lizzie" would take people to Kilkeel on Fridays and Saturdays for any extra stocks they needed.
- Supplies of fresh milk provided daily. **Kathleen Rooney** rode her bicycle strapped with two big cans of milk.
- A generator provided the first street lights in Ireland - original vacuum lamps.

Stage 02 **1923-1933**

Construction of Silent Valley, an impounding storage reservoir, with a capcity of 3,000 million gallons (13,620 million litres).

The dam cut off trench

- In an earth filled dam a cut off trench is required below the dam to prevent water from seeping under the dam and undermining it.
- Two critical problems were encountered during the excavation of the dam trench at Silent Valley:

  (1) the subsoil was unstable wet silt

  (2) the solid bedrock which was originally hoped to be found at 15m, was not located until a maximum depth of 60m was reached. The initial tests hit large boulders which were discovered to have been brought from Scandinavian glaciations.
- **Sir Ernest Moir**, the Senior Director for Pearson Ltd., decided to dig the trench by working in compressed air. The contract was renegotiated and work continued.
- Shafts, lined with cast iron, were sunk into the ground 11m apart by working in compressed air. Using the shafts the water was then pumped out from the waterlogged silt. The shafts were connected by a trench which was then filled with concrete.
- A specially made air lock "the Gazoon" was used to de-climatise the men from compressed air and so avoid "the bends".

NI Water would like to acknowledge its partners in this project.

This project has been part-funded through Northern Ireland Tourist Board's Tourism Development Scheme. The European Agricultural Fund for Rural Development: Europe Investing in rural areas. The Rural Development Programme 2007 - 2013 is part financed by the European Agricultural Fund for Rural Development and the Department of Agriculture and Rural Development.

Northern Ireland Water
PO Box 1026, Belfast, BT1 9DJ

Email: waterline@niwater.com
Waterline: 08457 440088
Text Phone: 08457 023206
www.niwater.com

The embankment

Above the dam trench, a watertight corewall of "puddle clay" was painstakingly built up layer by layer to prevent seepage of water through the dam. The embankment slopes were then completed with "graded rockfill", soil and grass layered on top, with a granite block surface to the reservoir side.

The workers had a sense of purpose and pride in their jobs and a few nicknames tell the story:

John Burden - 'Johnny the Hut' built himself a lamp shaped like a hut to light his way home through the mountains after dark.

Jimmy McKibben - 'The Clay Hog' worked as a "clay puddler" on the embankment wall. This involved marching up and down pressing the air bubbles out of sticky clay to make it waterproof. Men were issued with a pint of linseed oil per day to prevent their boots sticking in the clay.

Dozer Nolan - 'Dozer' worked as a "nipper" on the steam engines, he once wired a chap's tin tea mug up to a live cable for a joke.

Dan Dooley - the crane driver who set records for his speed and skill at working the steam excavator.

Constable Lawless - kept law and order.

Stage 03 **1949-1958**

Build 4km tunnel - Slieve Bignian Tunnel - through Slieve Bignian Mountain to divert the water from the Annalong River into Silent Valley.

Build Ben Crom Reservoir further upstream of Silent Valley.

Bignian Tunnel

- The tunnel linking Annalong with Silent Valley through Bignian (Binnian) Mountain, took 4 years to build, using power drills and simple chisels.
- It is 4km long, 2m high and 2.4m in width.
- It can carry up to 90 million gallons (409 million litres) of water per day into Silent Valley.
- The tunnel was built by Messrs A.M. Carmichael, Edinburgh. Two assistant BCDWC engineers who worked on the Bignian Tunnel were **Harold McCaughan** and **Norman Ervine**. Two groups worked towards the tunnel's completion, working from either side of the mountain: one from Annalong, the other from Silent Valley. They met in the middle, only 5cm apart.
- **Sam McMurray's** job was to record the levels of the contour lines of the surrounding land from Silent Valley to Dunnywater. This determined the height of the two tunnel mouths.
- At the tunnel mouth, near the head of the Valley, an electric pump ran to keep the works from being flooded.

Quotes from the workers of the Bignian Tunnel

I remember my father left home in Ballykeel at 4.30am each morning to cycle 4 miles to the "Valley" gates. They were all on a day shift, so for 6 months a year the only time they saw daylight was on a Sunday.
Robert Newell

A great attraction to work on the tunnel was that the pay was around half a crown an hour which was 3 pence more than local quarrying work paid. Although some of us stuck with the job for its entire duration, many men only stayed a few weeks or even days, unable to put up with the heavy work and awful conditions.
Sandy Heaney (Shift Boss)

I put the first hole that brought daylight between the two sides. I drilled that hole...there was about an inch and a half between mine and the hole from the other side.
Willy Davy (Shift Boss)

I didn't stand in to the siding when the first shot went off and I was blown this way and that...all over the place. The blast force was tremendous. By God I stood into the side the next time.
Bobby Davy (Spanner)

Even an hour after the blast you could hardly see or breathe for the "stour". We were spitting diesel and dynamite for weeks. The only fresh air you got was what came down the tunnel.
Tom Newell (Electrician)

About half way in we ran into flowing sand. It was unbelievable... who'd have thought in the middle of a mountain you'd have found running sand? That was a major set back that was to hold us up by 6 months.
Harold McCaughan (Engineer)

Ben Crom Reservoir

In 1954, 5km upstream from Silent Valley, work started on a new reservoir and took 3 years to complete. Unlike Silent Valley, it had a core of mass concrete and huge boulders and was founded on solid rock. It is known as gravity dam i.e. it depends on its weight for stability.

Tragedies during the Construction

A sobering side to this story of human achievement is that some workers paid the ultimate price, losing their lives in tragic accidents.

Jimmy Baines was found at a stone crushing plant, apparently having fallen from a concrete staging

Sam Cooke passed away when a rope holding a skip full of concrete broke above him

John Cousins was caught between two wagons when a locomotive moved them

William Forsythe was fatally injured when timber staging for tipping concrete collapsed

John Murphy was only 18 years old when he lost his footing climbing out of a trench

George Philips was a rope runner on the railway who developed a fatal infection from a leg wound sustained while jumping onto a moving train

Hugh Quinn was a pump man who drowned in a flooded shaft

Michael Synott's steam crane overturned but he managed to save the life of his workmate, pushing him from harm's way

Jim Moore was the one worker to lose his life in construction of Ben Crom dam, crushed by stones whilst working in a hut during blasting

northern ireland water

Life and Times at Silent Valley

SILENT VALLEY – General Details

Description of reservoir

Silent Valley reservoir is formed by the impoundment of the Kilkeel River with a straight earth embankment which was completed in 1932.
The reservoir has a capacity of 13,276 Ml and a surface area of 97 ha at a top water level of 149.60 mOD.
The dam is aligned almost East-West and the reservoir extends 3.0 km to the North.

9.2 Geology of dam

The dam is built across a deep glaciated 'buried' valley with unconsolidated deposits of river and morainic Sands and gravels containing large boulders overlying granite bed rock.

9.3 Catchment

The 1206 ha of direct catchment is made up of rugged mountain terrain. It is supplemented by the overflow from Ben Crom Reservoir and also by the Annalong River via the Slieve Binnian Tunnel which is supplied by a catchment of 939 ha in area.

Item Direct Catchment
Area ha 1206
Max Elevation m OD 743
Long Term Average Annual
Rainfall
1660
Period of Recorded Rainfall 1941 – present
Slopes of ground surface Steep
Nature of surface Rocky and peaty mountain terrain
Details of aqueducts and controls
Slieve Binnian Tunnel

9.4 Dam details

The dam, which was first filled in 1932, is a straight earth embankment 496 m long.
The maximum height above ground level of the 4.57 m wide crest is approximately 25m at a level of 152.30 mOD Belfast. A substantial masonry wave wall runs along the upstream side of the paved crest with a top level of 153.00 m.
The dam has a downstream grassed slope of varying gradient as shown below:-
Level (mOD) Gradient
Crest – 144.34 3:1
144.34 – 138.30 4:1
138.30 – 132.26 5:1
The dam has an upstream slope of varying gradient and protection as shown below:-
Level (mOD) Gradient Protection
Crest – 143.48 3:1 600 mm deep with 330 mm to 450 mm granite blocks from wave wall base down to 141.96 m
143.48 – 137.39 4:1
137.39 – 131.29 5:1 750 mm thick beaching from 141.96 m down to a heavy 750 mm thick rubble toe at foundation level
131.29 – Foundation 6:1
The central puddle clay core is 2.44 m wide at 0.75 m below crest level and battered out at 1:10 down to foundation level.
The puddle core is flanked by selected fill.
The cut off is formed by a concrete filled trench into rock and incorporates the cast iron segments used in the temporary works to achieve a dewatered trench using compressed air.

BEN CROM - General Details

Description of reservoir

Ben Crom Reservoir is formed by the impoundment of the upper reach of the Kilkeel River with a straight mass-concrete gravity dam which was completed in 1957.
The reservoir has a capacity of 7721 Ml and a surface area of 28.0 ha at a top water level of 247.19 mOD Belfast.
The main dam is aligned North West to South East and the reservoir extends 2 km to the North, North East.

9.2 Geology of dam

The reservoir is situated in an ice deepened valley and the dam is founded on granite.

9.3 Catchment

The 939 ha of direct catchment is made up of rugged mountain terrain.

Item Direct Catchment
Area ha 939
Max Elevation m OD Belfast 727
Long Term Average Annual
Rainfall (mm)
1765
Period of Recorded Rainfall 1941 – present
Slopes of ground surface Steep
Nature of surface Rocky mountain terrain
Details of aqueducts and controls
None

9.4 Dam details

The dam, which was first filled in 1957, is a straight mass-concrete gravity dam 215 m long and formed in 15 blocks.
The maximum height above ground level of the 3.76 m wide crest is approximately 37.8 m at a level of 250.24 mAOD. A reinforced concrete wave wall runs along the crest with a top level of 251.46 mOD.
The dam has a downstream slope of 1 horz: 1.5 vert and an upstream slope of 1 horz: 30 vert.
The concrete cut off trench was grouted up to 20 m deep.

9.5 Details of modifications, remedial works and history

There have been no significant modifications or remedial works.
Instrumentation for the monitoring of settlement, alignment, joint movement, uplift pressures and seepage flows was installed in 1990.

9.6 Overflow

The straight profiled concrete surface overflow weir in four sections totalling approximately 22 m in length is located at a level of 247.19 mOD centrally within the dam. The weir discharges to a tapered tailbay, into the Kilkeel River and hence into the Silent Valley reservoir 2 km downstream.