MUNICIPAL ENTERPR1SE.

HYDRO-ELECTRIC INSTALLATION.

Bay of Plenty Times, 19 October 1915

Tomorrow Tauranga will celebrate quietly the completion of the Hydro-electric Works for the Tauranga Borough on which Messrs H. W. Climie and Son have been engaged, in conjunction with other borough works, for the past two years. The Hon. W. H. Herries, Minister for Railways, and Parliamentary representative for the district, is visiting Tauranga for the occasion, and to-morrow morning is to be taken out to Omanawa to view the headworks. In the evening a banquet will be held in the Coronation Hall.

As the scheme is a highly important one for Tauranga, and as time goes on will be for the whole district, a brief description of the works will be of interest. We are indebted to Mr H. R. Climie for the necessary particulars.

Before the proposal for the hydroelectric scheme was placed before the ratepayers, arrangements were made by Mr B. C. Robbins, the then Mayor, and the Council in office at that time, to have the country within reasonable distance of Tauranga thoroughly examined to determine the best source from which to derive the energy. Tauranga County possesses a number of water powers of considerable size. After a preliminary investigation of the most important of these, the Council's engineers (Messrs H. W. Climie and Son), recommended the harnessing of the Omanawa Falls this, in their opinion, being the most suitable for supplying Tauranga and the surrounding district with electric light and power.

The Omanawa stream is an important tributary of the Wairoa River, which it joins about six miles from its mouth, and about eight miles from Tauranga near the junction of the Cambridge Road with that to the Omanawa Settlement. The valley from which the Omanawa Stream emerges soon changes its character, until at the Falls, seven miles above the confluence, it is a narrow precipitous gorge four hundred feet deep, the steep slopes covered with birch, and the bottom with fern trees which grow luxuriantly among the huge boulder, over which the stream flows in a series of rapids to the quieter reaches below.

At the falls the stream takes a leap of seventy-five feet into a small lake about five chains in diameter and of great depth, its rocky sides covered with moss and over-hung by groves of tree ferns. At the back and under the lip of the falls, a huge cavern has been hollowed out by the water, into which the, spray is flung and

converted into rainbow colours by the sun. The cliffs rising sheer up on all sides to a great height form an impressive frame for a beautiful picture. A series of smaller falls and rapids, interspersed with quieter stretches, continue for miles further inland.

Access to the falls is obtained by means of a branch road about thirty chains long, which leaves the County road at the tramway viaduct about twenty chains north of the Omanawa Settlement. The road runs down the bottom of a gully and falls 200 feet in its short length. ,The last ten chains of this road runs through the bush at a grade of 1 in 5, and parties visiting the falls should leave their cars or other vehicles where this steep grade begins.

The road, after passing through a rocky cutting, merges into a path blasted out of the cliff side, with the falls almost 200 feet sheer below. A stout hand railing has been erected along this ten chains of track to give the additional confidence and support usually required when traversing it for the first time. This track terminates in a subterranean passage which runs down for several chains through the rock on a circular curve, and at a grade of one in one. Concrete steps and a handrail make the descent to " Avernus" easy, though the sound of falling, rushing water may cause some apprehension. One again emerges into daylight, but the steps continue for some distance, until in turning the corner one comes suddenly upon the power-house, and finds oneself almost at the foot of the falls.

The power house is discovered to be a cavern accurately cut out of the cliff. It is nineteen feet wide, fifty feet long and has a height of nineteen feet in the centre of the parabolic arch. The outer end is closed with a concrete wall of the same parabolic shape as the power house, and well provided with windows of neat design with iron sashes, and with a door sufficiently wide to admit all machinery required. The power house has been lined with three inches of concrete to a height of eight feet. The floor is also laid down in concrete, which for half its width constitutes an arch over the tail race. This is a chamber cut out of the rock for half the length of the power house, and to a depth of eighteen feet below the floor level, with five feet of water in the bottom into which the turbines discharge. This water finds an outlet to the lake below the falls through a tunnel eight feet high and eight feet wide, across which a weir has been constructed to check the amount of water passing through the turbines.

In the tail race a system of ferroconcrete columns and beams support a large steel pipe which lies in a horizontal position beneath the power house floor, and supplies the turbines with water under high pressure. In the branches to the

turbines from this distribution pipe are placed large valves, which can be operated through gearing by means of a hand wheel in the power house. These valves control the supply of water to the individual turbines. Two turbines have been installed at present, but space has been provided in the power house, and the distribution pipe so arranged, that a third unit (of twice the size if necessary) can be installed at a later date.

The turbines have an output of 150 brake horse power, at a speed of 750 revolutions per minute. The turbines are of the Francis reaction type with casing? of the cast iron spiral pattern. The turbine wheel—the part of the machine which transforms the water power into rotational mechanical energy—is only about fifteen inches in diameter. It is made of bronze, as are also the internal movable guide vanes which direct the water upon the turbine wheel, and throttles it clown when full power is not required. This throttling movement is transmitted to the guide vanes through a system of. shafts and levers, from a piston moving in a cylinder, to which oil under high pressure is admitted, through a system of valves by means of a sensitive governor.

This oil pressure governor automatically controls the speed within very small limits. It is an intricate piece of mechanism. Each turbine is provided with a fly wheel, to which is attached a flexible coupling to transmit the power directly to the electric generators. The generators are of the alternating current three-phase type. Each is provided with a direct coupled exciter, which is capable of exciting the magnets of both generators under full load. A breakdown in an excitor does not therefore put the whole unit out of operation.

The current is brought in underground cables from the generators to the switchboard, which extend for twelve feet partially across the front end of the power house. It consists of six marble panels, two inches thick and seven feet six inches high. Two of the panels each control the current from one generator, another two each control a step-up transformer, on the fifth panel is mounted a Tirrel automatic voltage regulator, and the sixth panels, on which the telephone gear is at present mounted, is a spare one provided for controlling the third generator whenever it is installed.

A space about twelve feet square at the back of the switchboard, enclosed with high wire woven screens, accommodates the step-up transformers, high tension oil switches, etc. These transformers are required to increase the pressure from 400 volts, at which the current is generated, to 11,000 volts, so that it can be transmitted to Tauranga with the least expenditure on copper and loss of power.

The switches which control the high pressure current operate in tanks filled with oil, and are also placed in concrete cubicles to eliminate all fire risk etc. They are operated from a distance through a system of bell crank levers. The large steel pipe which is seen disappearing up a vertical shaft at the back of the power house, brings down the water from the supply tunnel ninety feet above to the turbines. The pipe is forty-two inches in diameter and its capacity is sufficient to supply two or three times the amount of power at present installed.

Access to the supply tunnel is obtained by means of several flights of steps, which branch off the main stairway at the outlet of the access tunnel. The supply tunnel terminates in a large concrete chamber twenty feet high and ten feet wide. This constitutes the forebay. The concrete is very strongly reinforced with steel, so as to safely withstand the heavy pressure it may be called on to sustain during floods. A revolving net strainer, ten feet wide and seventeen feet long, has been placed in the forebay, and is supported on a system of heavy steel joists and channels. This strainer prevents all leaves and other debris brought down by the water from entering the turbines.

From the forebay a tunnel, six feet high and four feet wide, has been blasted through the cliffs for a distance of nine chains, where it meets the stream above the falls. The original proposal was to take the water from just above the falls, but it was afterwards considered advisable to take advantage of the additional thirty feet of fall which could be obtained by extending the tunnel some five or six chains higher up the stream. The total fall now utilised is 109 feet.

The water is drawn off the stream from a deep pool, just above the rapids, which from a natural weir that diverts the water into the supply tunnel.

The intake is protected from floating logs, etc., by a large grating made of old rails. Behind this has been erected a large cast iron headgate with a waterway four feet square. The sliding faces are of gun metal. This valve is operated through gearing from a concrete valve house placed fifteen feet above normal water level. A manhole has been provided to give access to the tunnel when the valve is closed.

A track has also been benched out of the rock along the stream to give access to the intake from the forebay.

Owing to the .probability of large columns of rock becoming detached and falling down into the gorge, it was decided to put the transmission cables underground, as well as the power house, until open country was reached. The

underground cable is about twenty chains long, is about 2.5 inches in diameter, and weighs over four tons. It consists of heavy insulated strands lead-sheathed and armoured with steel tape. It is carried over the stream above the falls in steel pipes about thirty feet above the water. It then passes up the eastern slope through the bush and terminates in the lightning arrester- station, a small galvanised iron house, from which the overhead transmission line commences.

The transmission line consists of 3—No. 8 copper wires, supported on natural round ironbark poles, ten inches at the butt, 35 feet long and spaced on the average 100 yards apart. The poles also carry a telephone circuit. The line is about 13.5 miles in length. The first three miles are across country, both the Kopuererua and Tau Tau gorges being traversed in this distance before the Pye's Pa Road is reached. The line enters the town along the Waikareao Estuary and terminates in a sub-station at the western end of Wharf Street.

The sub-station is built entirely of ferro-concrete. It accommodates two step-down transformers, high tension oil switches, lightning arresters of the multigap shunted type, and a switchboard for controlling the transformers and the supply of current to the low tension distribution lines and street lighting circuits. The building has been made large enough to accommodate more apparatus when re-quired. The distribution lines are divided into two distinct net works, one extending from the Spit to the Fifth Avenue and supplied with current from .the sub-station, the other from the Fifth Avenue to the Southern boundary of the Borough and supplied from a step-down transformer fed from the high tension transmission line near the Eleventh Avenue. The two networks are arranged for inter-connection if found necessary.

Under the original scheme it was proposed to reticulate the Borough only as far south as the Fourth Avenue. It was considered advisable, however, to extend the lines right throughout the Borough so that anywhere a supply could be given merely by putting in the service connection. Eleven miles of distribution lines have been erected. To do this some forty miles of cables were required and. over 400 poles.

The Electrical Construction Company of Auckland were the contractors for the hydro electric equipment at the power house and sub-station, The turbines and governors were manufactured by Escher Wyss of Zurich, the generators and transformers by the British Electrical Engineering Company. Loughborough, the switchboards by Johnson and Phillips, London, and the lightning arresters by the

General Electric Company of U.S.A. For the other parts of the works contracts were let for the supply of materials, and the erection was done by day labour.

MUNICIPAL ENTERPRISE.
BAY OF PLENTY TIMES, VOLUME XLIV, ISSUE 6517, 19 OCTOBER 1915

Transitioned to an easier to read form by David de la Hyde - August 2018