THE BRIDGE RIVER POWER DEVELOPMENT

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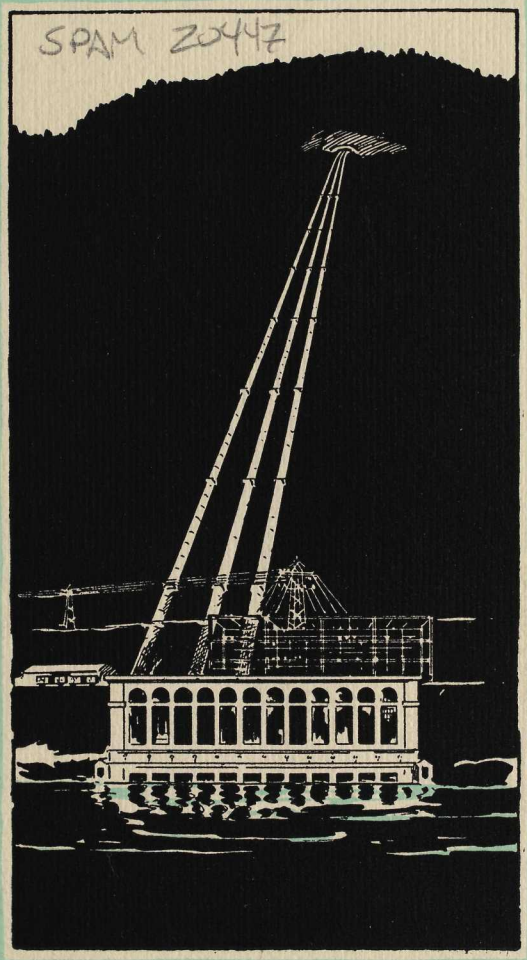

BRITISH COLUMBIA ELECTRIC RAILWAY COMPANY LIMITED

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THE BRIDGE RIVER POWER DEVELOPMENT

POSSIBLE 600,000 horse-power, a tunnel two and a half miles long, water at 500 pounds pressure to the square inch dropping 1,200 feet into a power-house, power transmitted at 220,000 volts: these are some of the features of the Bridge River Power Development of the British Columbia Electric Railway company. It will generate enough electric power to serve Vancouver and the lower mainland for the next generation. By this development, the British Columbia Electric Railway company, is pledging itself to take care of whatever demands for electric power may arise.

BRIDGE RIVER POWER DEVELOPMENT
BRIDGE RIVER DEVELOPMENT
BRIDGE R.
DAM
POWER PLANT
SETON LAKE
ANDERSON L.
LILLOOET
D'ARCY
LILLOOET RIVER
FRASER RIVER
LILLOOET LAKE
LILLOOET RIVER
TRANSMISSION LINE
ALTA L.
SQUAMISH R.
SQUAMISH
BRITANNIA
HOWE SOUND
PITT R.
HARRISON LAKE
LAKE BUNTZEN POWER PLANTS
ALOUETTE POWER PLANT
VANCOUVER
DIAMOND HANEY
STAVE FALLS POWER PLANT
RUSKIN POWER PLANT
NEW WESTMINSTER
FRASER RIVER
CHILLIWACK
NANAIMO
NANAIMO R.
LADYSMITH
INTERNATIONAL BOUNDARY
BELLINGHAM
ORCAS I.
BAMBERTON
GOLDSTREAM POWER PLANT
JORDAN RIVER POWER PLANT
VICTORIA

IN a growing community like Vancouver, there is never any cessation in the planning of future electric power facilities. As fast as one unit is completed, another is started upon and so the endless process goes on.

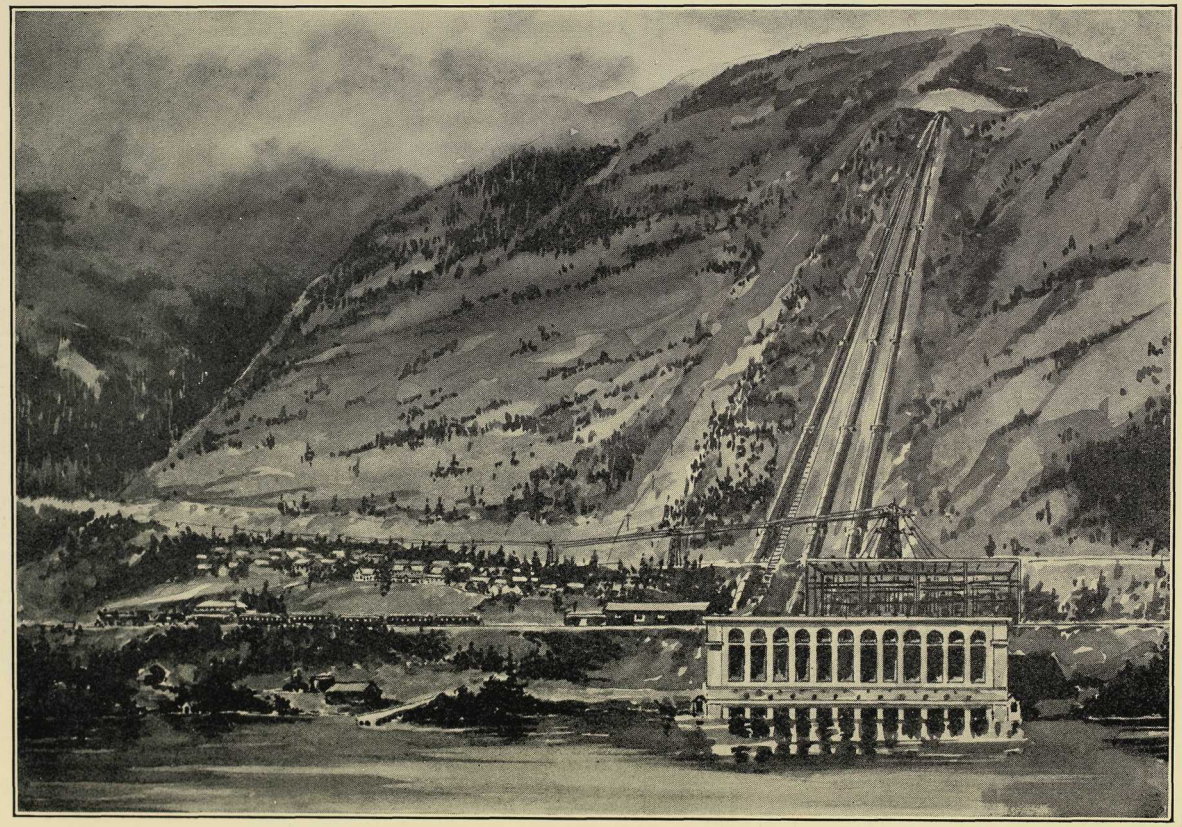
THE FUTURE POWER SUPPLY OF VANCOUVER

Back in 1925, the British Columbia Electric Railway company was completing the enlargement of its Stave Falls plant, now with a capacity of 80,000 horse-power. Here was power, one might think, sufficient for the needs of Vancouver and district for many years.

Yet at that time, the announcement was made that the B.C. Electric would develop the immense Bridge River project with its possible 600,000 horse-power. The initial development was announced to be 54,000 horse-power which will cost approximately $14,000,000, while 216,000 horse-power is estimated to cost approximately $30,000,000. Owing to the magnitude of the project the cost of the ultimate development has not yet been worked out in detail. One might have been excused for wondering why more power development was needed when the Stave Falls plant had just been enlarged by 25,000 horse-power and another plant of 12,000 horse-power coming in.

It is because public utilities must look ahead many years, not only because power plants take two, three or even more years to build but because transmission and distribution systems must be planned with a view to future additions and future public needs.

Five years is a short time in the planning of power supply. With the demand for power growing steadily, the B.C. Electric knew that by 1931, additional power development would be required. But no power company could begin a year or two before that date and look for a power site.



The Bridge River power plant as it will look when completed.

LOOKING AHEAD

Besides the actual construction work, there must be exhaustive surveys of all possible power sites to select the best; that is, the most economical. All this work takes time. In the case of Bridge River, the very magnitude of the project called for more time than usual. Here was a water power a hundred miles and more away from the nearest base of supplies, where a complete town and all the means of subsistence, travel and comunication had to be established before anything could be done.

Bridge river power, then, was to be developed by the British Columbia Electric Railway company and in a year or two it will be flowing into Vancouver in an ever-increasing quantity.

The existence of a huge potential water power on Bridge river has been known to engineers for about nineteen years, but so great was the project and so heavy the necessary investment that development was not economically feasible until Vancouver had reached its recent stride.

It is interesting to note that about fifteen years ago, the holders of the water rights offered them to the city of Vancouver for development but the offer was not taken up. Bridge river power awaited the growth of Vancouver and the resources of a company the size of the British Columbia Electric Railway company before it could be developed.

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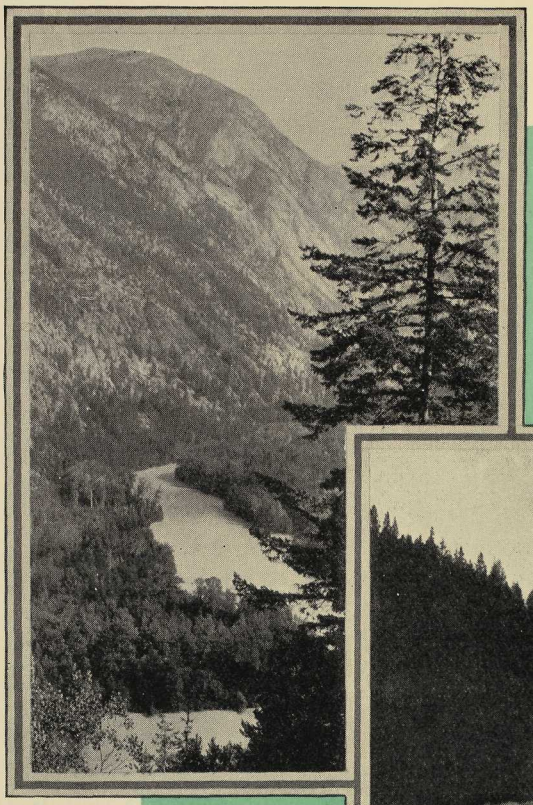
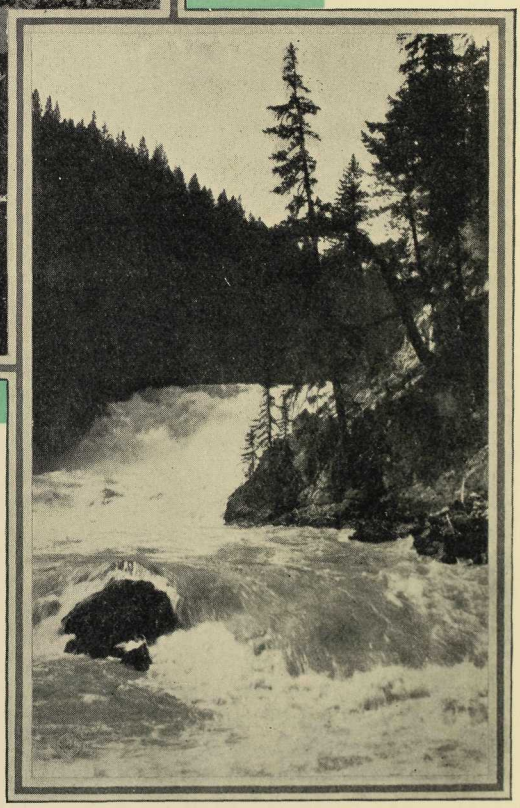
The decision of the B.C. Electric to take up Bridge river came after two years had been spent on surveying the project and all the other available water powers adjacent to Vancouver. Engineers made minute examinations of the scheme, estimating the cost in detail, locating sites for dams, surveying the route for the transmission line and generally settling upon the feasibility of the project.





Above: Bridge River from the Mission Mountain road.

Below: La Joie Falls, site of a future dam some thirty miles up Bridge River.

At the same time, they surveyed all the other water power sites which might have been developed, comparing the cost per horse-power and the ultimate capacity; and coming to the conclusion that Bridge river was the best one to develop.

PRELIMINARY SURVEYS

Not content with the decision of its own engineers, the B.C. Electric engaged two engineers of international repute who made independent examinations of the scheme, not only on paper but in the field. Their reports corroborated the other findings and Bridge river was pronounced without doubt the most desirable power development.

When brought up to its ultimate capacity some years in the future, the Bridge river power plant will be one of the largest on the continent. Possibly nowhere else, will there be such a quantity of power developed under one roof. The possibilities are so vast that no detailed estimate has been made of the date when the ultimate capacity of the plant will be reached. It is known that the site will ultimately warrant a power plant of about 600,000 horse-power.

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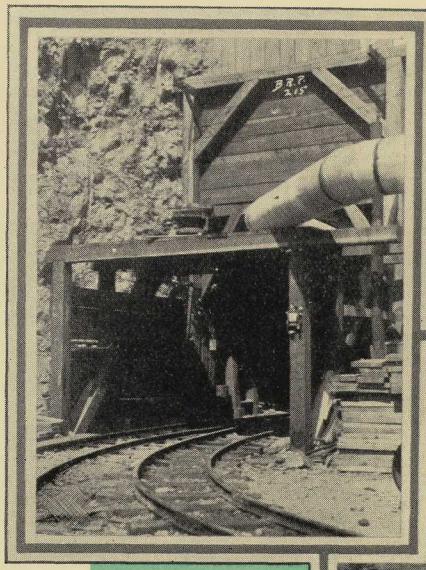
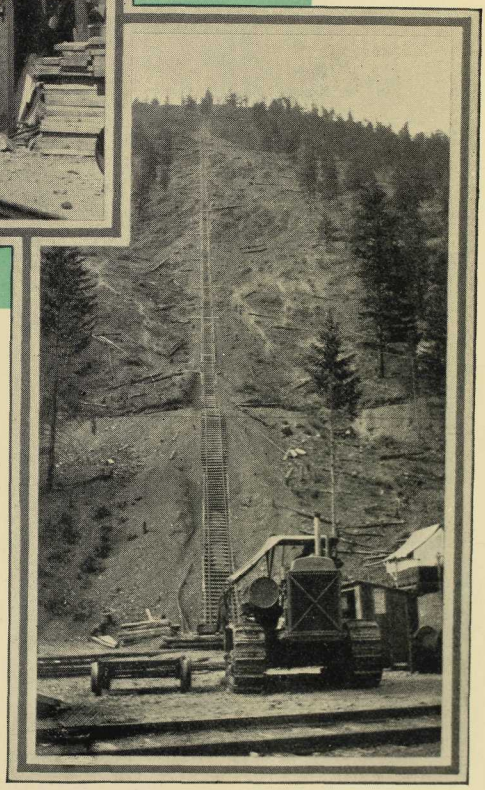
The Bridge river is a large stream, some 135 miles north of Vancouver, originating in many glaciers on the eastern slope of the Coast range mountains. It flows eastward into the Fraser at a point about five miles north of Lillooet.

On its way eastward, Bridge river flows within two and a half miles from Seton lake but 1,200 feet above it, it being separated from the lake by a high range of mountains. The scheme in brief is to tunnel through these mountains and thus utilize the head of water made available by the difference in leval between river and lake for the production of electric power. The power house will be located on the shore of Seton lake approximately 150 miles by water and rail from Vancouver.





Above: Seton Lake tunnel portal.

Below: Inclined tramway to the Seton Lake tunnel portal. The gradient averages approximately 60 per cent.

The initial development, now in progress, will consist of one and possibly two generators of 40,000 kilowatts each, depending upon load requirements. Power from the initial units will probably be delivered in Vancouver by the end of 1932.

MOVING MOUNTAINS

The first part of the project was to drive a tunnel through Mission mountain to divert the water of Bridge river into the penstocks and thus into the water wheels in the power house on Seton lake. This tunnel, as originally planned, was to be 12 feet in diameter and would supply water sufficient for 84,000 horse-power.

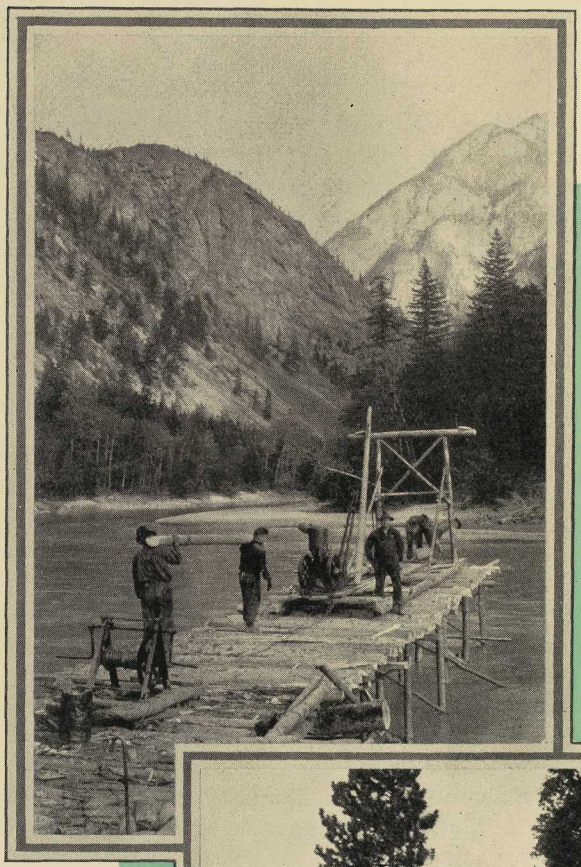
When more power was needed, another tunnel, 16 feet in diameter would be needed and then the first tunnel would be enlarged to a somewhat greater diameter.

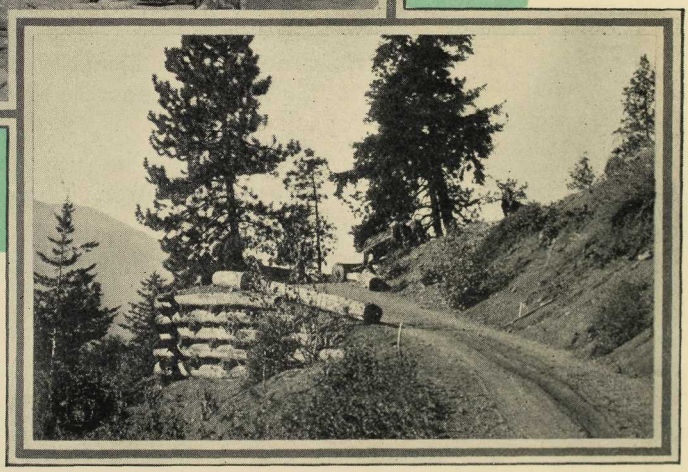
It was also planned to bring the first power to Vancouver in 1930, but in 1928 plans were changed to proceed with the first unit of the Ruskin plant, which will be delivering power by the end of September, 1930. This allowed the Company time to enlarge the first tunnel to its ultimate diameter, and to line it throughout with concrete thus greatly increasing its capacity.

This enlarged tunnel will be sufficient to supply water for 216,000 horse-power. Then the second tunnel will be driven.

Bridge river must also be dammed, first to divert the water through the tunnel and later to form a storage basin to store water over the dry seasons.

Like practically all other British Columbia rivers, Bridge is subject to floods and droughts. The average rainfall there is about 15 inches a year and the average flow of water in the river is 3,702 cubic feet a second. It has, however, been as high as 26,000 cubic feet a second and as low as 164 cubic feet a second.





Above: Diamond drilling on Bridge River, in quest of practical dam site.

Below: Road over Mission Mountain, characteristic of construction work necessary in the Bridge River development.

It is therefore a problem as in all other power developments in British Columbia, of storing up water by means of dams and releasing it as it is required.

A MAN-MADE LAKE

When the power plant reaches larger dimensions, dams must be constructed which will store a vast volume of water. It is proposed to replace the original cribwork diversion dam with a permanent structure 175 feet in height and costing about $6,000,000. This will create an artificial lake thirty or thirty-five miles in length up the Bridge river valley.

At some later date, other dams will be built farther up the valley. One of these will be at La Joie falls, which will probably be about 190 feet in height.

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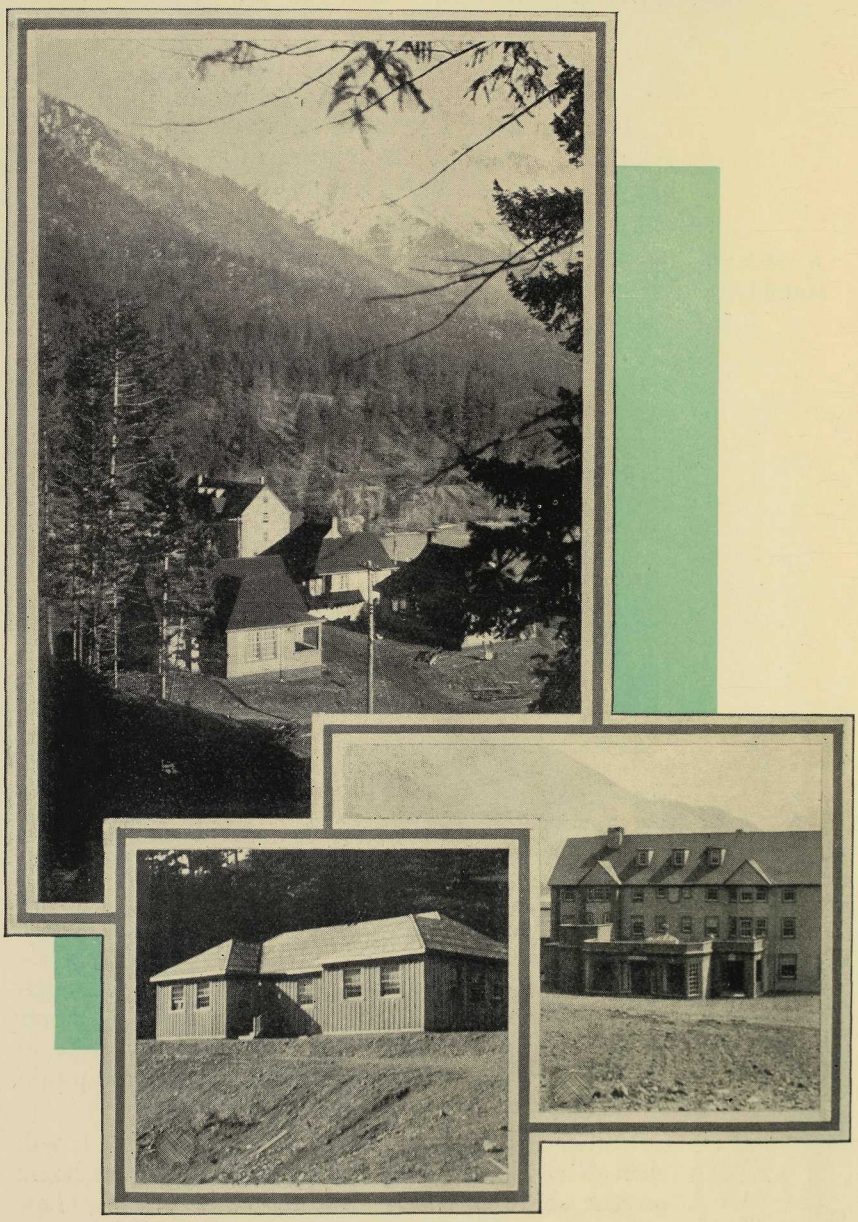
The first large contract was let in the autumn of 1927 for the driving of the 2½-mile tunnel through Mission mountain. When finished it is estimated that it will have cost $2,000,000. Work was begun from both ends, but recently it has been done only from the Seton lake end. As the tunnel slopes towards Seton lake, the water which seeps into it runs out by gravity whereas at the Bridge river end it must be pumped out.

It is expected that all this work will be completed by the end of 1930.

That men can overcome such obstacles of nature as Mission mountain points out the wonders of modern science. In order to ascertain the material through which the tunnel would run, a tiny core, three quarters of an inch in diameter and 1,000 feet in length was taken from the interior of the mountain by diamond drills.

When the water flows through the tunnel, it will then descend through steel pipes to the power house on the shore of the lake 1,200 feet below. These pipes, one for each water-wheel, will each be 2,200 feet in length.



Above: Buildings comprising the town of Bridge River.
Lower right: The B.C. Electric's hotel at Bridge River.
Lower left: Well-equipped hospital building.

This great "head" of water will exert a pressure of 500 pounds to the square inch at the bottom of the pipes or about three times ordinary boiler pressure. To hold this pressure of water, steel forming the pipes will be one and a quarter inches thick at the bottom.

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MODEL TOWN FOR WORKERS

Preparing for construction work that will be almost continuous for twenty or twenty-five years, as the Bridge river development proceeds step by step, has called for the establishment of a town of considerable size. The first actual work was the building of a road over Mission mountain from the power house site on Seton lake to Bridge river. Zig-zagging up the mountain, this road reaches a height of nearly 4,000 feet above lake level before dropping down on the other side to Bridge river. The maximum grade is 16 per cent. but caterpillar tractors haul fifteen-ton loads with ease over this road.

On this road are being hauled the men and materials for the driving of the tunnel and for the preliminary work on the dam.

The town of Bridge River on Seton lake has taken on actual form. Laid out as a model townsite, there are now community building, guest cottage, three operators' cottages, hospital and school house. A permanent water system for domestic use and fire protection and sewer system with septic tank are provided. Rows of cabins for workmen, houses for engineers and their families and a bank are part of the town. Most important of all, there is an 1,800 horse-power Diesel electric power plant, supplying power for the various machinery on the work and lighting for the community site.

The dam will be another step in the completion of the scheme. For an entire summer, crews of diamond drillers wrestled with the problem of finding a suitable foundation for the dam across Bridge river.

Bird's-eye view of the Bridge River power development. In the background is seen the Bridge River Valley as it will appear when flooded. Dotted lines indicate tunnel, carrying water to penstocks, and down into the plant where it generates electrical energy that is then sent out over high tension transmission lines to Vancouver.

Up and down the stream these drillers went, boring wherever they saw signs of solid foundations. No less than 35 holes, some of them 200 feet in depth were put down before the site was eventually selected, two miles below the entrance to the tunnel.

The first dam will be a timber-crib structure, forty feet in height above the river bed. It will ultimately be replaced by a more permanent structure, which will require the diversion of the river through a tunnel 30 feet in diameter and 3000 feet in length.

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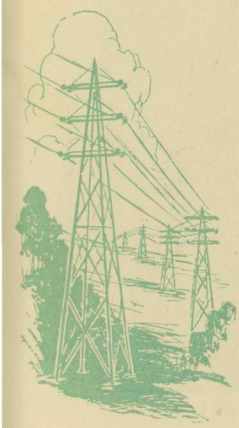
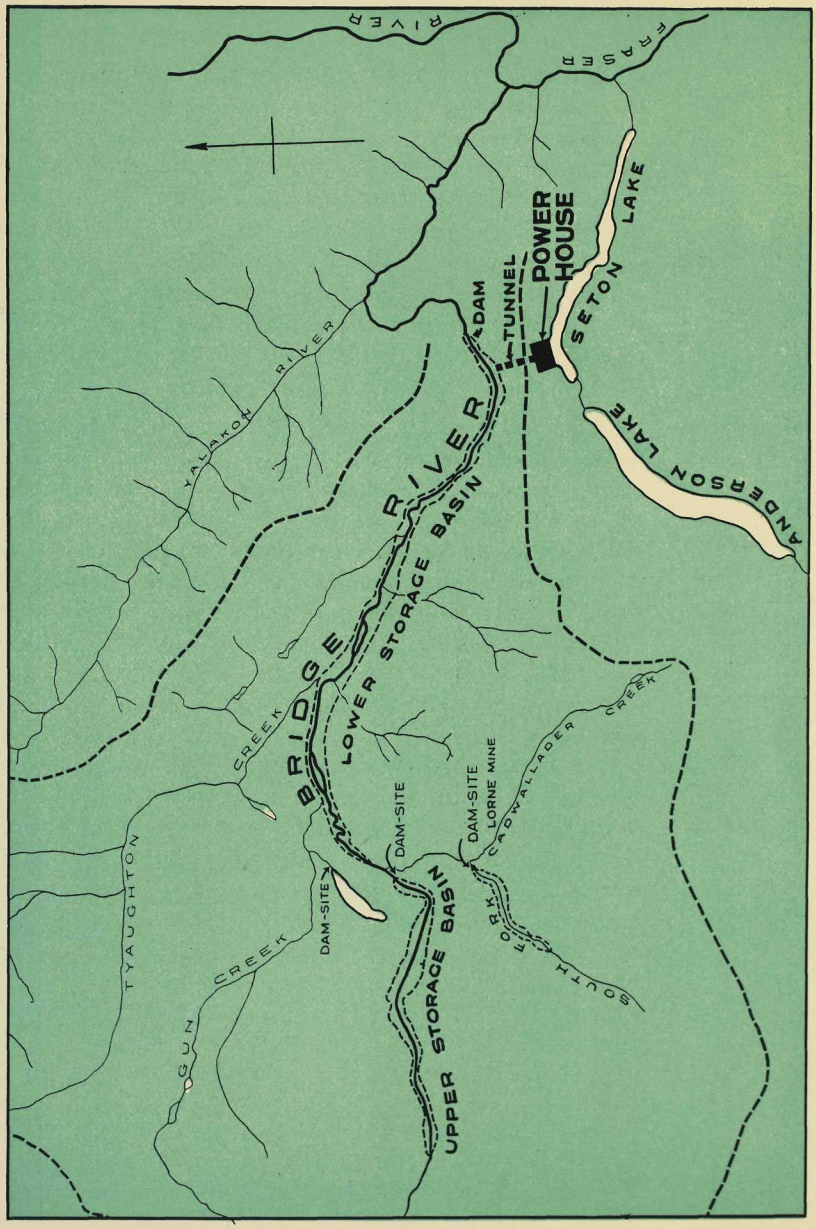
135 MILES of POWER LINE

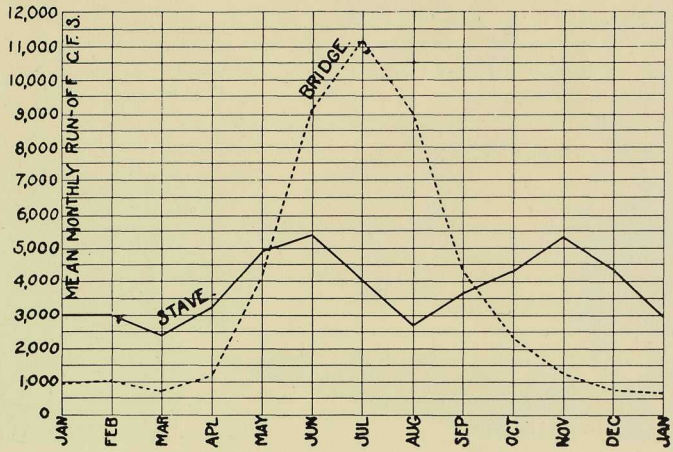
The power house on Seton lake will be linked with Vancouver by means of a high tension line operating at 220,000 volts. This is the highest voltage at which any power lines are at present operating. The line will follow the Pacific Great Eastern railway most of the way to Squamish. Much of the right-of-way has been obtained and cleared, some sections having to be 400 feet in width, where the trees are high and in danger of falling across the transmission line.

Approaching Vancouver the transmission line will come down the Capilano valley, around North Vancouver and into Vancouver by Second Narrows towers. The Horne-Payne receiving station will be doubled in size to accommodate Bridge river power.



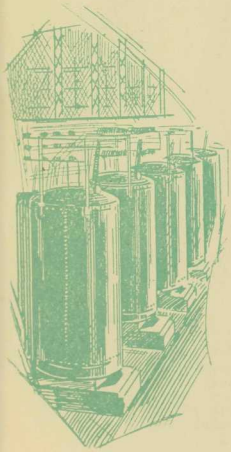
Costly as this development is, the British Columbia Electric Railway company has chosen it because it solves for a score of years or more any problem as to the future supply of power. There are several small potential power developments in the vicinity of Vancouver but with the industrial expansion of the city that is anticipated, the development of any of them would mean an ever-recurring problem of new projects. In this modern age, there must be no question as to the adequacy of electric power supply and as the company serving this territory, the B.C. Electric will not betray its trust to maintain this supply ever in advance of the community's needs.


RIVER
FRASER
POWER HOUSE
TUNNEL
DAM
SETON LAKE
ANDERSON LAKE
YALAKOM RIVER
BRIDGE RIVER
LOWER STORAGE BASIN
CREEK
TYAUGHTON
GUN CREEK
DAM-SITE
DAM-SITE
DAM-SITE
LORNE MINE
UPPER STORAGE BASIN
L.O.R.K.
CADWALLADER CREEK
SOUTH



THIS chart may explain to the layman one of the most important features of the Bridge River project, namely, the different seasonal characteristics of the run-off in that region as compared with those of the Lake Buntzen, Stave Lake and Alouette developments.

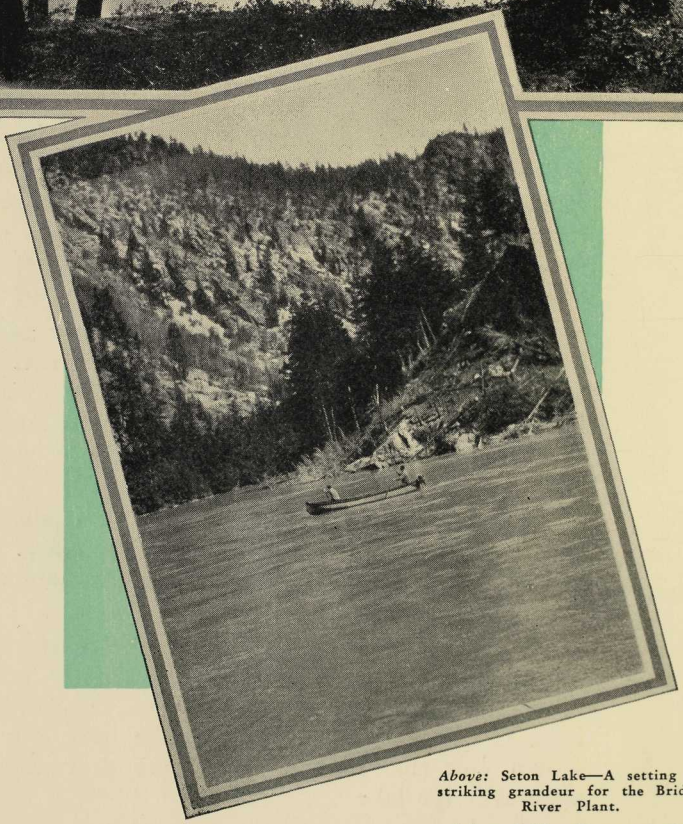
The lines represent the "mean monthly run-off" in cubic feet per second. In other words it is the flow of water in the river or into the lake. The way the lines go up and down represents the fluctuation in the run-off—high water at one period and low water in another.



One line represents Bridge river and shows an extreme rise in July, dropping in the winter when the cold climate of the district prevents much run-off taking place.

The other line represents Stave lake and shows two high water peaks, one in June and the other in November, with a severe dip between. For simplicity, Lake Coquitlam and Alouette lake have not been shown, but their characteristics are practically the same as Stave lake.

Now it will be noticed that the high water period



Above: Seton Lake—A setting of striking grandeur for the Bridge River Plant.

Below: Bridge River and the location of the major dam.

at Bridge river comes two months after Stave lake's peak and continues until September. This means that the Bridge river plant could carry practically the entire power load, depending on the lake plants only for the peak load, thus drawing upon the latter plants hardly at all during the summer and early fall months.

The significance of this is that Lake Coquitlam, Stave lake and Alouette lake would remain full all these months of July, August and September and have ample water to supply the power plants even should rainfall be deferred until late in the season as was the case in 1929.

The relation of the two types of development—Bridge river in the dry belt and the lake plants in the wet coastal region—is a complementary one. Bridge river water is held back by cold winters and released in midsummer; the lake plants have one high water period in spring or early summer and another in the fall.

The operation of the two types of plants will make for greatest efficiency and maximum utilization of the available power.

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The construction work on the Ruskin project is the subject of a companion booklet. The British Columbia Electric Railway company will be glad to mail you a copy on the receipt of your request. Write or telephone Publicity department, room 303, B.C. Electric Building, Vancouver.

SUMMARY OF THE BRIDGE RIVER POWER DEVELOPMENT

Capacity first unit	54,000 horse-power
Cost first unit	$14,000,000
Ultimate capacity	600,000 horse-power
Location of power house	Seton Lake
Source of water	Bridge River
Distance from Vancouver by water and rail	150 miles
Length of high tension lines	130 miles
Transmission voltage	220,000 volts
Length of tunnel (2½ miles)	13,267 feet
Diameter of tunnel lined	14 feet 3 inches
Pressure of water in penstocks	500 pounds to square inch
Length of penstocks	2,200 feet
Operating "head" of water	1,200 feet

THE VANCOUVER AND MAINLAND POWER SUPPLY AT A GLANCE

	Horse-power
DEVELOPED:	
Lake Buntzen, Nos. 1 and 2	64,000
Stave Falls	79,000
Alouette	12,500
Steam plant	16,800
UNDER CONSTRUCTION:	
Ruskin	47,000
Bridge river (one unit)	54,000
Total	273,300
POSSIBLE ADDITIONAL:	
Ruskin	141,000
Bridge river	546,000
Grand Total	960,300