

On the Kaikoura section construction of stop-banks on north and south banks of the Hapuka River has been continued almost to completion. Covering with topsoil and sowing is finished, and the planting of willows is in hand. Concrete-slab protection is complete and stone-pitching of the banks is well in hand.

The concrete sea wall, 1,400 ft. long, at 64 m. 50 ch. has been finished, except for the coping, 3,406 cubic yards of concrete, 7,520 cubic yards of rubble filling, and 6,335 cubic yards of sand filling having been placed.

A reinforced-concrete overbridge has been built at Oaro to carry the highway over the railway, and the approach ramp at the south end has been completed.

HYDRO-ELECTRIC DEVELOPMENT: CONSTRUCTION WORKS AND INVESTIGATIONS

Waikaremoana Upper Development.—Construction has been pushed on as rapidly as possible; although much finishing and cleaning-up work remains to be done, it is expected that water will be available through one penstock and the first machine will operate in September.

The last major portion of the job to be commenced is the intake channel leading from the bed of the lake to the tunnel entrance. The work involves excavation and removal of 80,000 cubic yards of rock and earth to a depth of 53 ft. below normal lake-level and protection of the batters of the excavation with concrete and stone work to reduce the risk of slips and erosion by wave-action. The material to be excavated consists of sandstone and papa rocks varying in size from small stones to gigantic blocks set in a matrix of puggy clay. This, coupled with the fact that so much of it is under water, makes excavation an unusually difficult task. It is necessary, therefore, to work to a carefully planned method by which water will be available for operating the turbines should the power-house machinery be ready before the intake channel is finished. All available earth-moving plant is being used on the excavation, which is being taken out in layers, each layer having to be broken up first with explosives. Excavation was started in February, and 25,000 cubic yards had been removed by the end of March.

At the entrance to the 10 ft.-diameter pressure tunnel a 12.5 ft. shaft has been carried down from the surface through country made safe and watertight by grouting beforehand. The shaft was lined with precast concrete rings to form a vertical pipe down which lake water will flow to the turbines pending completion of the intake channel.

The 10 ft. tunnel was pushed forward from the headgate shafts to the intake, a distance of 700 ft., through well-grouted country, and its concrete lining has been practically completed.

In this region 50,337 lineal feet of boring has been done during the year and 1,810 tons of cement injected into the country in the form of grout. All told, 233,574 lineal feet have been bored and 10,550 tons of cement have been used in grouting operations on the Waikaremoana Upper Development.

The two headgate shafts have been lined, the gates and winches installed, and the gate-houses built.

The twin 8 ft. tunnels extending from the headgates to the head of the pipe-lines have been concreted and grouted. These tunnels are to be lined with steel plate; the steel liner for No. 1 tunnel has been placed and welded up, and the annular space between the steel liner and the primary concrete has been filled with concrete, thus completing No. 1 tunnel.