

MANUHERIKIA RIVER.

Water can be taken from this river just below Ophir, and carried by race to Chatto Creek, a distance of seven miles. Here a fall of 350 ft. is obtainable. The drainage-area of the river above Ophir is about 800 square miles, but the minimum volume of flow is very disappointing, only amounting to 200 cubic feet per second. The river-basin is bounded by high mountain-ranges, altitudes of 5,000 ft. to 6,000 ft. being reached by the peaks, yet the flow is very small. Power to the amount of 5,000 to 6,000 b.h.p. would be obtainable at a power-station at the junction of Chatto Creek with the Manuherikia, just alongside the second crossing of the Otago Central Railway over the Manuherikia. The race would traverse difficult ground for about two and a half miles, where it might be necessary to have recourse to drives. There would be flume or siphon about 1,300 ft. long, the depression to be crossed being 150 ft. deep, and there would be a second depression about half a mile long and about 30 ft. deep. This could be crossed by armoured concrete pipes. The works would be likely to be somewhat expensive for the amount of power obtainable. The river at present carries much silt, due to mining operations.

HAWEA.

This lake lies at an elevation of 161 ft. above Lake Wanaka, as ascertained by accurate levelling from trig. stations to the water-level of each lake; Hawea being at a height of 1,083 ft. above sea-level, and Wanaka at a height of 922 ft. The distance between the lakes is 135 chains; but there is a lagoon of some size formed by detritus brought down by a creek flowing into Hawea, which reduces the distance to 100 chains. The lagoon is at a level of 8 ft. above the lake, and a channel could easily be cut to give free flow from the lake to the lagoon; though if the lake-level were permanently raised by a dam as proposed below, not much, if any, dredging would be required.

The drainage-area of the lake is 567 square miles, and the area of the lake is forty-five square miles. The length of the Alps drained is about fourteen miles. The flow measured in November last was 5,700 cubic feet per second. The corresponding low-water flow, as deduced from probable low-water levels, would be about 3,600 cubic feet per second, and the flow at high level about 9,600 cubic feet per second.

I think the lake can be safely dammed to a height of 60 ft., or perhaps a little more. The present outlet of the lake would be closed by a dam of sufficient height to prevent any chance of overflow. An overflow-channel would be provided, if thought necessary, in a second and smaller dam that would be required over an old channel on the right bank of the river lying parallel to the present channel, and distant a few chains from it. The old channel has rock sides, is separated from the present channel by a ridge of rock, and is in every way suited for an overflow-channel; and could, perhaps, be used to divert the river for forming the main dam during the construction of the latter. The lower end of the lake is bounded by a low moraine ridge with three old river-channels through it at the level of the plain, which slopes from the outer edge of the ridge evenly towards the Clutha River. The average level of the upper end of the plain is about 80 ft. above the lake.

Taking 30 ft. for storage and 30 ft. for permanent rise in the lake-level, the difference in level available would be 191 ft. The water-level in Wanaka rises in extreme floods such as in 1878—about 12 ft. When this happens there would be a corresponding rise in the Hawea Lake, or more, on account of the dam, as it is hardly possible for a flood of that height to obtain in Wanaka without a similar one in Hawea. It may therefore be taken that in extreme floods there would be no loss in power from a diminution in difference of levels, but there might be a small flood in Wanaka and no corresponding rise in Hawea. The best type of water-motors to meet the flood conditions would be turbines with vertical axes, fitted with draught pipes sufficiently long—15 ft., more or less—so that they would work safely in all levels of Wanaka Lake; the generators being fixed on the vertical shafts of the turbines at a safe height above flood-level. There would be wave-action to provide for in high floods. The waves might be of some height, and flood a power-station with broken water and spray.

The total length of conduit required from the lagoon to Wanaka by the shortest route is 6,600 ft. Of this length about 500 ft. would be pipes, 1,500 ft. canal at the Hawea end, and 4,600 ft. tunnel. This would begin about the upper end of the swamp above the lagoon, and apparently be in solid schist rock for its whole length. For continuous work a tunnel 24 ft. to 25 ft. in diameter would be required, depending on grade, the smoothness of finish, &c., of the lining, and the probability of the smoothness remaining unimpaired. The pure water of the lake should have but little cutting-action on the tunnel-lining, pipes, or working-parts of turbines, though the creek whose detritus formed the lagoon would at times cause some grit to go through the tunnel.

The power obtainable should be about 90,000 b.h.p. for continuous working. The cost for hydraulic works, dams, sluices, tunnel, pipes, &c., would be about £460,000, and the cost, complete with transmission-line to Dunedin, would be about £2,200,000. For a scheme to give more power for a shorter period each day, say, 180,000 b.h.p. for twelve hours, the cost would be about £4,300,000. Assuming that 50,000 b.h.p. were delivered in factories, or for lighting, &c., to Dunedin and intermediate places, the gross revenue, at the tariff assumed for this report, would be £600,000 a year, if so much energy could be sold.

There is a very good site for a power-station on the shore of Lake Wanaka, opposite the lagoon, in a slight indentation with some shallow water in front, though it would even there no doubt be exposed to effects of wave-action in heavy gales; but this is inevitable. This site is further up the lake than the point where the shortest line from the lagoon would cut the lake-shore. It will be a question whether the tunnel should not be made longer to enable the power-station to be located at this place.

The power-station would be distant about 170 miles from Dunedin by a transmission-line following the road *via* Cromwell, Alexandra, Clutha Valley, Tuapeka, and Milton. Another route might be practicable over the Dunstan Mountains *via* Thompson's Pass, and the route of the Otago Central Railway.