

The narrow neck of land almost enclosed by the bends of the river, on which the town of Balclutha stands, will be referred to in this report as "the peninsula." The island enclosed between the Matau and Koau Branches and the sea is known as "Inch-Clutha." The large area of swampy ground, now more or less reclaimed, lying on the right bank of the Koau Branch is known as "Otanomomo." The flat country lying to the left of the Matau Branch, and surrounding the Tuakitoto and Kaitangata Lakes, will be called "the lakes district."

PHYSICAL FEATURES.

The Clutha River, with its tributaries, drains country exhibiting most diverse characteristics. The waters from its 2,749 square miles of drainage area pass through Lakes Wakatipu, Wanaka, and Hawea, and consequently violent freshets are to a large extent steadied, or prevented from affecting the country below the lakes; but, on the other hand, when sustained and violent rain or melting snow has raised the lakes considerably above their normal level the river below continues to run high, frequently for many weeks, while this surplus water is draining away. The characteristics of the flow of the lower river are therefore different from those of the great majority of New Zealand rivers, in that as a rule floods rise slowly, giving ample warning, and, having risen, remain up frequently for days, and take a long time to subside. This is a characteristic which must be seriously considered in deciding the necessary cross-section for levees and other matters.

The country above the lakes is highly mountainous, and rain and snowfall there is extremely heavy. Below the lakes to Balclutha there are 5,072 square miles, over the greater part of which the rainfall is low, and in some places very low; in fact, the Clutha watershed contains the driest locality in New Zealand. Heavy floods resulting from widespread rain over this lower watershed are most unlikely, though at times any one of the tributaries is likely to be in a raging flood quite irrespective of the main river. The total stream cross-section in the lower reaches is, however, so great that tributary floods cause no trouble, except in the case of the Pomahaka, in the watershed of which the rainfall is higher than in the rest of the watershed below the lakes. The Pomahaka drains 800 square miles, and reaches the main river only ten miles above Balclutha.

The experience of May, 1917, shows that a flood sufficient to create widespread damage may come from a flood in this tributary, augmented only by the ordinary normal flow of the main stream.

The character of the rocks and soil above the lakes has no effect on silting, as the lakes form reservoirs so large that all matter in suspension entering them is precipitated, even in times of the fiercest floods.

Through a large portion of its course below the lakes the river—or, rather, the two main rivers, the Clutha and the Kawarau, which unite at Cromwell, and which are from that point known as the Clutha or Molyneux—runs through what is geologically a very youthful gorge, in which the forces of denudation have not yet brought the slopes to a stable angle. It is only the extremely low rainfall that saves the precipitation into the stream of vastly increased quantities of the extremely loose and friable schist rock which forms the greater part of the country.

Unfortunately, the mines operating in the watershed are almost entirely confined to beds of old and also fairly recent gravels, which have already been reduced to such shape and size as permits of their easy transportation by the stream. Nature takes long periods to reduce rock to gravels, and the pouring-in by the agency of man of immense quantities of gravels which have taken ages to produce naturally causes accelerated deposition lower down.

The Pomahaka watershed is entirely different from that of the balance of the Clutha watershed, being largely rolling country, almost entirely grass- and bush-covered, and the amount of detritus travelling in this stream is surprisingly small.

The fall in the river is moderate, as will be seen by plan No. 6. Where passing through narrow gorges the fall is steeper than average, and is succeeded usually by some miles of flatter stretches in which occur old gravel deposits. These steep and flatter alternations both become progressively flatter as the coast is approached, and when the vicinity of Balclutha is reached the fall had become very slight,