

motion; and this force depends, first, upon the rate of fall; secondly, upon the width of the stream being confined within certain limits, so as to concentrate the power of the water and cause it to travel with the required velocity.

These rivers differ slightly in their volume of water, in the fall of their beds, and in the class of material they bring down; and, therefore, to be able to say what are the exact conditions of inclination and width of bed, which would confine each to its course, and would enable it to carry the material forward, would require a much more elaborate and costly study than my opportunities have enabled me to make, and more than I feel justified in advising the Government to enter upon at present; but I may give the general conclusions which I have arrived at, and which may be taken as approximately correct—namely, when the inclination of the bed is less than 24 feet in the mile, the space over which these rivers can change their courses must be confined to within half a mile in order to keep the course open.

This opinion refers solely to those cases where the river bed is composed of shingle and sand, as in the case of the Rakaia and Rangitata. Where the river runs through silt and clay, a much less fall is required, as in the case of the Waimakariri near its mouth.

I believe that these plains may be rightly viewed as the delta of these great rivers, the mouths of which are at the gorges, through which they discharge their waters from the mountain base; and, in my opinion, the evidences which we are able to collect, as to the formation of these plains to a depth of 80 feet at many places, show that the same operations, which we see now going on, have been working for a long period, and may be quite sufficient to account for the whole construction of the lower plains, without resorting to any complicated theory.

To express this in a few words—the mountains are continually disintegrating; the debris is carried to the plains by the rivers, and is there distributed in the manner described.

The Rangitata.

I have examined this river with a view to considering the desirability of constructing works to return the Southern Creek or overflow-channel into its original course.

I am of opinion that no expenditure should be incurred for this purpose, for the following reasons:—

The water has left the old and taken to the new course, in accordance with the natural law which has been already described. The bed of the river is choked up by its own deposits, and has spread out to such an extent that it has no power to clear the way.

If works are constructed to prevent the banks being overflowed at the several points which form the entrances to the present overflow-channels, the banks will certainly be overflowed at other points lower down, and a continued series of works along both banks to the sea would be required to permanently confine the river within bounds.

I do not think advantages, at all commensurate with the outlay, would follow the construction of works for the purpose of saving a few hundred acres of land of a very poor quality; and instead of going to a large expenditure, to control the river and prevent its interrupting the lines of traffic, as at present laid out, I advise that they shall be diverted to a point higher up the river where it has no tendency to leave its course.

With a view to finding such a site, I have had some levels taken, but owing to the very difficult nature of the ground, they have not cleared up the question as satisfactorily as I could wish: a much more extended examination by levels and surveys would have to be made, than the time allowed to Mr. Kitson enabled him to carry out. I think, however, a good site may be selected between five and eight miles below Marshall's Ferry, to the west of the section E M, marked on plan No. 3. I send herewith a plan of the Rangitata, No. 3, with a diagram marked on it showing the lines on which the levels were taken, marked E M, F L, G K, and the position of the level course by the blue dotted line G L, which has nearly the same direction as those at the Rakaia, being N. 27° 30' E., Magnetic. I also send No. 4, three sections.

The Secretary for Public Works.

No. 2.

REPORT by Mr. PATERSON.

SIR,—

Dunedin, 1st November, 1869.

I have the honor herewith to transmit plan showing proposed reserves for bridges and roads at the River Rangitata, and general map showing present and proposed road and railway routes between Timaru and Ashburton.

Before selecting a site for the bridge, I examined the river from its mouth up to Peel Forest, beyond which I did not extend the examination, considering that a bridge any further up the river could not be of much general utility or advantage.

My inspection of the river at once convinced me of the imprudence of attempting to bridge the Rangitata at any point below the upper end of the large island, about four miles above the ferry, on the line of the present main road from Christchurch to Timaru.

Below the upper end of the island there is no well defined terrace on the southern side of the river to form a barrier to its encroachment in that direction, and the adjoining plains on that side are in many places only slightly elevated above the present level of the river bed; the force of the water at this part of the river is also now insufficient to clear the channels of the shingle brought down during the floods, and the consequence is, that as these channels become choked up, new channels are occasionally formed, and to such an extent is this action in operation, that within a period of only a few years, the course of the main body of the water has, at one part of the river, been changed to the extent of nearly two miles.