

from the lower end, so that all water turned will be finally diverted. The relative quantity of water flowing in the two branches will not be affected, as all the water turned will still return to its original bed by the fourth channel above named, but below the weak point. The quantity of water flowing down on the threatened breach will be gradually lessened from the commencement of the work. No. 1 groin will be 5 chains in length; No. 2, 16 chains; No. 3, 4 chains. The estimated quantity of material is, in No. 1 groin, 2,640 cubic yards; No. 2, 4,224 cubic yards; No. 3, 1,056 cubic yards. The total cost I estimate approximately at £1,200; the time, three months; employing eighteen men, with two teams of horses and carts. The time and cost of construction in such work as this so entirely depends on the number and volume of the floods experienced during the progress of the works that this estimate cannot be considered reliable. The works are just now being commenced, and the time of year is most favourable, as least liable to heavy floods. Should the works now in hand prove successful the immediate danger threatening the district will be averted. But the river will most probably, before any great lapse of time, make another inroad still higher up, from which point it will breach the railway still further southward, and eventually reach the Orare Lagoon, destroying in its course a far larger tract of country.

I do not think the Railway Department should be looked to to undertake the protection of such extensive areas of valuable freehold land, and I think steps should be taken to establish a permanent Board of Conservators, with statutory powers for rating the land to be protected, similar to that which has been in successful operation on the Waimakariri River.

The works now beginning must be regarded as but the first step of a work of years.

I have, &c.,

J. HENRY LOWE,

Resident Engineer.

The Commissioner of Railways, Middle Island.

Enclosure J. in Appendix I.
BURNING NATIVE COAL IN LOCOMOTIVES.

SIR,—

Dunedin, 28th May, 1878.

In compliance with your instructions, I have the honor to report the result of a series of trials made to test the adaptability of lignite or brown coal of this colony for use in locomotives. I originally intended to include the trials of Shag Point, Benhar, Greymouth, and coal from one or two mines in this district, but, owing to the shortness of engine-power and the increasing traffic, I found it impossible to keep the same engine for the special purpose; and the difficulty in doing this in a great measure is the reason of the delay in sending in this report. The coal tried was Newcastle (N.S.W., Australia), Kaitangata, Nightcap, Green Island, and Walton Park (New Zealand), the first being taken as a standard for comparison.

I may state here that I made one trial of a sample of coal from Greymouth with very good results, but, as I expect to be able to complete the trials at some future time, I have withheld the particulars.

As it was necessary that the trains hauled should be weighed, I determined to make the trials with the train known as the "Walton Park Coal Train;" but even with this it was found impossible to weigh every wagon, these being frequently dropped off at sidings; but in every case of this kind a note was made, and the weight approximated. A more serious objection was the amount of shunting that had to be done at Walton Park. This was often very heavy; but the time engaged on this work was always taken, and is entered for comparison. While on this subject it may be interesting to note, as indicating the power of the engine (a 10½ in. cylinder, Class F.), the weights moved on several occasions. In one instance a shunt had to be made on a grade of 1 in 48, when a load of 84 tons was lifted from a dead stand. This does not include the weight of the engine, which, taken at 17 tons, would be 101 tons. Pressure of steam in the boiler was 115 lb., the rails dry and clean.

Every care was taken to make the trials as complete as the appliances at command would admit. The water used was carefully measured, the coal weighed, and the pressure of the steam noted at frequent intervals during the trip, the temperature of the feed-water taken, and the length of time the injector was used. The weather throughout was favourable, being dry.

The engine selected for the trials was a 10½ in. cylinder, 6 wheels coupled, Class F., in good working order, fitted with a spark-arresting chimney, which answered well. I attach a tracing of the longitudinal section of the line between Dunedin and Walton Park, from which it will be observed the grades are severe, and change frequently. These were reduced to an equivalent length of level road, and from that length the load hauled was calculated. This course was rendered necessary through having to pick up and drop wagons at the various sidings on the journey.

From the experience gained during the present trials I do not think it is possible to use profitably any of the four kinds of colonial coal tried, at least with the class of engine at present in use here. No doubt if a locomotive was built with an enlarged fire-box, and with a tender attached to hold sufficient coal for a trip, say, of fifty miles, more favourable results might be looked for; but the action of the blast, increased by the heavy grades prevailing here, on the light coal makes the work of firing a most laborious job, and one that requires the most careful attention to maintain steam, which was done in all the trials, such as in every-day work I could not expect.

One great objection to the use of the Kaitangata coal is its liability to clinker. No engine could use this coal and run more than ten or twelve miles without having the fire-bars cleaned.

The sulphurous fumes emitted from the Walton Park and Green Island coals raises a serious objection to their use on passenger trains. This is especially felt when passing through tunnels. These, however, make no clinker, leaving a very little brown ash.

The Nightcap coal shows a better result than either of the other three, as it burns without forming any clinker, and throws off no gases having objectionable smell. With a locomotive specially designed for burning lignits, I am of opinion this coal could be profitably used.