

of the plant as built, included here, embody the recommendations made.

The following precautions were taken, based upon the report:—

1. The hard sandstone ledge, upon which the dam was to have been built, dipped at such a considerable angle that the cost of carrying the foundations down to this rock throughout the length of the dam, would have been excessive. The northern part of the dam was therefore built upon the shaly rock, overlying the hard sandstone, which it was considered would afford a safe foundation.

In order to obviate any leakage that might develop through the underlying seams, 3-inch holes were drilled

30 ft., so that most of the leakage around the end, if there is any, will be intercepted by the tunnel. This expectation has been realized by the stopping of leakage going on before the tunnel was extended. The tunnel itself is drained through an opening in the downstream side of the dam.

5. The protection of the foundation of the dam at the downstream side has required careful consideration. In order that erosion due to the water coming over the spillway section might be eliminated, Mr. Freeman recommended that the apron of the dam be extended downstream about 40 ft., heavily reinforced and anchored to the rock, and that baffle piers be built on the apron to reduce the velocity of the water and thereby prevent any

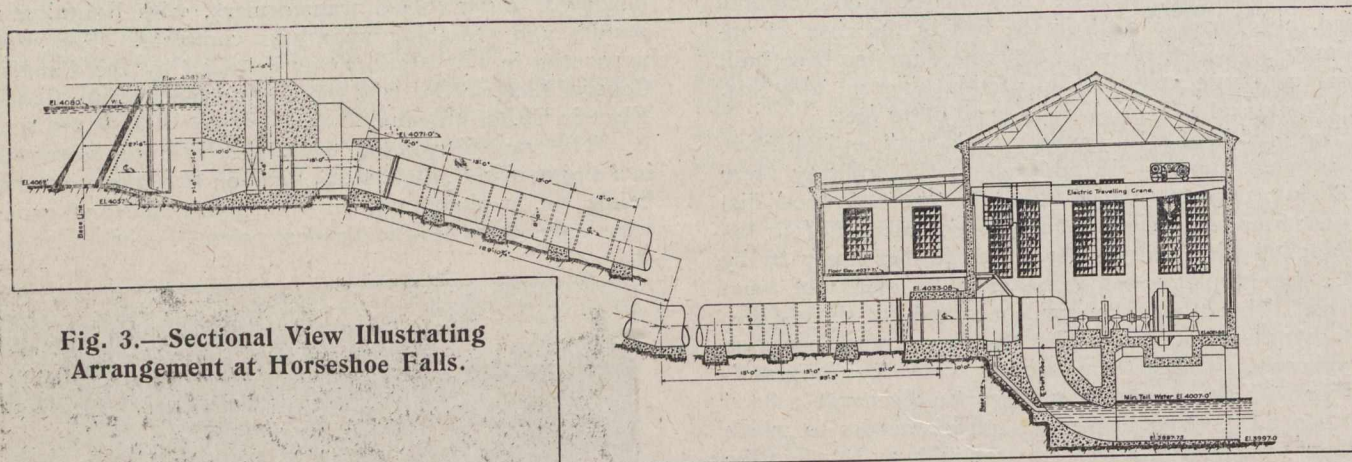


Fig. 3.—Sectional View Illustrating Arrangement at Horseshoe Falls.

through the rock, about 2 ft. in front of the face of the dam, 10 ft. apart, and to a depth of about 40 ft., a casing was then placed in the upper part of the hole, and a thin cement grout forced into the holes under a pressure varying between 60 and 80 lb. per sq. in. until they refused to hold any more. By this means the grout was forced into seams in the rock, cross-cut by the holes, and for a considerable distance from the holes. By first filling alternate holes and later filling the remainder, it was expected that all the seams would be completely filled for some distance from the line of holes.

2. The possibility of leakage around the north end of the dam was met by excavating a considerable distance into the cliff, for the total height of the dam. The cliff consists of a soft shale, liable to disintegration on exposure to air, but as the excavations were completely filled with concrete, any water leaking through the seams in the shale would be forced to travel a considerable distance, and the quantity would be greatly reduced by friction, and as the seams are liable to silting, the leakage would be very nearly eliminated.

3. The inspection tunnel also serves the purpose of a drainage tunnel. Drainage holes, about 16 in. square, and placed 16 ft. 8 in. apart, extend from the springing line of the arch of the tunnel upward through the body of the dam, so that any leaks that may develop through cracks will be intercepted and directed into the drainage tunnel. Other holes, 3 in. in diam., and about 12 ft. 6 in. apart, have been drilled down through the base of the dam into the underlying rock for depths of from 10 ft. to 18 ft. These are cased at their upper end, in order that the quantity of any water leaking through them and also the upward pressure may be measured.

4. The tunnel has been extended into the rock forming the north abutment of the dam for a distance of some

possible erosion. Other recommendations were made, one being the building of a baffle wall on the crest of the old falls at the south end of the dam, and the facing of the cliff below to prevent undermining.

The Kananaskis Falls Plant.—This development, the most recent on the Bow River, was described in considerable detail in our issue of August 6th, 1914.

SOUTH AFRICAN RAILWAYS.

The open mileage of Government-owned lines in South Africa at the end of 1913, was 8,281 miles, of these 7,807 miles being 3 ft. 6 in. gauge and 474 miles of 2 ft. gauge, the total increase during the 12 months being 433 miles. The mileage of new lines opened for traffic totalled 385 miles divided between the four provinces as follows:—Cape, 102 miles; Orange Free State, 56 miles; Transvaal, 165 miles; and Natal, 64 miles.

The position of the provinces on December 31, 1913, as compared with the end of the previous two years, was as follows:—

| | 1913. | 1912. | 1911. |
|------------------|-------|-------|-------|
| Cape | 3,638 | 3,492 | 3,397 |
| Free State | 1,162 | 1,106 | 1,070 |
| Transvaal | 2,362 | 2,197 | 2,020 |
| Natal | 1,116 | 1,052 | 1,052 |

The figures given above represent Government-owned lines only, with the exception of 50 miles leased from the Natal-Zululand Railway Company. The administration works the section from Vryburg to Bulawayo (597 miles) owned by the Rhodesian Railways, and also 56 miles privately owned within the Union.

Parliament authorized the construction of 14 new lines, but at the end of 1913 their construction had not been entered upon. The total mileage of these authorized lines was 794½ miles, the provincial allocation being: Cape, 306¼ miles; Transvaal, 191 miles; Orange Free State, 166½ miles; and Natal, 130¾ miles.