

1931.  
NEW ZEALAND.

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DEPARTMENT OF LANDS AND SURVEY.

# DRAINAGE OPERATIONS IN HAURAKI PLAINS.

REPORT FOR THE YEAR ENDED 31st MARCH, 1931, TOGETHER WITH STATEMENT  
OF ACCOUNTS.

*Presented to both Houses of the General Assembly pursuant to Section 20 of the Hauraki Plains Act, 1926.*

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SIR,—

Department of Lands and Survey, Wellington, 1st July, 1931.

I have the honour to present herewith the report of the Chief Drainage Engineer on operations carried out during the past year on the Hauraki Plains in accordance with the provisions of the Hauraki Plains Act, 1926.

I have, &c.,

W. ROBERTSON,

The Hon. E. A. Ransom, Minister of Lands.

Under-Secretary for Lands.

## REPORT OF CHIEF DRAINAGE ENGINEER.

SIR,—

I beg to submit the twenty-third annual report on the Hauraki Plains works for the financial year ending 31st March, 1931.

This reclamation scheme has now reached an advanced stage of progress, and in view of the widespread interest in the economic aspect of rural-land development at the present time a brief review is opportune of production accomplishments and the future possibilities of the Hauraki Plains.

The area deriving benefits from the works carried out under the scheme is approximately 163,000 acres, comprising 90,500 acres of Crown land and 72,500 acres of freehold and Native land. The benefits conferred by our works vary in both degree and kind. Practically all the Crown land and a large portion of the freehold was originally morass, with no production capacity until reclaimed. The reclamation scheme was commenced in 1907, and the first block of Crown land offered for selection, in 1910, comprised 16,300 acres, subdivided into 104 sections.

The following is a general classification of the Crown land according to present conditions and future possibilities :—

|                                                    | Acres. |
|----------------------------------------------------|--------|
| Crown land disposed of as farms .. .. .            | 45,200 |
| Crown land now being drained and roaded .. .. .    | 15,100 |
| Crown land unsuitable for rural settlement .. .. . | 30,200 |
|                                                    | 90,500 |

For some years the reclaimed land was used principally for fattening stock; but dairy-farming commenced in 1911 and rapidly became the main industry. Efforts have been made each year to record the value of the principal dairying and pastoral products, and the aggregate is now over £5,000,000. As it is impossible to get complete returns from a large district, the actual value exceeds this figure, and it does not include the very considerable value of the increased production from a large area which is directly due to the improved drainage conditions brought about by the operations of the Department. Though there can be no doubt that the development of new country, and more especially the creation of a high permanent productive capacity from waste land, is a matter of national importance, it is, however, very difficult to assess the return the Dominion receives from the application of capital expenditure to real productive work of this nature. General benefits, such as increased prosperity, more direct means of communication between districts, and the creation of more healthy local conditions, though obvious, cannot be expressed in monetary values.

An expert Board that was appointed to make an economic study of the reclamation policy of the United States of America, in a report recently presented to Congress, stated as a general rule applicable throughout progressive parts of the world that "Every agricultural community maintains an equally populous non-agricultural community, and every unit of agricultural capital leads to the formation of non-agricultural capital twice its own magnitude." From New Zealand statistics and an estimate of the aggregate income of individual members of the community prepared from census returns it was found that the ratio of general taxation to total income for the year ending 31st March, 1926, was about 1 to 7. On this basis, from a recorded production of £5,000,000 from the Hauraki Plains the total revenue collected would be about £700,000. If this extra revenue produced from the reclaimed land could be considered as part of the return from the investment, it would be more than sufficient to write off the difference between the capital expenditure and receipts from rent and sale of Crown lands to date; and on completion of the scheme the total receipts would exceed the total expenditure. When the scheme is completed the private income of the community will be permanently increased by £750,000 per annum, and from this amount the Consolidated Fund will receive over £100,000 annually. Though this presentation of the case has obvious weaknesses, it may help to convey an idea of the importance of the Hauraki Plains reclamation operations from a national and local standpoint. Broad vision is often obstructed by the difficulty in finding means to give definite values to vaguely recognized national benefits resulting from large-scale development works.

The past year has, unfortunately, been one of low prices for farm-products. Dairy-produce has increased in volume, but the quantity of fibre and tow has declined to about one-third of the previous year's production, and the total values recorded have decreased from the peak of £595,176 for the year 1929-30 to £421,195. The quantity and value of the principal products of the district for the year 1930-31 are given below. The figures in parentheses are the quantities for the previous year:—

|                               |    |    |    |    | Tons.            | Estimated Value.<br>£ |
|-------------------------------|----|----|----|----|------------------|-----------------------|
| Butter produced               | .. | .. | .. | .. | 2,326.15 (2,584) | 262,109               |
| Cheese produced               | .. | .. | .. | .. | 2,564.5 (1,686)  | 109,550               |
| Fibre and tow                 | .. | .. | .. | .. | 371.5 (969)      | 7,080                 |
| Estimated value of stock sold | .. | .. | .. | .. | ..               | 42,456                |
|                               |    |    |    |    |                  | <u>£421,195</u>       |

Cargo received and despatched over Piako River wharves, including road-metal, amounted to 26,872 tons (31,971).

The Ngatea Dairy Factory, which is supplied entirely by the reclaimed-swamp farms, has the distinction of winning the Weddell Cup for three consecutive years. This cup is awarded for the highest average grading points for butter in the Auckland Province.

A land ballot held in May, 1930, for an area of 1,371 acres, subdivided into twenty-three sections, on the Kerepeehi Block, attracted nearly two hundred applicants. The successful selectors have made amazing progress during the short period of occupation. Houses have been built on most of the sections, and several dairy herds have been established and have been producing during the past summer.

Owing the low market price of hemp, flax-milling has almost ceased temporarily. Four millers have been operating for short periods, and one of these has had the misfortune to lose practically his entire crop of flax by a fire which swept the Torehape district in the late summer and destroyed several thousand tons of growing flax. The annual loss caused by swamp-fires has been frequently referred to in previous reports, and each succeeding year helps to confirm the opinion that some provision for the control and prevention of fires on the lines of the fire district system of the Forests Act, 1921-22, is absolutely necessary for the full development of the flax industry in this district.

Rainfall at Kerepeehi for a period of fifteen years is given in the table below. In 1930 there were 146 days with rain, and the total fall was 37.72 in., which is below the average for Kerepeehi. The falls generally were not heavy, and very seldom indeed has the district experienced a period so entirely free from even minor floods. As the result of the moderate rainfall, feed has been more than usually plentiful during the summer, but growth was somewhat retarded by cold weather in the early spring.

RECORDS OF DAILY PRECIPITATION, KEREPEEHI, HAURAKI PLAINS.

| Year.    | Number of Days, with given Daily Precipitation in Inches. |               |               |               |               |               |               |               |               |               |               |               | Total Days. | Total Fall. | Wettest Month. | Driest Month. |               |
|----------|-----------------------------------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|-------------|-------------|----------------|---------------|---------------|
|          | 0.00 to 0.49.                                             | 0.50 to 0.74. | 0.75 to 0.99. | 1.00 to 1.24. | 1.25 to 1.49. | 1.50 to 1.74. | 1.75 to 1.99. | 2.00 to 2.49. | 2.50 to 2.99. | 3.00 to 3.99. | 4.00 to 4.99. | 5.00 to 5.99. |             |             |                |               | 6.00 to 7.00. |
| 1916 ..  | 109                                                       | 12            | 9             | 7             | 2             | 3             | ..            | 1             | ..            | ..            | 1             | ..            | ..          | 144         | Inches. 52.19  | In. Nov. 6.65 | In. Feb. 1.05 |
| 1917 ..  | 131                                                       | 11            | 4             | 4             | 3             | ..            | 1             | 1             | 1             | ..            | ..            | ..            | ..          | 156         | 45.61          | Feb. 6.26     | Jan. 0.65     |
| 1918 ..  | 145                                                       | 14            | 6             | 4             | ..            | 1             | ..            | ..            | 1             | ..            | ..            | ..            | ..          | 171         | 44.06          | Oct. 7.47     | May 2.24      |
| 1919 ..  | 122                                                       | 9             | 1             | 3             | 2             | ..            | ..            | ..            | ..            | ..            | ..            | ..            | ..          | 137         | 27.36          | July 4.52     | Dec. 0.89     |
| 1920 ..  | 85                                                        | 7             | 10            | 3             | 1             | 1             | 3             | 2             | ..            | ..            | ..            | ..            | ..          | 112         | 43.16          | Feb. 6.10     | July 1.73     |
| 1921 ..  | 93                                                        | 12            | 5             | 3             | 2             | ..            | ..            | 1             | ..            | ..            | ..            | ..            | ..          | 116         | 34.41          | Oct. 5.89     | Feb. 0.72     |
| 1922 ..  | 101                                                       | 17            | 9             | 3             | ..            | 1             | 1             | ..            | 1             | ..            | ..            | ..            | ..          | 133         | 42.81          | Feb. 6.62     | April 1.73    |
| 1923 ..  | 151                                                       | 6             | 5             | 4             | ..            | 1             | 1             | ..            | ..            | ..            | ..            | ..            | 1           | 169         | 47.04          | April 9.76    | Mar. 1.72     |
| 1924 ..  | 132                                                       | 8             | 10            | 5             | 2             | 5             | 1             | 1             | ..            | 2             | ..            | ..            | ..          | 166         | 60.37          | April 8.55    | July 1.87     |
| 1925 ..  | 142                                                       | 15            | 4             | 2             | ..            | ..            | ..            | 1             | ..            | ..            | ..            | ..            | ..          | 164         | 37.64          | June 6.67     | April 0.84    |
| 1926 ..  | 149                                                       | 15            | 6             | 4             | 5             | 2             | 2             | ..            | ..            | ..            | ..            | ..            | ..          | 183         | 55.53          | May 8.86      | Feb. 1.79     |
| 1927 ..  | 159                                                       | 10            | 6             | 5             | ..            | 4             | ..            | ..            | ..            | ..            | ..            | ..            | ..          | 184         | 45.33          | July 6.29     | April 2.01    |
| 1928 ..  | 125                                                       | 7             | 9             | 2             | 3             | 2             | 2             | 1             | ..            | ..            | ..            | ..            | ..          | 151         | 47.30          | May 7.52      | Jan. 0.01     |
| 1929 ..  | 124                                                       | 19            | 8             | 3             | 1             | ..            | ..            | ..            | ..            | ..            | ..            | ..            | ..          | 155         | 41.05          | April 5.09    | Feb. 0.74     |
| 1930 ..  | 131                                                       | 4             | 2             | 2             | 3             | ..            | 2             | 2             | ..            | ..            | ..            | ..            | ..          | 146         | 37.72          | Jan. 6.87     | Dec. 0.80     |
| 1931* .. | 30                                                        | ..            | 1             | ..            | ..            | ..            | ..            | ..            | ..            | 1             | ..            | ..            | ..          | 32          | 7.66           | Jan. 5.30     | Mar. 0.98     |

\* First three months of year only.

Average annual rainfall over fifteen years is 44.11.

Since 1928 extra work has been undertaken each year for the relief of unemployment. During the period April to December, 1930, about forty men were employed on road and drain construction in the Torehapa and Waitakaruru districts. Works undertaken in advance of requirements for the relief of unemployment certainly increase the cost of a scheme, which has to bear accumulated interest charges; but if they are productive works, that will in time produce a return on the investment, they effect more real economy than non-productive works, which are an increased cost to the community at large. These considerations, together with the fact that it is more than ever necessary at the present time to provide word to relieve distress due to unemployment, appear to warrant the commencement of further works ahead of the normal programme of progressive construction by stages. A suitable work that could be undertaken now is the ballasting of peat roads with clay in the Waitakaruru-Torehapa area.

#### DREDGES.

As in previous years, power excavation occupies a central place in a *résumé* of construction performance. Though all the dredges have not been continuously employed, a considerable amount of canal and stop-bank construction has been accomplished, and the river-improvement works have advanced a long step.

Between 6 m. and 11 m. 8 ch. on the Piako River the channel-enlargement is completed, with the exception of some further deepening near the Horohia Wharf and the removal of some shoaling due to bank-caving near Ngatea. The stop-banks have also been strengthened, and, with the exception of a short section near Ngatea, are completed. Between Kerepeehi and Kaihere Landing (11 m. 8 ch. to 14 m. 45 ch.) a considerable amount of channel-enlargement has been done. The stop-banks on left of western bank of river are completed, and the bank on the eastern side is now being strengthened with spoil dredged from the river. Two machines are now engaged improving the river between 15 m. 47 ch. and 20 m. 9 ch.

The following schedule gives the quantities excavated by the dredges during the past eleven years:—

| Year.   |    |    |    | Cubic Yards. | Cost per<br>Cubic Yard. |
|---------|----|----|----|--------------|-------------------------|
| 1920-21 | .. | .. | .. | 158,865      | 7·42d.                  |
| 1921-22 | .. | .. | .. | 246,022      | 7·29d.                  |
| 1922-23 | .. | .. | .. | 440,092      | 8·20d.                  |
| 1923-24 | .. | .. | .. | 508,654      | 7·27d.                  |
| 1924-25 | .. | .. | .. | 822,286      | 5·86d.                  |
| 1925-26 | .. | .. | .. | 856,653      | 6·32d.                  |
| 1926-27 | .. | .. | .. | 647,182      | 7·42d.                  |
| 1927-28 | .. | .. | .. | 652,413      | 7·32d.                  |
| 1928-29 | .. | .. | .. | 619,911      | 6·54d.                  |
| 1929-30 | .. | .. | .. | 595,565      | 6·25d.                  |
| 1930-31 | .. | .. | .. | 536,692      | 8·32d.                  |

The reduced output and increased unit cost last year is accounted for by the fact that dredge operations in the case of four plants has been intermittent, and interest and depreciation charges for the whole year are included in the cost. Since the first week in December all dredges have been working only eight-hour shifts, instead of ten-hour shifts as formerly, and this has reduced the total output and to a slight degree increased the unit cost.

No. 1 Priestman dredge has been employed deepening the upper reaches of the Piako River between 17 m. 30 ch. and 20 m. 9 ch. Apart from stoppages for minor repairs, and the loss of some days when the dredge had to be beached to repair a leak in the pontoon, operation has been continuous and progress good. Generally easy dredging material was encountered, but some hard bars had to be removed. In 264 working-days this dredge excavated 40,949 cubic yards of material at a cost of 9·22d. per cubic yard.

No. 2 Priestman dredge has been deepening the Maukoro Canal between 4 m. 15 ch. and 6 m. 10 ch. Where there was originally 17 ft. to 24 ft. of peat the dredge is now bringing up clay, which will be used as ballasting for road-construction through the adjacent peat lands. Following the usual practice, dams placed in this canal maintain a high water-level. The lateral support afforded by the water in the bank-full canal is sufficient to prevent excessive bank-caving, excepting in very wet and unstable country. Prior to 1931 the banks of the upper reach of the Maukoro Canal held remarkably well. Unfortunately, while closed down for Christmas vacation the dredge sank in deep water, and when the water in the canal had been gradually lowered about 4 ft. to facilitate salvage operations extensive bank-caving occurred, and it became evident that any further lowering of the water-level might cause general collapse of the canal-banks. The dredge was successfully raised, and recommenced work on the 16th January. Owing to the inaccessible position in which this plant has been working for the past twelve years, it has not been possible to dock the dredge for repairs to the pontoon, which has not been out of the water since it was launched twenty-one years ago. Though the hardwood timber hull is perfectly sound, the caulking is perished. In 243½ working-days this dredge excavated 29,331 cubic yards at a cost of 6·26d. per cubic yard.

No. 6 Priestman dredge was engaged during about eight and a half months of the financial year deepening the Piako River above Kerepeehi (11 m. 8 ch. to 13 m. 8 ch.). The plant was idle for the periods 17th July to 19th August and 20th January to 31st March, when the crew was transferred to No. 11 dredge in the Awaiti Canal. In 175 working-days this machine excavated 29,331 cubic yards at unit cost of 9·06d.

No. 11 Kingston dredge has been working intermittently deepening the Awaiti Canal where shoaling due to bank-caving has occurred, and also raising the stop-banks. In this work progress is limited by the small quantity of material that can be placed on the banks at one time without causing further subsidence. This dredge has also been deepening the Intercepting Canal, where depth has been reduced by the movement of a large amount of sediment into the canal, caused by dredging in the Upper Elstow Canal. The dredge worked eighty-three days and excavated 16,252 cubic yards, the cost, including interest and depreciation during the time the dredge was idle, being 15·92d. per cubic yard.

No. 15 Bucyrus excavator, operating with 50 ft. boom and  $\frac{1}{2}$ -cubic-yard drag-line bucket, was engaged during the months April to June (inclusive) on the Intercepting Canal stop-bank in the Netherton district. Attempts to raise this bank to final level without a dam in canal to keep the water at ground-surface level proved unsuccessful, and work had to be discontinued until the dam was built. In July the machine reached the junction of the Intercepting Canal and Awaiti Canal, and proceeded down the eastern bank of the latter, completing the stop-bank to Awaiti West Road, a distance of 2 miles 21 chains. Early in December the machine was shipped to the Piako River and has been employed widening and deepening the Waikaka spillway. Working two shifts per day, the output for 495 eight-hour shifts was 91,122 cubic yards at unit cost of 7·56d.

No. 16 Bucyrus excavator has been raising the stop-bank on the western side of the Awaiti Canal between 2 m. 30 ch. and 7 m. 55 ch. Good progress was made throughout the year, though a breakdown necessitating extensive repairs to the girder frame of the machine caused delay in July. This machine is using  $\frac{1}{2}$ -yard drag-line equipment and 50 ft. boom, and, working two shifts, excavated 135,296 cubic yards during the year at a cost of 5·5d. per cubic yard.

No. 19 dredge is a plant that was reconstructed on the works in 1929 and put into service early in 1930. The original machine was a Michigan dipper dredge designed for the construction of ditches 20 ft. to 25 ft. wide. Making use of most of the original machinery, the plant was redesigned for widening the channel of the Piako River to 170 ft. For this duty the machine operates a 1-cubic-yard drag-line bucket on boom 105 ft. long. The material excavated from the channel is placed on the river-bank 50 ft. to 100 ft. from the river, which is a special advantage in eliminating the troubles due to collapse of the banks under the weight of the material placed upon them. With an operating-range of over 200 ft., costly rehandling of material is avoided. From April to December, 1930, the machine was working below Ngatea Bridge, and completed 95 chains of channel-enlargement. The quantity excavated on this reach was 62,480 cubic yards, and the cost 7·44d. per cubic yard. In January the machine was loaded on to a pontoon and landed on the right bank of the river below Kaihere Ferry. The moving-costs were heavy, as the machine had to be partially dismantled to reduce weight and to allow it to pass through the opening span of the Ngatea Bridge. The work from the Kaihere Ferry down-stream is similar to that on which the plant was engaged below Ngatea. The total yardage for the year was 70,612, and the cost, including moving-costs and all charges, 8·87d. per cubic yard. The actual working-time was 249 days.

No. 23 steam dipper dredge, after being out of commission since March, 1929, recommenced work in the Intercepting Canal and Upper Elstow Canal on the 16th September, 1930, and has deepened these canals for a distance of 3 miles 18 chains, and extended the Elstow Canal by the construction of 25 chains of new canal. The dredge is now working back to the starting-point, and indications are that the peat through which the channel is excavated is now sufficiently consolidated to allow the required cross-section to be excavated. Owing to the accumulation of floating peat behind the dredge, some difficulty was experienced in getting supplies to the dredge, and a considerable amount of labour was often required to maintain a channel to float the coal-punt through the floating material. The dredge worked 130 days and excavated 40,968 cubic yards of material, the cost being 13·07d. per cubic yard.

No. 24 steam dipper dredge was engaged on the construction of the Pouarua Canal during the first five months of the financial year. The land through which this canal passes consists of peat and timber 8 ft. to 10 ft. deep, overlaying soft alluvium. Due to the instability of the banks, it was not possible to construct a ditch of sufficient depth to float the dredge without raising the water-level by means of temporary dams placed in the channel behind the dredge. It was found, however, that the impounded water percolated through the timber and peat forming the abutments of the dams, so it was decided to suspend operations temporarily to allow the land to consolidate, and the dredge crew was transferred to No. 23 dredge in September. The plant was working only thirty-four days. In that time 20,166 cubic yards was excavated, the unit cost, including interest and depreciation charges for the whole year, being 18·75d.

No. 28 Bay City drag-line excavator is a light machine specially suitable for the construction and maintenance of large drains. During most of the year the machine was used for improving the large machine-excavated drains in the Kerepeehi Block. The work involved the removal of growth and sediment from the drains and sloping the drain-banks, which were originally constructed more or less vertical by dipper dredges. One man operates the machine, and it has proved very satisfactory and economical for reconditioning large drains. The average quantity of spoil removed from 475 chains of drains improved by the machine was about 55 cubic yards per chain, and this was handled for 6d. per cubic yard. During June, 1930, the excavator was used for the construction of an outlet channel through the river-bank mud-flat for a new two-barrel flood-gate at Pipiroa. The output for the year was 28,329 cubic yards, and the cost 7·06d. per cubic yard.

## CENTRAL DISTRICT.

The principal activities in this district comprised river-improvement work, road-metalling, and drain-construction. A scheme for metalling 3 miles 57 chains of roads in the Kerepeehi Block, commenced in October, 1929, was completed in February, 1931, winter conditions having necessitated cessation of the work during the period June to October (inclusive). During the year formation was completed, and base-course metal was laid for a distance of 63 chains and surface course completed on 3 miles 57 chains of roadway. The total quantity of metal used was 4,856 cubic yards, which was delivered by scow to various points on the river-bank and carted on to the roads by motor-lorry and horse teams. The Hopai West Road was metalled for a distance of 71 chains, using 1,768 cubic yards of metal. Between thirty and forty men accommodated in relief works camp at Kaihere were engaged on drain-construction on the Kerepeehi Block until July, when the camp was closed and some of the men moved to a new camp established at Waitakaruru. A total of 4 miles 2 chains of new drains were constructed in the Central District, and 1 mile 73 chains of drains widened and deepened by manual labour, the quantity of excavation being 19,320 cubic yards. 15 miles 4 chains of drains were cleaned. The reconditioning of 5 miles 75 chains of drain by drag-line excavator necessitated excavation amounting to 28,329 cubic yards.

At the central depot at Kerepeehi stores, fuel, and supplies are received and distributed by barge, launch, or motor-lorry.

Minor undertakings include ring-barking willows on the stream-banks; spraying and grubbing blackberries on flax plantations; planting 1,040 trees; cutting and hauling 323 white-pine logs for earthwork timbering and temporary construction; fencing stop-banks; and levelling, cultivating, and sowing grass-seed on spoil-banks. The vehicular river-ferry service at Kaihere has been maintained without interruption. One 4-ft.-diameter concrete culvert was constructed on the Ngatea-Waitakaruru Road.

## WAITAKARURU-TOREHAPE DISTRICTS.

As the result of efforts to reduce unemployment, a considerable volume of useful development work has been accomplished in the unsettled portions of these districts. A camp to accommodate about fifty workmen, established at Torehape in October, 1929, was maintained until June, 1930, when about thirty-five men were transferred to a new camp at Waitakaruru. 15 miles 13 chains of new drains were constructed during the year, and 19 miles 2 chains of existing drains reconditioned. These works, which were carried out under a system of co-operative contracts, involved 70,335 cubic yards of excavation. General maintenance work was carried out, and 30 miles 42 chains of drains were cleaned. Improvement of the Mangatarata Stream, consisting of the enlargement of the channel and removal of growth and obstructions, was carried out for a distance of 27 chains for the purpose of preventing the flooding of a low portion of the Torehape-Mangatarata Road. Between July and October 4,122 cubic yards of clay ballast was carted by tramway on to the Torehape Road, and 540 black-birch sleepers were cut and used for repairing tramway.

## AWAITI DISTRICT.

For some time past work connected with the Elstow-Awaiti drainage scheme has comprised the bulk of the yearly construction in this district. This scheme, which is now nearly completed, involved approximately 1,050,000 cubic yards of excavation in the construction of 12 miles of canals, over 17 miles of stop-banks, and 18½ miles of drains. It also includes 15 miles of road-construction, and the building of five road-bridges and eleven large flood-gates. During the year under review the stop-banks on the northern side of the Intercepting Canal have been completed, and the stop-banks of both sides of the Awaiti Canal have been raised to required level, with the exception of two sections, each about 6 chains in length—one on the right bank of the canal where subsidence of 1 ft. to 2 ft. has taken place, and the other comprising two openings in the left bank which it is not advisable to close until the temporary dams in the canal are removed. Nearly all the drain-construction included in this scheme is now completed. A large drain connecting the upper end of the Elstow Canal with the outlet of the Elstow Drainage Board's Central Area system at the Tirohia-Otway Road was completed during the year, and also 1 mile 44 chains of road-formation. A total quantity of 19,618 cubic yards of material was excavated by manual labour in the construction of 48 chains of new drain, widening and deepening 5 miles 23 chains of existing drains, and strengthening 52 chains of light stop-bank. Roading and drainage for the development of the Koromatua Block, comprising about 935 acres of peat land adjoining the Otway Settlement, in the Elstow district, was commenced in December, and at the end of the financial year 9,285 cubic yards had been excavated by co-operative contractors in the construction of 2 miles 25 chains of new drains of various sizes, and 2,998 cubic yards of clay ballast was carted by the Department's teams for the formation of 133 chains of road on peat subgrade. The construction of two road-culverts, one 18-ft.-stringer access bridge, and 10 chains of fencing are additional works carried out on this block. In the Awaiti district 44 chains of fencing was erected for the protection of drains and stop-banks, thirteen pipe road-culverts varying in diameter from 2 ft. 6 in. to 5 ft., two two-barrel flood-gates, and one small road-bridge were constructed. 30 chains of drain was cleaned.

## PATETONGA DISTRICT.

The metalling of a seven-mile section of the Patetonga Main Road, commenced in May, 1929, was continued during the summer months, and at the end of the year the base-course metal had been laid throughout and top course for a distance of 6 miles. The work carried out on the main road during the year comprised 51 chains of hill-road reconstruction, the spreading of 4,710 cubic yards of metal, and the cartage of 1,285 cubic yards of clay for haunching metal on the peat section of the road. The base-course metal was laid for a distance of 100 chains on the Patetonga Landing Road 1,095 cubic yards of metal being used, and 590 cubic yards of clay carted by tramway for haunching the metal. The metal for these roads is obtained from a quarry opened up by the Department on Hauraki Plains County Council property. The quarrying, crushing, and delivering of the metal is carried out by contract.

Drain-maintenance work carried out in this district comprised 37 miles 51 chains of drain-cleaning, and the excavation of 1,492 cubic yards for the widening and deepening of 61 chains of drain.

The metalling of the main road has affected the river traffic, and cargo for Patetonga is now discharged at Ngatea or Kaihere Wharves, and all cream is now conveyed by road, instead of by launch as formerly. In consequence of these changes the tramway service for the delivery of goods from Patetonga Wharf to the township, which had been operated by the Department for thirteen years, was discontinued in June.

142 cubic yards of gravel was obtained from the Mangawhero Road drain and used on that road, and the important work of maintaining the roads during reconstruction and after metalling has not been neglected.

## STRUCTURAL WORK.

Particulars of the flood-gates, culverts, and bridges completed during the year are contained in the summary. Extensive alterations and repairs were carried out to the Kaihere Wharf. The wharfshed was placed on shore on grid foundation, new approach to wharf constructed, and six piles in the original wharf renewed. Three large temporary dams were built of timber and steel-sheet piling to float dredges in canals under construction. All repairs to dredges and other plant were carried out on the works or at the Kerepeehi workshops.

## ENGINEERING AND LAND SURVEYS.

In addition to engineering survey work, land-subdivisional surveys of 2,030 acres were carried out, 41 miles of theodolite traverse were completed, 36 miles of leveling for road and drainage works, and 153 cross-sections of the river-channel were taken. Investigations and reports of several small schemes have been made. Rainfall records have been kept up to date, also river stage records. No stream-flow gaugings have been carried out, as practically normal river conditions prevailed throughout the year.

## SUMMARY.

The total length of the subsidiary drains constructed on the Hauraki Plains to date since the inception of the works is 731 miles 26 chains. Particulars of the works carried out during the year under review are summarized in the following schedule:—

|                                                                                                                       | Length.<br>Miles ch. | Excavation.<br>Cub. yd. |
|-----------------------------------------------------------------------------------------------------------------------|----------------------|-------------------------|
| Drains cleaned by manual labour .. .. .                                                                               | 93 61                | ..                      |
| Drains widened and deepened by manual labour .. .. .                                                                  | 26 29                | 60,176                  |
| Drains—New construction by manual labour .. .. .                                                                      | 21 64                | 60,520                  |
| Stop-bank constructed by manual labour .. .. .                                                                        | 0 52                 | 2,300                   |
| Total quantity of drainage excavation by manual labour .. .. .                                                        |                      | 122,996                 |
| New canals constructed by machines .. .. .                                                                            | 0 77                 | 28,394                  |
| River and canal improvement, machine construction .. .. .                                                             | 12 34                | 479,969                 |
| Reconditioning drains by machines .. .. .                                                                             | 5 75                 | 28,329                  |
| Total excavation by machines .. .. .                                                                                  |                      | 536 692                 |
| Stop-banks constructed or partially constructed in conjunction with river-improvements and canal-construction .. .. . | 10 74                | ..                      |
|                                                                                                                       | Miles ch.            | Cub. yd.                |
| Roads metalled .. .. .                                                                                                | 2 13                 | 3,981                   |
| Roads metalled, base course only .. .. .                                                                              | 1 20                 | 1,095                   |
| Roads metalled, top course only .. .. .                                                                               | 7 21                 | 7,353                   |
| Total quantity of road-metal laid .. .. .                                                                             |                      | 12,429                  |
| New roads formed, Hauraki Plains .. .. .                                                                              | 2 21                 | ..                      |
| Roads reconstructed and improved .. .. .                                                                              | 1 78                 | ..                      |
| Clay carted for ballasting roads on peat subgrade and haunching metal .. .. .                                         | 3 68                 | 9,598                   |
| Fences erected .. .. .                                                                                                | 2 41                 | ..                      |

| Bridges—                                                            | No. |
|---------------------------------------------------------------------|-----|
| Road-bridge, 20 ft. span, pile abutments .. .. .                    | 1   |
| Access bridge, 18 ft. span .. .. .                                  | 1   |
| Flood-gates—Reinforced concrete, two 4 ft. by 4 ft. barrels .. .. . | 2   |
| Concrete road-culverts .. .. .                                      | 18  |

## FLAX LEASES.

For flax-growing purposes 3,141 acres are leased, divided into eight holdings, on which the annual rental amounts to £435 8s. Rents totalling £110 2s. 6d. were collected during the year.

## GRAZING-AREAS.

The area leased for grazing purposes under temporary tenancies is 6,762 acres, let to forty-seven settlers. The annual rental is £524 17s., and some £407 14s. 5d. was collected in this connection.

## WORKS EXPENDITURE.

The total expenditure recorded was £51,056 10s. 3d., of which day labour accounted for £23,999 8s. 8d., and 123 piecework and co-operative contracts for £5,100 3s. 9d.

The drainage rate struck for 1930–31 totalled £3,033 19s. 8d., entailing the issue of 364 notices, and £3,181 5s. 5d. was collected in respect to rates.

## GENERAL.

I wish to place on record my appreciation to all members of the staff for their loyal and efficient assistance.

I have, &c.,

R. G. MACMORRAN, Chief Drainage Engineer.

The Under-Secretary for Lands, Wellington.

## HAURAKI PLAINS SETTLEMENT ACCOUNT.

## RATE ACCOUNT AS AT 31ST MARCH, 1931.

| <i>Dr.</i>                   | £             | s.       | d.       | <i>Cr.</i>              | £             | s.       | d.       |
|------------------------------|---------------|----------|----------|-------------------------|---------------|----------|----------|
| To Rates written off .. .. . | 188           | 2        | 6        | By Rates levied .. .. . | 3,038         | 19       | 8        |
| Cost of maintenance .. .. .  | 2,414         | 3        | 2        | Penalty .. .. .         | 111           | 4        | 4        |
| Balance .. .. .              | 547           | 18       | 4        |                         |               |          |          |
|                              | <u>£3,150</u> | <u>4</u> | <u>0</u> |                         | <u>£3,150</u> | <u>4</u> | <u>0</u> |

## REVENUE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 1931.

| <i>Dr.</i>                                                                         | £               | s.        | d.       | <i>Cr.</i>                                                | £               | s.        | d.       |
|------------------------------------------------------------------------------------|-----------------|-----------|----------|-----------------------------------------------------------|-----------------|-----------|----------|
| To Interest on debentures issued under Hauraki Plains Settlement Act, 1926 .. .. . | 31,850          | 3         | 3        | By Accrued rent .. .. .                                   | 9,879           | 13        | 2        |
| Interest on expenditure from Public Works Fund .. .. .                             | 202             | 16        | 0        | Accrued royalties .. .. .                                 | 161             | 0         | 10       |
| Administration expenses .. .. .                                                    | 408             | 11        | 9        | Grazing fees .. .. .                                      | 100             | 13        | 8        |
| Remissions of rent and interest .. .. .                                            | 218             | 0         | 6        |                                                           |                 |           |          |
| Remissions by Dominion Revaluation Board .. .. .                                   | 9               | 9         | 0        | Tram freight and ferry fares .. .. .                      | 485             | 13        | 2        |
| Rebates-rent and interest .. .. .                                                  | 595             | 8         | 3        | Less half profits Kaihere Ferry to County Council .. .. . | 26              | 15        | 2        |
| Interest on temporary advances .. .. .                                             | 39              | 9         | 0        |                                                           |                 |           |          |
| Expenses raising loans .. .. .                                                     | 29              | 15        | 1        | Interest on investments .. .. .                           | 458             | 18        | 0        |
| Irrecoverable rents, &c. .. .. .                                                   | 239             | 5         | 3        | Interest on sales of land .. .. .                         | 277             | 18        | 4        |
|                                                                                    | <u>£33,592</u>  | <u>18</u> | <u>1</u> | Interest allowed on sinking-fund contribution..           | 413             | 1         | 5        |
|                                                                                    |                 |           |          | Miscellaneous .. .. .                                     | 351             | 16        | 8        |
|                                                                                    |                 |           |          | Net loss carried down .. .. .                             | 112             | 1         | 5        |
|                                                                                    |                 |           |          |                                                           | 21,837          | 14        | 7        |
|                                                                                    |                 |           |          |                                                           | <u>£33,592</u>  | <u>18</u> | <u>1</u> |
|                                                                                    |                 |           |          |                                                           |                 |           |          |
|                                                                                    | £               | s.        | d.       |                                                           | £               | s.        | d.       |
| To Net loss brought down .. .. .                                                   | 21,837          | 14        | 7        | By Balance carried forward .. .. .                        | 123,759         | 1         | 5        |
| Balance from previous year .. .. .                                                 | 101,921         | 6         | 10       |                                                           |                 |           |          |
|                                                                                    | <u>£123,759</u> | <u>1</u>  | <u>5</u> |                                                           | <u>£123,759</u> | <u>1</u>  | <u>5</u> |

## RECEIPTS AND PAYMENTS ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 1931.

| <i>Receipts.</i>                                        |         |       | <i>Payments.</i>                                                                                                                                                                                  |         |       |
|---------------------------------------------------------|---------|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------|
|                                                         | £       | s. d. |                                                                                                                                                                                                   | £       | s. d. |
| To Balance, 1st April, 1930 .. .. .                     | 24,252  | 9 2   | By Drainage-works, stop-banks, clearing channels, and other expenditure incidental to conducting drainage operations (including metalling and formation of roads), material supplied, &c. .. .. . | 19,195  | 7 5   |
| Rates .. .. .                                           | 3,822   | 12 1  | Machinery and plant .. .. .                                                                                                                                                                       | 1,520   | 14 9  |
| Inscribed stock issued—Hauraki Plains Act, 1926 .. .. . | 24,000  | 0 0   | Material and stores .. .. .                                                                                                                                                                       | 10,707  | 8 10  |
| Temporary advances from other accounts .. .. .          | 7,500   | 0 0   | Fuel .. .. .                                                                                                                                                                                      | 5,178   | 7 7   |
| Sales of land .. .. .                                   | 563     | 6 10  | Maintenance, completed works .. .. .                                                                                                                                                              | 2,506   | 16 7  |
| Rents .. .. .                                           | 8,369   | 10 5  | Management and engineering expenses .. .. .                                                                                                                                                       | 3,313   | 18 1  |
| Interest on sales of land .. .. .                       | 308     | 0 9   | Accident compensation .. .. .                                                                                                                                                                     | 467     | 14 4  |
| Artesian-well boring—                                   |         |       | Refund of rates .. .. .                                                                                                                                                                           | 55      | 19 11 |
| Repayment of advances .. .. .                           | 88      | 5 10  | Discharged Soldiers Settlement Account—                                                                                                                                                           |         |       |
| Interest on advances .. .. .                            | 58      | 5 11  | Recoupment in respect of merged transactions .. .. .                                                                                                                                              | 75      | 7 10  |
|                                                         |         |       | Exchange .. .. .                                                                                                                                                                                  | 29      | 15 1  |
| Tram freights and ferry fares .. .. .                   | 538     | 17 3  | Consolidated Fund—Interest on debentures .. .. .                                                                                                                                                  | 15,000  | 0 0   |
| Interest on investments .. .. .                         | 394     | 6 0   | Temporary transfer from other accounts .. .. .                                                                                                                                                    | 7,500   | 0 0   |
| Instalments on buildings .. .. .                        | 14      | 11 0  | Balance—Cash in Public Account .. .. .                                                                                                                                                            | 13,941  | 6 1   |
| Credits in reduction of expenditure .. .. .             | 9,576   | 1 7   |                                                                                                                                                                                                   |         |       |
| Rates prepaid .. .. .                                   | 6       | 9 8   |                                                                                                                                                                                                   |         |       |
|                                                         |         |       |                                                                                                                                                                                                   |         |       |
|                                                         | £79,492 | 16 6  |                                                                                                                                                                                                   | £79,492 | 16 6  |

## BALANCE-SHEET AS AT 31ST MARCH, 1931.

| <i>Liabilities.</i>                                                                                                                  |          |       | <i>Assets.</i>                                                                                                      |          |       |
|--------------------------------------------------------------------------------------------------------------------------------------|----------|-------|---------------------------------------------------------------------------------------------------------------------|----------|-------|
|                                                                                                                                      | £        | s. d. |                                                                                                                     | £        | s. d. |
| Capital Account—                                                                                                                     |          |       | Improved land handed over to                                                                                        |          |       |
| Debentures issued under Hauraki Plains Act, 1926—                                                                                    |          |       | Land Board for settlement—                                                                                          |          |       |
| Debentures at—                                                                                                                       |          |       | Leased .. .. .                                                                                                      | 184,656  | 1 3   |
| 3½ per cent. .. 60,000                                                                                                               |          |       | Unleased .. .. .                                                                                                    | 12,702   | 7 8   |
| 3¾ per cent. .. 25,000                                                                                                               |          |       |                                                                                                                     | 197,358  | 8 11  |
| 4 per cent. .. 591,500                                                                                                               |          |       | Unpaid purchase price of land sold on deferred payment .. .. .                                                      | 12,426   | 15 9  |
| 4½ per cent. .. 122,500                                                                                                              |          |       | Unimproved land not disposed of .. .. .                                                                             | 42,325   | 14 11 |
| 5½ per cent. .. 10,000                                                                                                               |          |       | Improvements on adjoining Crown lands .. .. .                                                                       | 7,710    | 0 0   |
|                                                                                                                                      | 809,000  | 0 0   | Permanent reserves .. .. .                                                                                          | 8,851    | 0 0   |
| Expenditure from Public Works Fund .. .. .                                                                                           | 5,070    | 0 0   | Works in progress—Expenditure on land in process of reclamation, including formation and metalling of roads .. .. . | 501,272  | 12 9  |
| Value of Crown lands set apart under the Act .. .. .                                                                                 | 45,000   | 0 0   | Artesian wells—                                                                                                     |          |       |
|                                                                                                                                      |          |       | Crown tenants, Hauraki Plains .. .. .                                                                               | 661      | 0 2   |
|                                                                                                                                      |          |       | Permanent reserves and Crown lands .. .. .                                                                          | 216      | 10 9  |
| Discharged Soldiers Settlement Account—Merged interests under section 20, Discharged Soldiers Settlement Amendment Act, 1923 .. .. . |          |       |                                                                                                                     | 877      | 10 11 |
| Consolidated Fund—                                                                                                                   |          |       | Buildings .. .. .                                                                                                   | 5,887    | 3 0   |
| Interest on debentures under Local Bodies' Loans Act, 1908 .. .. .                                                                   | 22,083   | 6 8   | Wharves .. .. .                                                                                                     | 4,326    | 15 0  |
| Interest on expenditure out of Public Works Fund .. .. .                                                                             | 4,664    | 8 0   | Machinery and plant .. .. .                                                                                         | 46,767   | 3 11  |
| Interest on temporary transfers from other accounts .. .. .                                                                          | 628      | 9 11  | Live-stock .. .. .                                                                                                  | 81       | 11 0  |
| Rates unpaid, 1917–21 .. .. .                                                                                                        | 47       | 15 0  | Loose tools .. .. .                                                                                                 | 307      | 9 11  |
| Interest on debentures under Hauraki Plains Act, 1926 .. .. .                                                                        | 95,132   | 1 2   | Stores and fuel .. .. .                                                                                             | 5,191    | 5 8   |
|                                                                                                                                      |          |       | Stamps on hand .. .. .                                                                                              | 0        | 3 0   |
| Interest on debentures accrued but not due .. .. .                                                                                   |          |       | Sundry debtors—                                                                                                     |          |       |
| Sundry creditors—                                                                                                                    |          |       | Rent .. .. .                                                                                                        | 2,632    | 3 8   |
| Departmental .. .. .                                                                                                                 | 1,257    | 5 11  | Rates .. .. .                                                                                                       | 3,232    | 7 6   |
| Miscellaneous .. .. .                                                                                                                | 2,478    | 5 3   | Instalments of principal on deferred-payment sales .. .. .                                                          | 171      | 11 8  |
|                                                                                                                                      |          |       | Interest on deferred-payment sales .. .. .                                                                          | 157      | 11 8  |
| Rents charged in advance .. .. .                                                                                                     |          |       | Interest on well-boring .. .. .                                                                                     | 96       | 12 2  |
| Rate Account .. .. .                                                                                                                 |          |       | Law-costs .. .. .                                                                                                   | 93       | 8 10  |
| Suspense Account .. .. .                                                                                                             |          |       | Ferry fares and tram freights .. .. .                                                                               | 114      | 8 11  |
| Writings-off in suspense .. .. .                                                                                                     |          |       | Grazing .. .. .                                                                                                     | 66       | 2 0   |
| Payments in advance—                                                                                                                 |          |       | Royalties .. .. .                                                                                                   | 205      | 7 10  |
| Rent .. .. .                                                                                                                         | 59       | 15 7  | Departmental .. .. .                                                                                                | 1,367    | 11 9  |
| Interest on deferred-payment sales .. .. .                                                                                           | 1        | 0 0   | Miscellaneous .. .. .                                                                                               | 5,676    | 6 0   |
| Rates .. .. .                                                                                                                        | 6        | 10 11 |                                                                                                                     |          |       |
| Miscellaneous .. .. .                                                                                                                | 2        | 2 4   |                                                                                                                     |          |       |
|                                                                                                                                      |          |       |                                                                                                                     |          |       |
|                                                                                                                                      |          |       |                                                                                                                     |          |       |
|                                                                                                                                      | £995,173 | 9 3   |                                                                                                                     | £995,173 | 9 3   |

6th July, 1931.

I hereby certify that the Receipts and Payments, Rate and Revenue Accounts, and Balance-sheet have been duly examined and compared with the relative books and documents submitted for audit, and correctly state the position as disclosed thereby. The following comments are appended: (1) In the opinion of the Audit Office interest charged on works in progress should be capitalized. (2) A Bad Debt Reserve should be created. (3) Suggestions in reference to the treatment of expenditure on lands already handed over for settlement were made to and are at present under consideration by the Department.—G. F. C. CAMPBELL, Controller and Auditor-General.

W. ROBERTSON, Under-Secretary for Lands.  
W. E. SHAW, Accountant.

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