

plant in comparison with the many projects involved. A visit to similar works in the United States has resulted in the choice and purchase of plant calculated to allow of greater concentration on certain areas, and the following proposed distribution of such plant is recommended:—

Plant-distribution.—Hauraki Plains: One Rood walking land dipper dredge; One Wilson walking land dipper dredge; two Bucyrus caterpillar drag-line excavators; two steam dipper dredges, 1½-yards capacity. Rangitaiki Plains: One Bay City walking dipper land dredge, 1-yard capacity; two Monighan walking drag-line excavators. Kaitaia area: One Bay City dipper dredge; one Priestman grab-dredger (from England). Waihi area: One steel dipper dredge (oil-driven), with steel hull. Poukawa area: One steel dipper dredge (steam-driven). Hikurangi area: Three Bucyrus steam-navvies convertible to drag-lines; two petrol locomotives; seven gasoline-driven air-compressor and receiver units, with jack-hammers and steel drills, &c.

Spare parts will be allocated to various machines, and as each plant arrives it will be conveyed to its approved destination. This distribution will materially accelerate work and hasten completion of main projects, and thus release plant from time to time for other undertakings.

Photographs of these machines will be found appended hereto.

Office.—The No. 3 photostat will be installed as soon as a suitable room is available. This outfit is a fine one, and has innumerable purposes of application. It is proposed to do much work of direct reduction of all descriptions of plans, not only for the Land Drainage Branch, but for the two District Offices and the Standard Survey Branch. Plans of 36 in. by 48 in. can be reduced to sizes of 18 in. by 24 in. and smaller, and portions of plans can be photostated to various scales. All classes of documents can also be readily copied, and, in fact, there are a-thousand-and-one ways where time and money can be saved.

The operation of this machine is a most suitable occupation for a young woman. Quite a feature of this machine's use is the reduction of plans for binding in atlas form for either file or field use. This application is general throughout the United States. A report on the scope of the instrument by the Taft Commission to Congress is attached hereto.

Two flow-recorders and one current-meter were purchased for use in connection with investigations of this branch. It is unnecessary to state that these instruments are absolutely essential, and should form part of the scientific equipment of any engineering office.

THE FUTURE OF THE LAND-DRAINAGE MOVEMENT IN NEW ZEALAND.

Past History.—In the initial stages of the movement comparatively small areas of swamp lands were being drained by community or private enterprise working under the Land Drainage Act. The reclamation of large areas could not well be financed without Government aid, and finally parliamentary sanction was obtained to the proposed development of what was then known as the Piako Swamp, but now as the Hauraki Plains. An enabling Bill was brought down for this particular area, and later for the Rangitaiki Plains area, and the results obtained by the drainage operations called forth applications from many districts for similar aid.

The old procedure of individual empowering Bills was then decided to be too cumbersome, and the Government of the day decided to bring down a measure which would enable it to handle subsequent applications. This measure was finally placed on the statute-book as the Swamp Drainage Act, 1915, the Hon. Minister of Lands being the administrative authority.

The Future.—To date, the drainage operations carried out under Government control have resulted in bringing previously useless swamp land to profit, and expectations have been more than realized. These operations are incomplete as regards present undertakings, and there are many areas untouched which it will pay to take in hand.

One cannot be too enthusiastic in the matter of land-reclamation, and the watching of seemingly irreclaimable areas coming to profit is very heartening. There is a big field of undeveloped possibilities in New Zealand that can be best carried out by the Government under its own Swamp Drainage Act, 1915, or by community enterprise working under the machinery of the Land Drainage Act, 1908.

There are many purely swamp areas throughout the Dominion, perhaps small individually, but large in the aggregate, which must, in the ordinary course of events, be reclaimed. Then come the large tracts of marsh lands on the foreshores of the coast. The periodically flooded bottom lands in the flood-plane slopes of rivers is another avenue for development. Fortunately, gravity drainage governs the larger proportion of future possible reclamation projects. Installation of low-lift pumps will be necessary to deal with certain of the areas. Generally, the field is a broad one, and offers every inducement for investigation.

There will without doubt come a time when necessity will demand intensive cultivation of swamp and marsh areas; holdings will become smaller, and the necessity for close drainage of same will arise. To meet these conditions tile drains will be required, in sizes of 6 in. and upwards. Their use has been most successful, and they will eventually largely replace open ditches, which occupy so much land.

Investigations necessary.—It is recognized in Canada and in the United States that practical assistance by the respective Governments is required in the direction of providing reliable data for information of Drainage Boards, settlers, and engineers, and to this end there exists an investigation staff. The Drainage Investigations Bureau of the United States is a most valuable branch of the Federal Government, and might well be adopted as a model for requirements in New Zealand and elsewhere.