securing a stump of sufficient length when longer distances are in use; for example, 3,500 feet or upwards. With the rod in this position the target, whatever it may be-a field book or a page of white paper-is read on some part of the stump. By this means the writer has taken sights of 4,000 feet on several occasions when absolutely necessary, as in the case of an intervening lake. The transit might be set up on one shore of the lake and a sight to the opposite shore might necessitate readings through such a distance. I have known sights of one mile in length to be taken on a lake. These are rare instances, however, and conditions must be suitable, for telescopes are few through which a target can be satisfactorily read at a distance of a mile. Extreme difficulty is experienced in focusing the wire upon it even at a distance of 4,000 feet, it being almost impossible to see the target unless a little ingenuity is used in distinctly outlining it.

Such long-distance sights, provided proper precautions are taken, have great advantages in traversing. One accomplishes more, and again, a single long-distance sight is more correct than two of short distances. The longer the sight the straighter the line. This is well exemplified in chain measuring where the transit man who strives to run a perfectly straight line knows the value of a single sight of, say, 2,400 feet in comparison with two sights of 1,200, or four sights of 600 feet each.

On land, of course, these distances are frequently impossible owing to divergencies of contour; but on the water and in some parts of the western provinces very long sights may sometimes be taken. In the case of the latter, however, level or open prairie work is no longer abundant, the major portion of the unsurveyed west being covered with bush and muskeg.

J. A. MACDONALD. Ottawa, Ont., July 10th, 1913.

## ADDITION TO THE TORONTO FILTRATION PLANT.

N his report to the Board of Works relative to the proposed extensions to the waterworks system of the City of Toronto, Commissioner of Works R. C. Harris recommends the installation of a mechanical system of filtration to supplement the slow sand methods now in use at the Island.

This report is the first official announcement that has been made concerning the expenditure which the \$6,ooo,ooo by-law of January 1st, 1913, was intended to cover. During the past six months the Works Department has given the situation most careful study, and the scheme of extension now advocated is the result of a very thorough investigation. As intimated in the June 26th issue of *The Canadian Engineer*, the Commissioner of Works had decided it advisable to base his report upon the experience and careful investigation of the city's own engineering staff, rather than merely to accept the report of the board of experts appointed previous to his administration.

The new report in full is as follows :----

Gentlemen,-We beg to herewith submit report re addition to Island filtration plant.

There are two standard methods of filtration, viz., slow sand and mechanical, both of which are capable of giving equally effective results. In the former system, the raw water, without chemical treatment, is passed through beds of sand and gravel at the rate of from three to five million gallons per acre per day, and the effluent is carried by gravity to a clear water reservoir, from which it flows to the distributing pumps.

In the mechanical system, the water is pumped from the source, and a coagulant, usually in the form of sulphate of alumina, is applied before entering a coagulating basin, where sedimentation takes place for several hours. The water is then passed through rapid sand filters at the rate of from seventy-five to one hundred and fifty million gallons per acre per day, then flowing to a reservoir for distribution by pumping.

The slow sand process is particularly adapted to purifying water without color and with comparatively little suspended matter. The mechanical process will successfully handle any type of water, regardless of color of turbidity, and operates at maximum efficiency when raw water conditions are worst.

Ordinarily, the first cost of a mechanical filter installation is considerably less than that of slow sand, and occupies but a fraction of the area required by the latter, while the operating costs are considerably higher than the slow sand method, due largely to the necessity for using coagulant.

For the purpose of acquiring information to enable us to advise the administration, we visited mechanical filter plants at Montreal, Que.; Little Falls, N.J.; Cincinnati, O.; Toledo, O.; Columbus, O., and Niagara Falls, N.Y. We also viewed the slow sand plants at Philadelphia, Pa.; Pittsburg, Pa., and Washington, D.C.

At each of these cities the type of plant used was giving satisfactory results.

At Philadelphia, we found that pre-filtration was necessary before admitting the water to the slow sand beds. This pre-filtration was accomplished by what is known as a "roughing filter," which is in effect a mechanical filter without the use of coagulant, and which removes from the water the greater portion of the suspended matter, thereby enabling the slow sand beds to be used at a rating much above normal.

At Pittsburg, they were having considerable trouble with the water, and were making plant additions to overcome same. This, however, was not due to any demerit of the slow sand method, but is accounted for by the chemical quality of the raw water.

At Washington, the water travels many miles from the source before it reaches the filters, sedimentation taking place in the channels and in certain basins en route.

The mechanical filters above referred to were also giving excellent satisfaction. Especially good results were obtained at Cincinnati, which may, in a measure, be accounted for by the fact that the water is allowed to settle for several days in reservoirs, prior to entering the plant.

The works at Montreal are the most recent in point of construction.

The Medical Officer of Health and Alderman Rowland, chairman of the local Board of Health, also visited a mechanical plant at New Orleans, La., which is giving excellent results.

The plants of both types visited were handling river waters.

The slow sand plant located on Toronto Island, consists of twelve beds, having an area of .8 acres each, designed to handle a maximum of five million gallons per acre per day, or four million gallons per filter, making a