

ment was made to strike out the qualifying clause; it was lost on a division. The Railway Committee of the Privy Council subsequently heard evidence upon the whole question, examined into it carefully, & came to the conclusion that satisfactory arrangements could not be made over the M.C.R. for the running of the L. E. & D.R. trains.

The Regulation of the Level of Lake Erie.

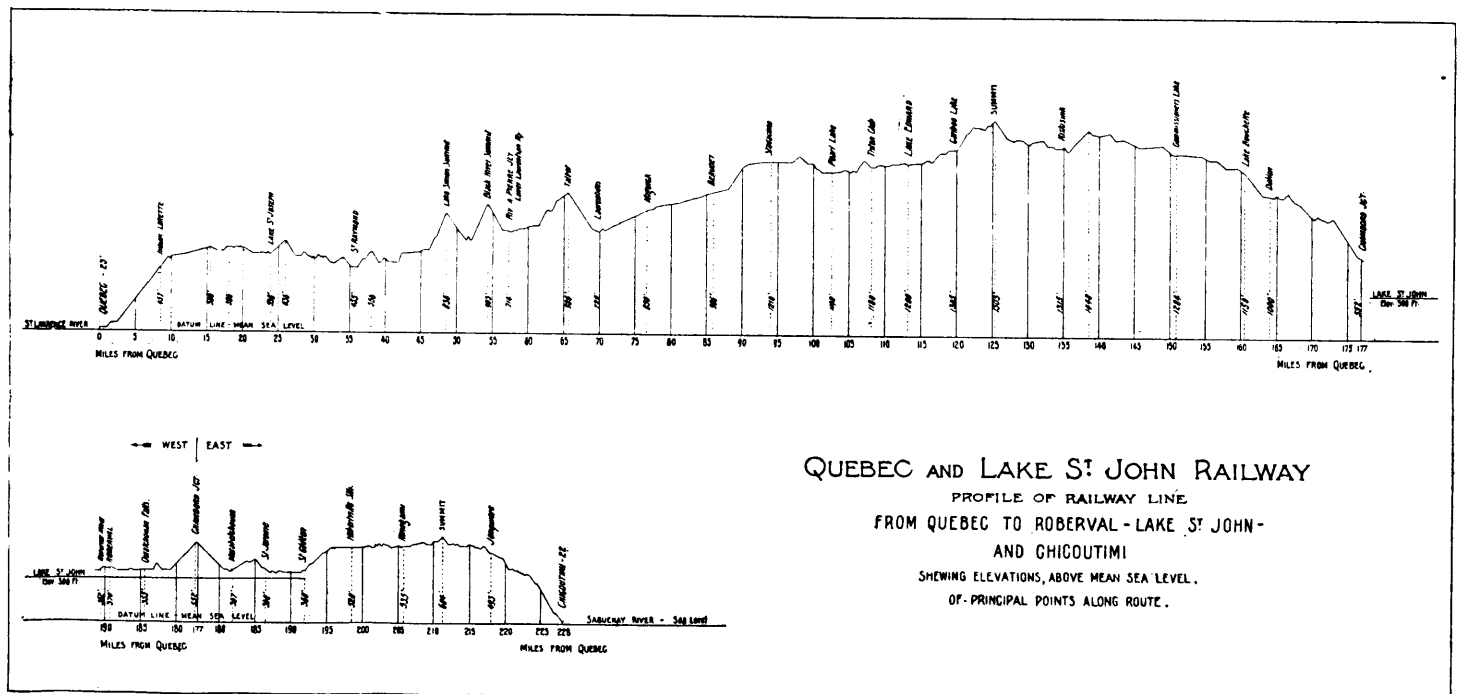
By F. W. Farncomb, O.L.S., London.

The necessity for increasing the safety, certainty & facility of the navigation of the Great Lakes & the deep waterways between them & the Atlantic tide waters, is one of the great undertakings of international importance which will require the immediate action of the Canadian & U.S. governments. The comparatively great variation, both annual & periodical, in the height of the water, in Lake Erie alone, involves enormous loss to the shipping interest, as well as the expenditure of millions of dollars in deepening harbors, channels & waterways.

varying rainfall, ice, etc., which practically governs the variation of its water level. The flood water pouring into the upper end from the Detroit river, the lake water at normal height must rise until the sectional area & slope of the upper portion of the Niagara river, which forms the outlet, is increased till its capacity is equal to the increased supply from above, when the lake water level becomes once more stationary until the conditions are again changed.

It is evident that no matter what system be adopted for regulating the water to a uniform height, or in other words making the discharge equal to the supply, that the capacity of the Niagara river must be increased below the required lake level so that it will at all stages be sufficient to carry off the maximum supply. It is also evident that this can only be accomplished by deepening or widening its bed for a certain distance, or by raising the water in the lake above the river bed until a like result is obtained. With this result accomplished, by either method, means must be devised to regulate the discharge into this huge tail race when its full capacity is not required, so that it will equal the volume of

deflecting about 35 degrees northerly & running in at right angles to the Canadian shore, a total distance of 2,810 ft. Of this 1,600 ft. will be a fixed weir, 1,040 ft. will be sluice openings, & the remainder will be taken up by sluice gate piers. About 1,200 ft. of the reef will be utilized at small cost for the proposed weir as it is about the required height, viz., 6.6 ft. below the surface of the water when regulated to the height proposed. The river bed deepens suddenly at the end of this rock, & it is from there the piers & sluice gates will be placed. They will be 13 in number, 80 ft. each in width, & have a depth of 20 to 24 ft. To each gate will be attached suitable hoisting gear & counter weights so arranged that the variation in weight due to immersion will be so equalized that the hoisting gear will only be required to overcome the friction, etc. So nicely will this adjustment be made, that it is stated two men only will be required to operate each sluice & the whole system will be opened in three-quarters of an hour. The piers, 52 ft. long & 12 ft. in width, will be built of concrete faced with granite, & paving stone will be carried up 9½ ft. above the water, &



How to regulate or minimize this variation is the subject of a special & exhaustive report prepared by G. Y. Wisner, a member of the U.S. Board of Engineers on Deep Waterways, from data gathered by this board, & endorsed by his colleagues, as a preliminary report upon the whole subject to be investigated, for which the necessary data & conclusions have not been completed. Records taken at Cleveland since 1865, up to 1898 inclusive, show that the mean elevation of the water in Lake Erie above mean tide at New York is 572.4 ft., and using the same datum, the highest mean monthly water mark, which was reached in 1876, is 574.3 ft., & the low water mark reached in 1895 & 1896 was 570.6 ft. The greatest variation in the height of the water in the last 35 years was therefore 3.7 ft., and the mean annual variation, which continues about the same in recent years, is about 20 ins. The chief source of supply to Lake Erie is drawn from the Great Lakes above, which with their respective watersheds include an area of over 150,000 square miles, or about six times the area of Lake Erie & watershed; it is, therefore, the fluctuation in the supply from these lakes due to

water flowing into the lake. This can only be done by means of a dam & flood gates, in either case. For economical reasons alone, therefore, the scheme recommended for raising the water to or near high water mark, seems to be the proper one, apart from all important questions of the actual height which will be most convenient & beneficial to the majority of interests that will be affected.

By means of accurately measured cross sections of the river & careful observations taken at different stages of the water level, the volume of each mean monthly discharge from the lake has been accurately determined from 1865 to 1898 inclusive, & from these results the necessary height of the proposed submerged weir & width of sluice gates have been calculated, which fixes the height to which the water will have to be raised & maintained at 574.5 ft., or a little over 2 ft. above the mean elevation & about 2 ins. over high water mark; for the period referred to, which was reached in 1876. The location chosen for the proposed fixed weir & sluices will follow a rock reef which extends into the river from the breakwater of Black Rock harbor, Buffalo, for about 1,300 ft., & then

upon these the steel superstructure, 40 ft. in height, to carry the weights & hoisting gear, will be placed. The weir will be made with concrete, 5 ft. wide on top with rounded crest with upper side sloped 1 to 1, the lower side vertical, & both sides filled in with large stones. The foundation is upon rock bottom throughout.

In calculating the discharge in the last 35 years, it is estimated that the mean monthly discharge was 220,430 cubic ft. a second, & the greatest mean discharge for the first six months (which occurred in 1876), 285,200 cubic ft. a second. The volume of discharge over the weir with the water at 574.5 ft. will be 113,400 cubic ft. a second, which can be increased at will up to 159,500 cubic ft. a second by opening the sluice gates, & making the total discharge 272,900 cubic ft. a second, exceeding by 1,900 cubic ft. a second the average supply for the storage season for any year excepting 1876. But it is pointed out that in the last six months of 1895 the discharge was 60,000 cubic ft. a second less than the capacity of the proposed regulating works, which could then have lowered the water 1 ft. in two months, & that this contingency, as well as