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MEAN SEA LEVEL AT QUEBEC AND NEW YORK.

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(To be read before the General Section, November 19, 1908.)

The following information and deductions with regard to Mean Sea Level at New York compared with its determination at Quebec will prove of interest; as it affords a relation which has long been desired by engineers to bring our levels along the St. Lawrence, including the harbours of Quebec and Montreal, into relation with the open Atlantic.

The result is based on a long series of tidal observations at Quebec obtained by the Tidal and Current Survey, under the direction of the author, and on the levels of the Georgian Bay Canal Survey, under the direction of Mr. A. St. Laurent, C.E., the field work being in charge of Mr. C. F. X. Chaloner.

The comparison is based upon the elevations of the sill of Old Lock No. 1 of the Lachine Canal, at the head of Montreal harbour, where the levels meet which have now been carried through from New York via Rouses Point, and along the St. Lawrence from Quebec by Mr. R. Steckel, C.E., of the Public Works department, by the geodetic series taken previous to 1891.

The tidal observations at Quebec have been obtained by a registering tide gauge situated at the Dry Dock at Levis, which gives a continuous record day and night throughout the year. They are reduced throughout to the Admiralty Low Water datum at Quebec, as used for the chart of Quebec harbour. This datum has also been adopted by the Tidal Survey as the plane of reference for the Tide Tables for Quebec. It is defined by the Admiralty in their

own publications as 28.00 feet below the Bench Mark cut on the east side of the principal gateway to the Marine and Fisheries building in Quebec.

The various connections by means of which the reductions are made, are as follows: From the Admiralty Bench Mark in Quebec to the Levis dry dock where the tide gauge is situated, connected by Mr. Steckel's levels across the river; one of his Bench Marks being set in the masonry of the dry dock. From Levis to Montreal, connected by Mr. Steckel's levels. From Montreal to Rouses Point, from the levels of the Georgian bay Canal Survey, which there connect with the levels of the United States Coast and Geodetic Survey from New York. The elevation taken for the Coast Survey Bench Mark at Rouses Point is the revised value of 1903. As explained in Mr. St. Laurent's report, the elevation of this Bench Mark is based upon a readjustment made in that year by the United States Coast Survey, and is now accepted as 107.955 feet above Mean Sea Level, instead of 110.06 as used before the 1903 determination. The difference between Mr. Steckel's datum and that of the Georgian bay Canal Survey, is based on a common Bench Mark at St. Lambert.

Admiralty Bench Mark at Quebec, as above described.	28.00
Sill of Old Lock No. 1, Lachine canal. Difference of level as determined by Mr. R. Steckel, 15.50 feet below the Admiralty Bench Mark at Quebec. Resulting elevation.	12.50
Mean Sea Level, or half tide at Quebec, as determined at the Levis dry dock; from the hourly ordinates of the tide during eight years of continuous observations, from 1894 to 1902. Mean of the eight years, 8.584 feet above the Admiralty datum.	8.58
(The value adopted by the Royal Engineers in 1864, for mean sea level in Quebec harbour, corresponds to 8.72 feet above the Admiralty datum. This would be somewhat further up the river than the dry dock.)	
Mean Sea Level at New York determined by the Georgian bay Canal Survey, as 5.38 feet below the sill of Old Lock No. 1, Lachine canal.	7.12
Steckel's datum referred to the Admiralty datum; the elevation of the Admiralty Bench Mark above his datum being 27.039 feet.	0.96
Admiralty Low Water datum at Quebec; adopted as the datum for the Tidal Survey.	0.00

It thus appears that Mean Sea Level or half tide at Quebec, when accurately determined by tidal observations, is 1.46 feet above Mean Sea Level at New York.

Note.—With regard to this determination, it may be noted that the method of determining Mean Sea Level by the summation of hourly ordinates is equivalent to taking it at the level of the horizontal line which bisects the area of the tide curve. This is the most accurate way of dealing with a river tide, in which the rising side of the curve is steeper than the falling side.

Also, it is found from precise observations that there is a variation in Atlantic Mean Sea Level from year to year, which is possibly periodic in a term of years. For strict accuracy, such a comparison as this should therefore be made during the same set of years at both places. As the re-determination of the elevation of the Bench Mark at Rouses Point was made in 1903, this should make the comparisons practically simultaneous, as regards the years on which the data are based.

There are no other known sources of error which affect the result, within the limits of accuracy in geodetic levelling.