

recording instrument. The rusting and breaking of the steel tape, and the frequent re-determination of its length, the removal and replacement of the gauge in March, 1894, and an error of scale in the construction of the recording instrument, have involved much revision in the reduction of the levels; but to avoid any technical details, the methods adopted in dealing with these difficulties and the means taken to overcome them, will not be here described; as all outstanding causes of error have been eliminated from the results. To meet the immediate need for some determination of low water level, preliminary values were computed from the early part of the record, which were communicated to the department of Public Works, and also to the City Engineer of St. John.

The original plans of the breakwater at Negro Point, show the levels of low water and high water at spring tides as adopted during its construction. This low water level is presumably the same as that used in the latest survey of St. John harbour, which was also made by the Engineers of the department of Public Works at about the same date. This breakwater is of crib-work; and the outer end may have settled to some extent. The original plans show the tide levels then adopted to be as follows:—High water at 5 feet 0 inches, and low water at 30 feet 6 inches below planking on top of crib-work. With the co-operation of Mr. E. T. P. Showen of the department of Public Works, and Mr. D. L. Hutchinson, the tidal observer, levels taken near the inner end of the breakwater were carried across to the tide gauge, a distance of 8,000 feet, by means of simultaneous observations of the level of the surface of the water at high tide on a calm day. This method should give quite as close a result as the levels do; as the top of the breakwater itself is uneven to the extent of about two inches; as the following levels show. The elevation of the planking of the breakwater at 150 and 250 feet from the shore end, was found to be as follows, the bench mark on the custom house being 100·00:—

	Feet.
At 150 feet. Planking, north side. ....	76·89
do do south side. ....	76·79
At 250 feet. do north side. ....	76·79
do do south side. ....	76·64
Mean elevation at 150 feet, where the settlement is presumably the least. ....	76·84
Low water, as above defined. ....	30·50
Hence, original low water datum as adopted when the breakwater was built. ....	46·34

A similar determination was made from the level of the Government wharf on the St. John side; the low water datum being shown on the original plans as 31 feet 6 inches below the level of the timber cap of that wharf. The resulting level of the low water datum was 43·57; and this was further checked by comparison with the zero of a tide-board spiked to one of the wharfs, and said to be at the same level as the one used while the survey of the harbour was being made. The level of the zero of this tide-board is 43·78 which agrees nearly with the above; but the indications make it more probable that settlement has occurred here, rather than in the case of the breakwater at Negro Point. The datum as obtained from that breakwater, probably gives the level of low water at spring tides as then adopted, as nearly as it can now be arrived at from existing structures, for purposes of comparison with the new determinations. The tidal observations themselves show that the actual level of low water at spring tides is below this. The uncertainties attached to determinations of this character are obviated for the future by the establishment of a bench mark to which the series of levels now obtained are referred.

The comparison of the various old and new datum planes is given in the following list, together with the levels resulting from the analysis of two complete years of tidal record; namely, from April, 1894, to May, 1896. This record was carefully reduced to one uniform plane of reference by the method above referred to; and the analysis itself was made by Mr. E. Roberts, F.R.A.S., of the Nautical Almanac Office, London. The levels are given in the order of their height; the elevations are all referred to a plane of reference 100·00 feet below the Tidal Survey bench mark