## GILBERT.] NEED OF AND PLANS FOR PRECISE MEASUREMENT. 641

## PLANS FOR PRECISE MEASUREMENT.

While it is believed that the general fact of earth movement has been established by the present investigation, the measurement of its rate and the determination of its direction fall far short of the precision which is desirable. For the purposes of science the order of magnitude of the change is more important than its precise measurement, but there are involved great economic interests, and these demand more definite information. The account of the present investigation is therefore supplemented by an outline plan of the more elaborate investigation which appears necessary to give measurements of the precision that is desirable.

Existing data are neither full enough nor exact enough to give satisfactory measures of the small quantities sought. Doubtless a more elaborate disension would yield better results than I have obtained, but the improvement could not be great. Observations by the Lake Survey were conducted for purposes not demanding a high order of precision, and high refinement was not attempted. The supplementary work done in 1896 attempted only to be good enough for use in combination with the work of 1874 and 1876, and can not serve as the first term of a new comparison. The problem requires a new set of highgrade observations at each station of a carefully planned system, to be followed, after an interval of at least a decade, by a second set of observations at the same stations.

Foreseeing no opportunity to undertake such a work myself, J have formulated in the following paragraphs a plan embodying the results of my experience—a plan intended to afford useful suggestions to some investigator by whom the work may be actually undertaken.

Selection of stations.—To measure the rate of change in any given direction, observations at two stations sufflee; but to determine also the direction of change, it is necessary to use three stations grouped in the form of a triangle. The longer the sides of the triangle the better the measurement of rate, and the larger its smallest angle the better the determination of direction. A brief inspection shows that the shores of Lake Michigan and Lake Huron give the best opportunity for the planning of a well-conditioned triangle. Though the narrowness of their connecting strait has led to the giving of separate names, they are really a single lake, and the stretch of their water surface is in every direction greater than that of Lake Superior.

For the purpose in view the point of first importance is the outlet of the lake at Port Huron. This is peculiar in that the plane of mean water level has here a constant relation to the adjacent land, a relation altogether independent of the progressive deformation of the basin. This station should not be on the St. Clair River, but on the shore of the lake near by,

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