through the Chicago Drainage Canal, will for mean stage amount to 0.53 ft., while the loss of level to Lake Erie due to this diversion and 1,000 c.f.s. through the Erie Canal and 1,100 c.f.s. through the Welland Canal will at mean stage amount to 0.43 ft. and 0.09 ft., respectively, a total of 0.52 ft. The American power companies have also lowered the level of Lake Erie probably by 0.08 ft.

The project here proposed for restoring the loss caused by these diversions is the construction of a submerged weir of suitable type, on a line between Gill Creek and Welland River, as shown in Fig. 1, of such a height of crest as will create sufficient backwater to offset it.

To determine this, backwater curves have been computed, based upon Bernoulli's theorem for steady flow. The backwater on Lake Erie caused by the submerged weir has also been computed by the supply, storage, and discharge method, and the results by the two methods check very satisfactorily, the latter giving 0.07 ft. greater backwater in the high-water year of 1876 and 0.08 ft. greater in the low-water year of 1895.

Owing to the fact that the weir has an increasing efficiency with increase in stage, it was thought that the flow of the river might vary slightly from present natural conditions and therefore might affect injuriously the stage of water in the St. Lawrence Canals. The computed results show that the effect on Lake Ontario of any variation in the flow from Lake Erie caused by the submerged weir would be negligible.

Submerged-Weir Experiments.—As previously stated, submerged-weir experiments were made upon seven different types of weirs, ranging in height from 3.70 to 6.02 feet. All of the models were approximately 4 feet long. The following table, No. I., gives the dimensions of the several models tested:—

Table No. I.—Dimensions of Submerged-Weir Models.

Model No.	Length	H't	Crest	Width bottom	Upstr'm face	Downstream face	Remarks
	Feet	*Feet*		*Feet*			
1	4.005	6.02	Flat, 6 feet wide	31.76	1-3 slope	1-1 slope	Upstream corner sharp, downstream corner rounded, radius 9.5 feet
2	4.01	4.53	do.	25.79	do.	do.	do.
3	4.01	4.53	do.	27.33	do.	do.	Up and down stream corners rounded, radius 9.5 feet
4	4.02	5.17	Rounded, radius 9.5 feet	27.70	do.	do.	Ogee curve downstream face
5	4.005	4.35	do.	23.50	do.	do.	Ogee curve bottom, downstream face
6	4.005	3.70	Flat, 6 feet wide	23.50	do.	do.	Upstream corner sharp, downstream corner rounded, radius, 9.5 feet, Ogee curve bottom, down stream face.
7	4.005	3.70	do.	25.04	do.	do.	Up and down stream corners rounded, radius 9.5 ft. Ogee curve bottom downstream face.

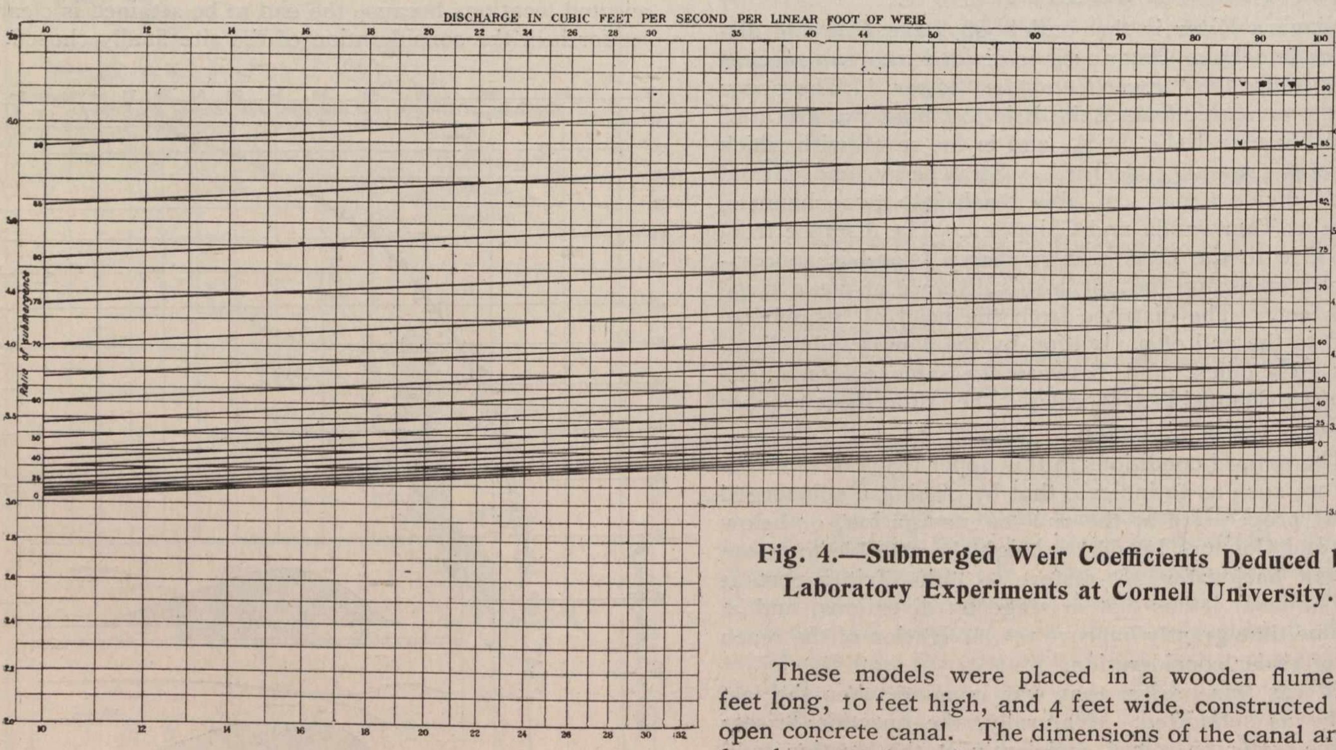

Fig. 4.—Submerged Weir Coefficients Deduced by Laboratory Experiments at Cornell University.

These models were placed in a wooden flume 95.5 feet long, 10 feet high, and 4 feet wide, constructed in an open concrete canal. The dimensions of the canal are 418 feet long, 16 feet wide, and 10 feet deep. The grade of bottom of channel is approximately 1 foot in 500. A bulkhead located about 60 feet from upper end of canal divides it into two parts. A standard sharp-crested weir placed on top of this bulkhead measures the quantity of water flowing in canal. The wooden flume mentioned above was built in this canal, the upper end being located about 87 feet below the standard weir. The upper end of flume had a bell-shaped mouth, about 15 feet long, converging from 16 feet, the width of canal, to 4 feet, the width of flume. The crest of weir of tested models was placed about 46 feet below upper entrance to bell mouth. The flow of

Knowing the elevation of the flood waters of this new compensated flood stage from Lake Erie to the site of the proposed weir, the topographic surveys previously referred to were studied with a view to determining the effect that these new flood waters might have upon adjacent lands. So far as can be seen, but little, if any, damage would result from the proposed weir placed on the Gill Creek-Welland River section. The investigation has also shown that it would not be possible to raise the water at the weir by much more than 3 feet without danger of damage from floods.