At Pointe Madeleine—

$$D = 50 - .0005491 \times 38{,}280 + \frac{(.0005491 \times 38{,}280)^2}{4 \times 50}$$

$$= 50 - 21.02 + 22.1 = 30.19$$

$$= 30.19 + 21 = 51.19$$

The elevation of the water at Pointe Madeleine will be 156.19.

At Mekinac—

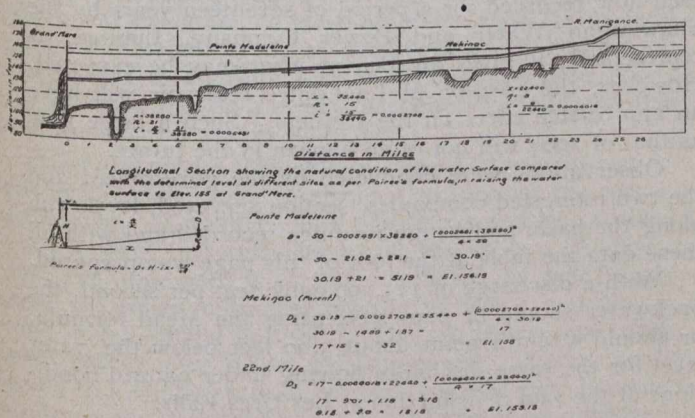
$$H + h = 30.19, \quad i = .0002708, \quad x = 55{,}440$$

$$D_2 = 30.19 - .0002708 \times 55{,}440 + \frac{(.0002708 \times 55{,}440)^2}{4 \times 30.19}$$

$$= 30.19 - 14.99 + 1.87 = 17$$

$$= 17 + 15 = 32$$

The elevation of the water surface at Mekinac is 158.



River St. Maurice, Showing Backwater

It shows that the actual backwater as per the Poirée formula is 3 feet at Mekinac, as the raising of the water at the dam site is considered to remain at elevation 155, while it is 2.24 feet as per observations made of the gauging scales in 1917.

This discrepancy is probably due to the fact that the Poirée formula must have been determined by the largest flow of the river. By the actual problem 78,500 cubic feet per second is the normal discharge, but the maximum one recorded is 170,000 cubic feet per second.

According to Mead, the underlying principle is the comparison of sections, establishing the ratio between the two surfaces, the coefficient of roughness, the velocities under the same quantity of discharge, *i.e.*, when under natural conditions and when an obstruction is located in the river.

The ordinary formula used for opened channel is:

$$Q = Av$$

But by raising the surface level the new condition becomes

$$Q = A'v'$$

Q = discharge.
A = area of the cross-section.
v = velocity in cubic feet per second.

By using the Kutter formula to determine the value of c in the formula

$$v = c\sqrt{rs}$$

where r = hydraulic radius and s = slope, we may substitute

$$Av = A'v'$$

$$Ac\sqrt{rs} = A'c'\sqrt{r's'}$$

Now we can establish the value of h' or the height of the new levels between the dam and the considered site, if h is taken as the difference in elevation between the same two sites under natural conditions. We then deduce

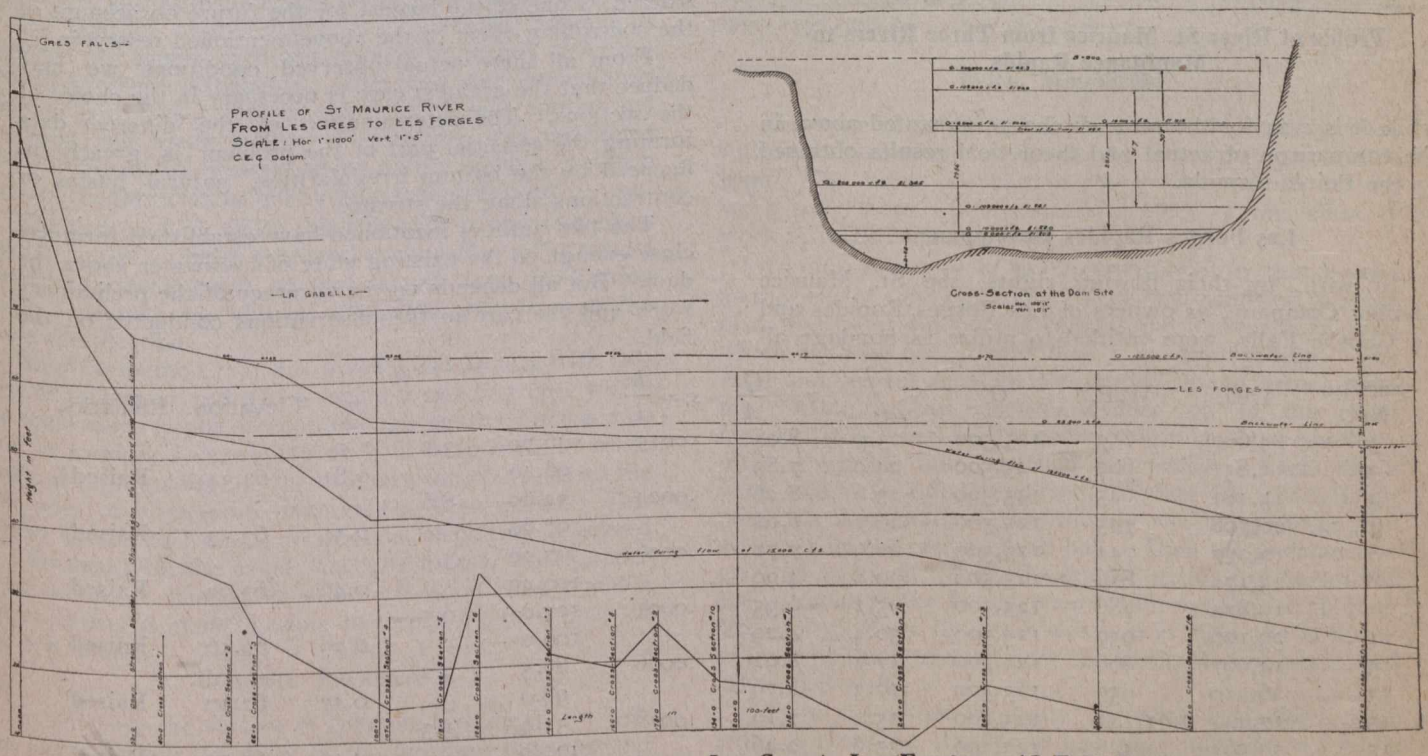
$$h : ac\sqrt{rs} \quad :: h' : a'c'\sqrt{r's'}$$

or

$$h' = \frac{h \times A^2c^2r}{A'^2c'^2r'}$$

The value of h' will be at Pointe Madeleine:

Area.	W.P.	r	Slope.	c	v	Q	Remarks.
51,289	1,894	27.08	.00002525	58.24	1.54	78,200	Raised
48,636	1,872	24.91	.00000842	15.27	0.22	10,800	Raised
32,268	1,619	19.93	.0005491	23.27	2.42	78,200	Natural
19,469	1,535	12.68	.0005491	6.55	0.55	10,800	Natural



Profile of St. Maurice River from Les Gres to Les Forges. (C.E.C. Datum)