Moffat Water Tunnel
15 ft. Imp. Venturi Flume
East Portal

Aug 1930
DAYTON-DOWD COMPANY
MANUFACTURERS OF CENTRIFUGAL PUMPS
QUINCY, ILLINOIS

Aug. 26, 1930

Mr. Ralph L. Parshall,
U. S. Irrigation Engr.
Colorado Agri. College,
Ft. Collins, Colo.

SUBJECT: CENTRIFUGAL FIRE PUMPS

Dear Sir:

In the field of centrifugal fire pumps there is no name of higher repute than Dayton-Dowd.

Hundreds and hundreds of installations throughout the world speak more loudly than words, the position Dayton-Dowd occupies in this field.

From Armour in South America to the Hudson Bay Store in Winnipeg; from the Royal Bank Building in Montreal to Metro-Goldwyn-Mayer Studios in California; from Florida East Coast at St. Augustine to Dupont de Nemours Company, Dupont Spur, Washington, you will find Dayton-Dowd fire pumps everywhere.

Our latest bulletin on fire pumps is a most valuable and complete treatise on the subject.

You should have it in your files, but if not, we’ll be glad to send one or more copies on request.

Yours truly,

[Signature]

DAYTON-DOWD COMPANY

CNA/DH
Enc. 1
Memorandum Concerning Proposed Large Improved Venturi Flume for the Moffat Water Tunnel - Denver Municipal Water Board - Denver, Colo. August 1930

Economic consideration - propose 15 foot flume.
Because of large discharge depths are to be increased - Approach channel, stilling basin to flume is relatively short - recommend no grade for this section

For 1300 sec ft the depth of water at entrance of flume will be approx 8.10 ft.

Width of channel at upper end of flume 27 ft.
See sketch for suggestions of app. channel.

Because of relatively short distance between stilling basin and flume (400 ft.) there is some doubt as to smoothness of flow through the Venturi flume because of the turbulence in stilling basin.
The use of a 20-ft flume would require at water depth at upper end of flume of about 6.7 ft.

\[
\begin{align*}
32 & \quad \quad \quad 6.7 \\
22 & \quad \quad \quad 2.24 \\
1.93 & \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad 6.7 \text{ flue sec.}
\end{align*}
\]

\[
\begin{align*}
214.4 & \quad \quad 13000 \\
12864 & \quad \quad \quad \quad \quad \quad \quad 1360
\end{align*}
\]
Moffat Tunnel Flume 15-ft Throat

Width of section at 18' 18'
Depth for Q = 1300 sec.ft 7.00'
Area 126 sqft, Mean vel 10.31 ft/sec, V = 8.02 \sqrt{H}

H = \frac{10.31}{8.02} = \sqrt{H} \quad H = 4.455 / 1.664

Energy gradient 8.654
Area = 144 sq ft

Try 7.2
Vul 9.03
Try 7.3 A 146
Vul 8.90
Try 7.4 148
Vul 8.00
Try 7.43 A 148.6
Vul 7.43
Try 7.46 A 149.2
Vul 7.46
Try 7.48 A 149.6
Vul 7.48
Try 7.93 A = 174.5
Vul 7.93
Try 7.85 A = 172.7
Vul 7.85
Try 7.75 A = 170.5
Vul 7.75

Try 8.00 A = 192
Vul 7.90
Try 7.90 A = 189.6
Vul 7.90
Try 7.92 A = 190.1
Vul 7.92
Try 7.93 A = 190.3
Vul 7.93
Table of Measurements:

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Memorandum - Improved Venturi Flume for Moffat Water Tunnel.

Discharge 1280 cfs, Wax 10 sec./ft.min.
Grade of canal upper stream from flume 0.1 percent.
Velocity in canal section 9 ft./sec.
Concrete lined section - \( H = 0.012 \)

Can change section to suit, that is, width and side slope.
Provide suitable transition.
Venturi flume to be of concrete.

For \( Q_{15} = 57.81 \text{ Ha}^{1.6} \) \( H_a = 7.66 \) 1300
For \( Q_{20} = 76.25 \text{ Ha}^{1.6} \) \( H_a = 5.89 \) 1800
Memorandum concerning the proposed large Improved Venturi Flume for the Moffat Water Tunnel, Denver Municipal Water Board, August, 1930.

Economic considerations concerning the use of a large Improved Venturi Flume, measuring a 1300 second feet discharge through the water tunnel seem to warrant a structure with a 15-foot throat width. It is believed that this 15-foot flume would be more suited for the measurement of the minimum flows than the 20-foot size. It will be noted from the accompanying pencil sketch for the 15-foot flume, that the water depth at the upper end of the converging section will be approximately 3.1 feet. This will require the water to run at about this depth in the approach channel. It is believed that this depth will not interfere materially with the present design of the approach channel other than to require additional height in the side slopes. It will be noted further that for the 15-foot flume the upstream width is 27-feet. For the 20-foot flume, it has been determined that the water depth at the upper end of the structure will be about 5.7 feet where this structure would require about a 32-foot width at the upper end of the converging section. For this condition the velocity of water in the channel upstream from the Venturi Flume would be about 6-feet per second which is essentially the same as for the 15-foot flume.

Some doubt is entertained as to the matter of smooth hydraulic flow in the channel leading from the stilling basin to the Venturi Flume. At this time, I am not able to satisfy my mind as to what condition the water will leave the stilling basin. In all probability the exit velocities will be high and the water in a turbulent condition resulting in waves of moderate height. The channel leading from the stilling basin to the Venturi Flume is something like 400-feet. It is doubtful whether these waves might not be carried downstream and interfere somewhat in the accuracy of the measurement of water in the flume. In my opinion, it will not be necessary to provide any grade in the channel leading from the stilling basin to the Venturi Flume. Warped surfaces may be provided upstream from the Venturi Flume as a transition from the flume width of 27-feet to the standard 15-foot bottom of the trapezoidal section.

Aug-29/30
Fort Collins, Colorado
August 29, 1930

Mr. D. D. Gross
Chief Engineer
Denver Municipal Water Board
1509 Cleveland Place
Denver, Colorado

Dear Mr. Gross:

I am enclosing herewith a memorandum concerning the proposed large Improved Venturi Flume for the Moffat Water Tunnel. In this connection, I am enclosing a pencil sketch showing the general outline for a 10-foot Improved Venturi Flume which I believe to be better suited to meet your condition than the 20-foot flume would be.

The suggestions made will require some alteration in design, in accommodating this structure to meet your conditions. The one point doubtful in my mind is whether or not there will result a fairly smooth flow of water in the channel leading from the stilling basin to the Venturi Flume. If this flow condition is rough, there may be some question as to the accuracy of the measurement of the discharge. I am not at all sure that water entering the stilling basin at the upper end which will create a very agitated condition will not be carried on through and be felt at some considerable distance downstream.

I wish to call at your office the first opportunity I have and confer with you more in detail as to this proposed design.

Yours very truly

Senior Irrigation Engineer

RIP:s
Enc.
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