STATE OF NEVADA

BIENNIAL REPORT

OF THE

STATE ENGINEER

1929-1930

GEORGE W. MALONE
State Engineer of Nevada

CARSON CITY, NEVADA
STATE PRINTING OFFICE - - JOE FARNSWORTH, SUPERINTENDENT
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CHAPTER VII
Measurement of Water

Throughout the entire West the term miner's inch has been used up to the present time by the majority of water users in preference to the second foot and the acre foot, which are the legal units in most, if not all, of the western States. The reason for this comes, perhaps, from the fact that the miner's inch was the standard of measurement during the pioneer days of mining and farming in the west, and the people having become used to gaging water in accordance with this term are loath to depart from it.

The term miner's inch, however, is very uncertain unless when used the pressure under which the discharge is delivered is given. The different States have different values for a miner's inch, as the head or pressure is not the same. The legislatures have recognized this uncertainty and have accordingly made the standard of measurement the cubic foot per second, or second foot, and the standard of volume the acre foot.

USEFUL EQUIVALENTS

The following equivalents of the terms second foot, acre foot and miner's inch will serve as a guide where necessary to transpose them;

One acre foot of water is the quantity that will cover an area of one acre one foot deep.

One second foot of water is the quantity that will fill a space of one cubic foot in one second of time.

1 second foot equals 40 miners' inches.

1 second foot equals 7.4805 gallons per second, or 448.83 gallons per minute.

1 acre foot equals 43,560 cubic feet or the volume of water that will cover one acre one foot deep.

1 miner's inch equals 0.186+ gallons per second.

1 miner's inch equals 11.21 gallons per minute.

1 miner's inch equals 672.60 gallons per hour.

1 miner's inch equals 16,142.40 gallons per day of 24 hours.

1 miner's inch flowing 20.16 days will cover an acre of land 1 foot deep or it will be the equivalent of 1 acre foot.

1 miner's inch flowing 150 days (5 months of 30 days each) will cover an acre of land 7.4 feet deep.

1 second foot of water flowing 150 days equals 297.06 acre feet or enough water to cover 100 acres of land 2.9706 feet deep.

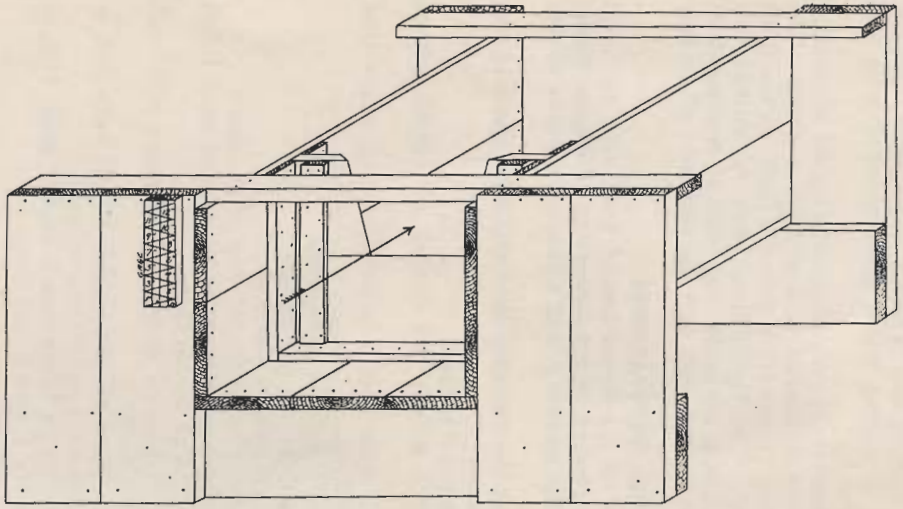
1 second foot of water flowing 24 hours equals 86,400 cubic feet, or 1.98 acre feet, or approximately 1 acre 2 feet deep.

1 acre foot equals 325,850 gallons.

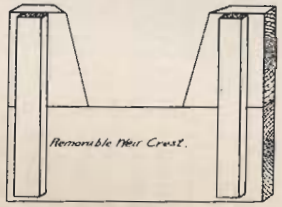
METHODS OF MEASUREMENT

Irrigation water is usually measured by one of three methods: Over a weir, through an orifice, or in an open channel. Of these methods the one most commonly used by water users is the weir.

A weir is a notch in a vertical wall through which water flows. The weir is the best instrument ever devised for common use in the measurement of irrigation water. It is cheap and simple of construction.



Scale 1½"=1'



Bill of Material for Box for 1 Foot Weir.

1-1"x"-18'
1-2x4 - 12'
1-2x12 - 18'
1-2x12 - 16'
1-2x12 - 12'
1-2x12 - 10'
TOTAL 196 BOARD FEET.

CIPPOLETTI WEIR AND BOX.

The results are accurate and easily understood. The measurements are easy to make and the computations are rapid.

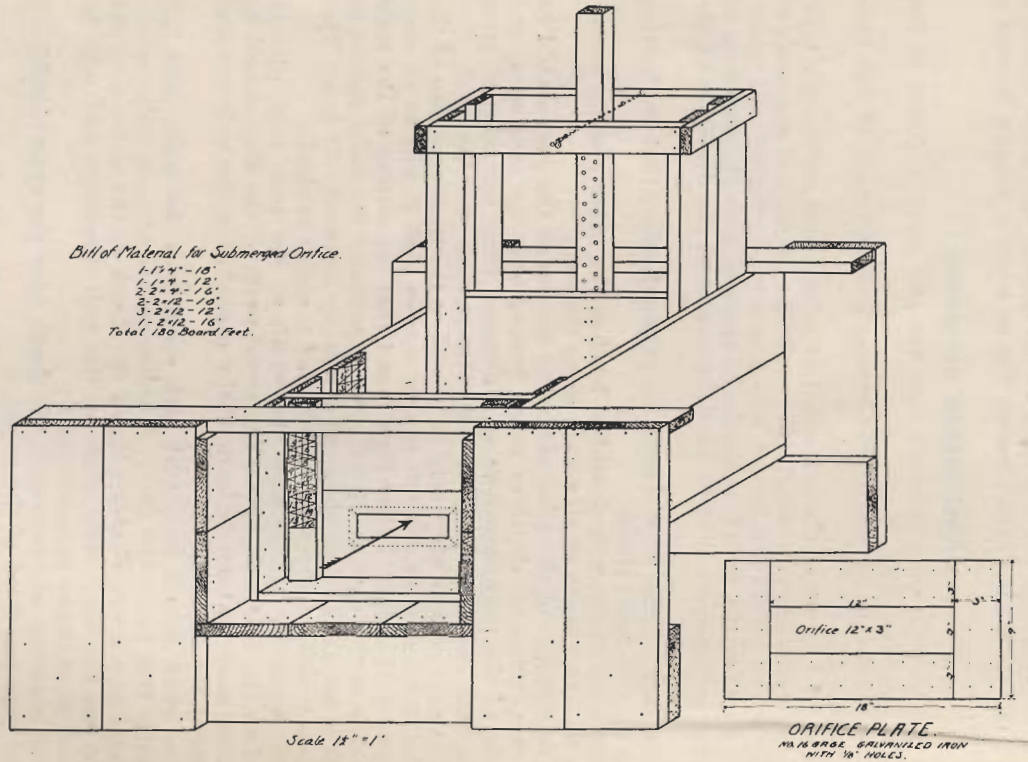
There are many types of weirs, but the one most commonly used in the measurement of irrigation water is the Cippoletti weir, so called because it was designed by an Italian engineer named Cesare Cippoletti. The weir has a thin horizontal crest and thin sides, and the weir notch is wider across the top than at the bottom, the sides having a slope of one inch out to four inches rise or what is usually termed a 1:4 slope.

CONSTRUCTION OF WEIRS

The construction of a two-foot weir box and crest is shown in the accompanying drawing.

The requirements for the proper setting and operating of this type of weir are:

1. It should be set at the lower end of a long pool sufficiently wide and deep to give an even smooth current with a velocity of approach of not over 0.5 of a foot per second, which means practically still water.
2. The line of the weir box should be parallel with the direction of flow, that is, the crest is to be at right angles to the direction of the flow.
3. The face of the weir should be perpendicular, that is, leaning neither up nor down stream.
4. The crest of the weir should be level so the water passing over it will be the same depth at all points along the crest.
5. The distance of the crest above the bottom of the pool should be about three times the depth of water flowing over the weir crest, and the sides of the pool should be at a distance from the sides of crest not less than twice the depth of the water passing over the crest.
6. The gage or weir scale may be placed on the upstream face of the weir structure and far enough to one side so that it will be in comparatively still water. It has been found that the setting of the scale at one side of the weir as shown gives practically the same results as when it is set in the pool above as is usually directed. It is set with much less trouble, is more permanent and is easier to check.
7. The structure should have the width of the weir crest plainly marked on the upstream face. The metal parts of the weir should be accurately made and should be carefully placed after the weir box and weir board are installed.
8. The crest should be placed high enough so the water will fall practically free below the weir. A submergence or back water condition equal to a depth of about $\frac{1}{16}$ of the depth of the water over the weir or less has very little effect on the weir discharge and may be neglected in ordinary measurements.
9. For accurate measurements the depth over the crest should not be more than one-third of the crest.
10. The depth of water over the crest should not be less than about 2 inches as it is difficult to get sufficiently accurate gage readings below this point to give close results. However, a broad crested weir with low gage heights used where there is little fall will give more reliable results as a rule than can ordinarily be obtained by the use of an orifice using the same amount of head.



SUBMERGED ORIFICE AND BOX.

THE SUBMERGED ORIFICE

The structure for the submerged orifice is built the same as for a weir, but instead of placing a weir crest in the front heading an opening known as an orifice is placed therein as shown in the accompanying cut.

This opening may be of any required dimensions and of any shape, though for convenience of computation certain standard dimensions are usually selected. The orifice is not used as generally as the weir. This is due to certain inherent disadvantages. First, the orifice structure is such that it gathers trash which tends to check the flow and hence to destroy the accuracy of the measurement. Second, there is a chance for inaccuracy on low heads, that is, where there is but little difference between the upper and lower gage readings the relative discharge for this small difference is so great that a slight error in reading the gage makes a very great difference in the result of the computed discharge. Third, unless some special provision is made the submerged orifice is not adapted to passing large quantities of water; it will pond the water above the orifice so that damage from overflow is liable to be done to the canal or the heading. In the case of the weir the proportional discharge is increased as the head increases and the excess flow is automatically taken care of by passing over the weir.

The coefficient of discharge in the orifice is much more uncertain than in the case of the weir, and is affected by a greater variety of factors that are not so easily regulated. Notwithstanding the above-mentioned disadvantages there are times when it is desirable to use the orifice as a measuring device. This may occur where it is imperative to save head, or hold the water level as high as possible in the canal. In this case it may be necessary to sacrifice accuracy for the sake of saving head. There are times when it is desirable to combine a canal heading with a measuring device, in which case an orifice can well be used because the heading shuts out the trash and regulates the flow.

RULES GOVERNING THE USE OF THE ORIFICE

The orifice opening should be regular in shape, and should have sharp edges. The pressure head should be not less than 0.10 of a foot.

The depth of submergence of the orifice should not be less than the height of the orifice, and a submergence of twice the height of the orifice is preferable.

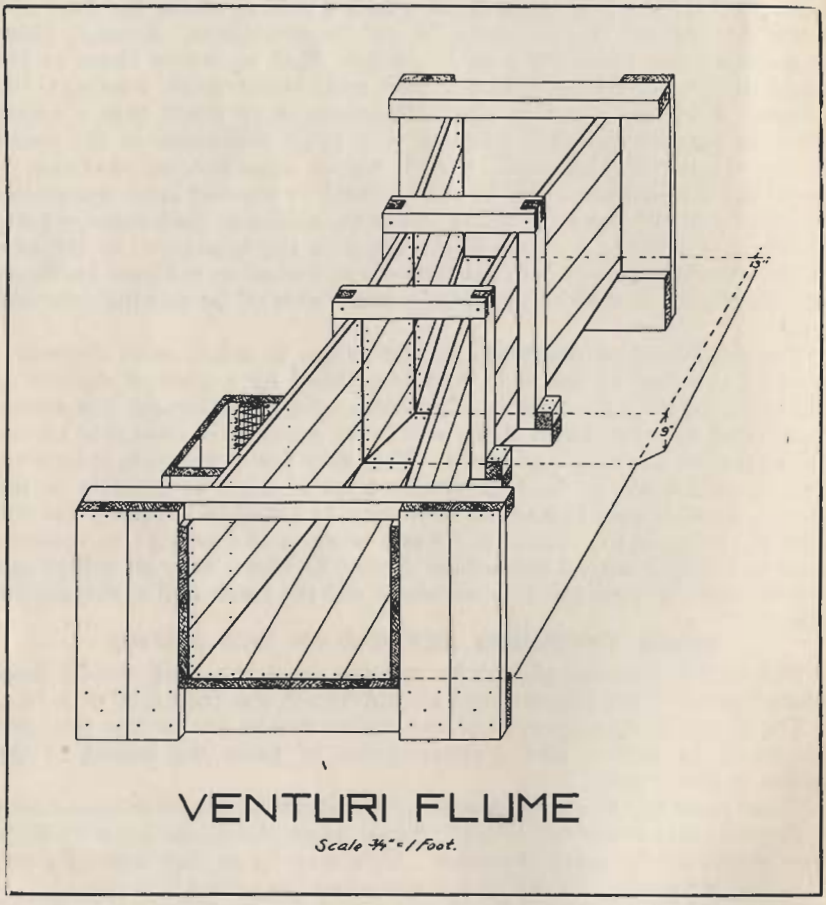
There must be two gages, one of which should be set on the head-wall to one side and below the orifice. These gages should be set with their zero marks at the same elevation. This may be at any desired point so it will always be covered with water when the orifice is in use.

Where a canal gate or heading is used for an orifice to measure water the coefficient of discharge must be determined for each different condition, either by measuring the water over a weir or by a current meter measurement, if any degree of accuracy is required. This is because the discharge coefficient changes with the form and kind of orifice and in many cases with the depth of water and the water pressure. For this reason, if good measurements are desired, the standard orifice structure should be used, and the discharges may then be taken from the table as given.

ORIFICE TABLE

In using the table find the difference between the reading of the upper and the lower gages. This will be the "effective head" as used in the table. In the accompanying tables will be found the discharges for orifices having openings of different sizes with effective heads as shown by the gages. Discharge for orifices of larger sizes may be found by multiplying the discharge for one foot orifice by the size of the orifice desired.

The coefficient used in this table is 0.62. If any other coefficient is



desired, divide the given discharge by 0.62 and multiply the result by the desired coefficient and the required discharge is obtained.

THE IMPROVED VENTURI FLUME

This device for the measurement of water flowing in open channels is adaptable to both large and small flows.

Probably the most accurate known device for the measurement of water is the weir. Due to changeable conditions in the ditch section from growth of vegetation, deposit of silt above the weir, carelessness

in placing the same in the ditch, and generally to the lack of sufficient fall in the ditch which is most needful, its practical use is rather limited.

The most common type of measuring device is the rectangular flume in which there is installed a gage rod to determine the depth of water flowing at any particular stage. For determining the carrying capacity of such a flume at different depths of flow, it is necessary to keep the flume rated. This is usually done by means of a current meter. Due to change in conditions resulting from sand deposits, growth of vegetation or use of check boards in the canal below, it is necessary to keep such type of flume carefully rated if serious errors are to be avoided.

To overcome practically all of the aforementioned objections, there was prefected by R. L. Parshall, Engineer of the Division of Agricultural Engineering, Bureau of Public Roads, United States Department of Agriculture, in cooperation with the Colorado Agricultural Experiment Station, what is known as the Improved Venturi Flume.

This device, consisting of three main parts, has, first, an upstream converging section with a level floor; second, a throat or contracted section two feet in length, with a floor sloping downstream; third, a diverging section with the floor sloping upward. The side walls are all vertical, and in the throat section they are parallel. In all structures, the downstream or outlet end of the floor of the diverging section is three inches lower in elevation than the level floor of the upper end of the flume, while the lowest point in the floor is always placed nine inches lower than the floor at the upper end of the flume. The crest is the downstream end of the floor of the converging section, or is the place of entry to the throat.

The principal advantages of this flume over that of any other measuring device are:

First—It is self rating, *i. e.*, it does not require rating with a current meter.

Second—It is self-cleaning of sand and silt deposits.

Third—The discharge at any given height is not affected by backwater conditions due to vegetable growth, or sand bars or other obstructions in the canal below the flume under usual conditions of operation.

Fourth—The rating table for this flume based upon a constant formula does not vary unless the water below the flume backs up so as to destroy more than 70 per cent of the difference in head between tail water below the flume and head water above the same.

Fifth—It requires a much less fall in the ditch than does the standard weir.

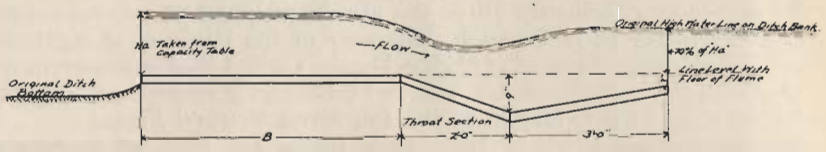
The accompanying tables, together with a cut of this structure, are published for the information of those who are interested in such matters.

A bill of material for the construction of Venturi flumes may be obtained by writing to the State Engineer's office at Carson City.

STANDARD DIMENSIONS AND CAPACITIES, IMPROVED VENTURI FLUME

		Dimensions in Feet					Maximum†		Minimum†	
W*	A	⅔A	B	⅔B	C	D	Ha	Sec. Ft.	Ha	Sec. Ft.
1	4′–6″	3′–0″	4′– 4¼″	2′–11¼″	2	2′– 9¼″	2.50	16.1	0.20	0.35
2	5′–0″	3′–4″	4′–10⅜″	3′– 3¼″	3	3′–11½″	2.50	33.2	0.20	0.66
3	5′–6″	3′–8″	5′– 4⅝″	3′– 7⅛″	4	5′– 1⅞″	2.50	50.4	0.20	0.97
4	6′–0″	4′–0″	5′–10⅝″	3′–11⅛″	5	6′– 4⅛″	2.50	67.9	0.20	1.26
5	6′–6″	4′–4″	6′– 4½″	4′– 3 ″	6	7′– 6⅝″	2.50	85.6	0.25	2.22
6	7′–0″	4′–8″	6′–10½″	4′– 7 ″	7	8′– 9 ″	2.50	103.5	0.25	2.63
8	8′–0″	5′–4″	7′–10⅜″	5′– 2¾″	9	11′– 1¾″	2.50	139.5	0.30	4.62

Directions for Placing Venturi Flume



DIRECTIONS FOR PLACING FLUME.

First—Select from table of flume capacities the proper depth of water or head "Ha" that corresponds with the maximum capacity of the ditch, so that "Ha" will ordinarily not exceed one-half of the width of throat "W" which may be adopted.

Second—Locate the high water line on the ditch bank where the flume is to be installed, as shown by previous flows.

Third—Place the surface of the floor "B" at a depth of 70 per cent of "Ha" below the high water line.

Fourth—Place the floor "B" level both length and crosswise and construct all flume bottoms with the drop and rise and at the lengths as shown by above sketch.

Fifth—Place gage on side of flume at a distance upstream from the throat, equal to two-thirds the distance "A."

Sixth—Provide cut-off wall and wings at each end of flume at 45 degree angles, to prevent water cutting under or around same.

NOTE—Refer to isometric drawing.

*Crest width in feet. †Discharge capacity in cubic feet per second, free flow conditions.

DISCHARGE OVER CIPPOLETTI'S TRAPEZOIDAL WEIR

For Various Lengths and Depths. Formula: $Q=3.3\frac{2}{3} LH^{\frac{3}{2}}$

Discharge in Cubic Feet per Second

Head "H" on Crest Measured in Still Water		Length of Weir Crest in Feet											
In feet	In inches	1	1½	2	2½	3	3½	4	5	7½	10	12½	15
.01	⅛	.003	.01	.01	.01	.01	.01	.01	.02	.02	.03	.04	.05
.02	¼	.010	.01	.02	.02	.03	.03	.04	.05	.07	.10	.12	.14
.03	⅜	.018	.03	.04	.04	.05	.06	.07	.09	.13	.18	.22	.26
.04	½	.027	.04	.06	.07	.08	.09	.11	.13	.20	.27	.34	.40
.05	⅝	.038	.06	.08	.09	.11	.13	.15	.19	.28	.38	.47	.56
.06	¾	.050	.07	.10	.12	.15	.17	.20	.25	.37	.49	.62	.74
.07	⅞	.062	.09	.12	.16	.19	.22	.25	.31	.47	.62	.78	.94
.08	1	.076	.11	.15	.19	.23	.27	.30	.38	.57	.76	.95	1.14
.09	⅛	.091	.14	.18	.23	.27	.32	.36	.45	.68	.91	1.14	1.36
.10	¼	.107	.16	.21	.27	.32	.37	.43	.53	.80	1.06	1.33	1.60
.11	1⅜	.123	.18	.25	.31	.37	.43	.49	.61	.92	1.23	1.54	1.84
.12	½	.140	.21	.28	.35	.42	.49	.56	.70	1.05	1.40	1.75	2.10
.14	⅝	.176	.26	.35	.44	.53	.62	.71	.88	1.32	1.76	2.20	2.65
.15	¾	.196	.29	.39	.49	.59	.68	.78	.98	1.47	1.96	2.44	2.93
.16	1⅞	.216	.32	.43	.54	.65	.75	.86	1.08	1.62	2.15	2.69	3.23
.17	2	.236	.35	.47	.59	.71	.83	.94	1.18	1.77	2.36	2.95	3.54
.18	⅛	.257	.39	.51	.64	.77	.90	1.03	1.29	1.93	2.57	3.21	3.86
.19	¼	.279	.42	.56	.70	.84	.98	1.12	1.39	2.09	2.79	3.49	4.18
.20	⅜	.301	.45	.60	.75	.90	1.05	1.20	1.51	2.26	3.01	3.76	4.52
.21	2½	.324	.49	.65	.81	.97	1.13	1.30	1.62	2.43	3.24	4.05	4.86
.22	⅝	.347	.52	.69	.87	1.04	1.22	1.39	1.74	2.61	3.47	4.34	5.21
.23	¾	.371	.56	.74	.93	1.11	1.30	1.49	1.86	2.79	3.71	4.64	5.57
.24	⅞	.396	.59	.79	.99	1.19	1.39	1.58	1.98	2.97	3.96	4.95	5.94
.25	3	.421	.63	.84	1.05	1.26	1.47	1.68	2.10	3.16	4.21	5.26	6.31
.26	3⅛	.446	.67	.89	1.12	1.34	1.56	1.79	2.23	3.35	4.46	5.58	6.70
.27	¼	.472	.71	.94	1.18	1.42	1.65	1.89	2.36	3.54	4.72	5.90	7.09
.28	⅜	.499	.75	1.00	1.25	1.50	1.75	2.00	2.49	3.74	4.99	6.24	7.48
.29	½	.526	.79	1.05	1.31	1.58	1.84	2.10	2.63	3.94	5.26	6.57	7.89
.30	⅝	.553	.83	1.11	1.38	1.66	1.94	2.21	2.77	4.15	5.53	6.92	8.30
.31	3¾	.....	.87	1.16	1.45	1.74	2.03	2.32	2.91	4.36	5.81	7.26	8.72
.32	⅞	.....	.91	1.22	1.52	1.83	2.13	2.44	3.05	4.57	6.09	7.62	9.14
.33	4	.....	.96	1.28	1.60	1.91	2.23	2.55	3.19	4.79	6.38	7.98	9.57
.34	⅛	.....	1.00	1.33	1.67	2.00	2.34	2.67	3.34	5.01	6.67	8.34	10.01
.35	¼	.....	1.05	1.39	1.74	2.09	2.44	2.79	3.49	5.23	6.97	8.71	10.46
.36	4⅜	.....	1.09	1.45	1.82	2.18	2.56	2.91	3.64	5.45	7.27	9.09	10.91
.37	½	.....	1.14	1.52	1.89	2.27	2.65	3.03	3.79	5.68	7.58	9.47	11.37
.39	⅝	.....	1.23	1.64	2.05	2.46	2.87	3.28	4.10	6.15	8.20	10.25	12.30
.40	¾	.....	1.28	1.70	2.13	2.56	2.98	3.41	4.26	6.39	8.52	10.65	12.78
.41	4⅞	.....	1.33	1.77	2.21	2.65	3.09	3.54	4.42	6.63	8.84	11.05	13.26
.42	5	.....	1.37	1.83	2.29	2.75	3.21	3.67	4.58	6.87	9.16	11.46	13.75
.43	⅛	.....	1.42	1.90	2.37	2.85	3.32	3.80	4.75	7.12	9.49	11.87	14.24
.44	¼	.....	1.47	1.97	2.46	2.95	3.44	3.93	4.91	7.37	9.83	12.28	14.74
.45	⅜	.....	1.52	2.03	2.55	3.05	3.56	4.07	5.08	7.62	10.16	12.70	15.24
.46	5½	.....	1.58	2.10	2.63	3.15	3.68	4.20	5.25	7.88	10.50	13.13	15.76
.47	⅝	.....	1.63	2.17	2.71	3.25	3.80	4.34	5.42	8.14	10.85	13.56	16.27
.48	¾	.....	1.68	2.24	2.80	3.36	3.92	4.48	5.60	8.40	11.20	14.00	16.79
.49	⅞	.....	1.73	2.31	2.89	3.46	4.04	4.62	5.77	8.66	11.55	14.43	17.32
.50	6	.....	1.79	2.38	2.98	3.57	4.17	4.76	5.95	8.93	11.90	14.88	17.85

DISCHARGE OVER CIPPOLETTI'S TRAPEZOIDAL WEIR—*Continued*

For Various Lengths and Depths. Formula: $Q=3.3\frac{2}{3}\ LH^{\frac{3}{2}}$

Head "H" on Crest Measured in Still Water		Discharge in Cubic Feet per Second — Length of Weir Crest in Feet											
In feet	In inches	1½	2	2½	3	3½	4	5	7½	10	12½	15	18
.51	6⅛	1.84	2.45	3.07	3.68	4.29	4.90	6.13	9.20	12.26	15.33	18.39	22.07
.52	¼	1.89	2.52	3.16	3.79	4.42	5.05	6.31	9.47	12.62	15.78	18.94	22.72
.53	⅜	1.95	2.60	3.25	3.90	4.55	5.20	6.50	9.74	12.99	16.24	19.49	23.38
.54	½	2.00	2.67	3.34	4.01	4.68	5.34	6.68	10.02	13.36	16.70	20.04	24.05
.55	⅝	2.06	2.75	3.43	4.12	4.81	5.49	6.87	10.30	13.73	17.17	20.60	24.72
.56	6¾	2.12	2.82	3.53	4.23	4.94	5.64	7.05	10.58	14.11	17.64	21.16	25.40
.57	⅞	2.17	2.90	3.62	4.35	5.07	5.80	7.24	10.87	14.49	18.11	21.73	26.08
.58	7	2.23	2.97	3.72	4.46	5.20	5.95	7.44	11.15	14.87	18.59	22.31	26.77
.59	⅛	2.29	3.05	3.81	4.58	5.34	6.10	7.63	11.44	15.26	19.07	22.89	27.46
.60	¼	2.35	3.13	3.91	4.69	5.48	6.26	7.82	11.74	15.65	19.56	23.47	28.16
.61	7⅜	.....	3.21	4.01	4.81	5.61	6.42	8.02	12.03	16.04	20.05	24.06	28.87
.62	½	.....	3.29	4.11	4.93	5.75	6.57	8.22	12.33	16.44	20.54	24.65	29.58
.64	⅝	.....	3.45	4.31	5.17	6.03	6.89	8.62	12.93	17.24	21.55	25.86	31.03
.65	¾	.....	3.53	4.41	5.29	6.18	7.06	8.82	13.23	17.64	22.05	26.46	31.76
.66	7⅞	.....	3.61	4.51	5.42	6.32	7.22	9.03	13.54	18.05	22.56	27.08	32.49
.67	8	.....	3.69	4.62	5.54	6.46	7.39	9.23	13.85	18.46	23.08	27.70	33.23
.68	⅛	.....	3.78	4.72	5.66	6.61	7.55	9.44	14.16	18.88	23.60	28.32	33.98
.69	¼	.....	3.86	4.82	5.79	6.75	7.72	9.65	14.47	19.30	24.12	28.94	34.73
.70	⅜	.....	3.94	4.93	5.92	6.90	7.89	9.86	14.79	19.72	24.65	29.58	35.49
.71	8½	.....	4.03	5.04	6.04	7.05	8.06	10.07	15.11	20.14	25.18	30.21	36.25
.72	⅝	.....	4.11	5.14	6.17	7.20	8.23	10.28	15.43	20.57	25.71	30.85	37.03
.73	¾	.....	4.20	5.25	6.30	7.35	8.40	10.50	15.75	21.00	26.25	31.50	37.80
.74	⅞	.....	4.29	5.36	6.43	7.50	8.57	10.72	16.07	21.43	26.79	32.15	38.58
.75	9	.....	4.37	5.47	6.56	7.65	8.75	10.93	16.40	21.87	27.33	32.80	39.36
.76	9⅛	.....	4.46	5.58	6.69	7.81	8.92	11.15	16.73	22.31	27.88	33.46	40.15
.77	¼	.....	4.55	5.69	6.82	7.96	9.10	11.37	17.06	22.75	28.43	34.12	40.95
.78	⅜	.....	4.64	5.80	6.96	8.12	9.28	11.60	17.39	23.19	28.99	34.79	41.75
.79	½	.....	4.73	5.91	7.09	8.27	9.46	11.82	17.73	23.64	29.55	35.46	42.55
.80	⅝	.....	4.82	6.02	7.23	8.43	9.64	12.05	18.07	24.09	30.11	36.13	43.36
.81	9¾	.....	4.91	6.14	7.36	8.59	9.82	12.27	18.41	24.54	30.68	36.81	44.18
.82	⅞	.....	5.00	6.25	7.50	8.75	10.00	12.50	18.75	25.00	31.25	37.50	45.00
.83	10	.....	5.09	6.36	7.64	8.91	10.18	12.73	19.09	25.46	31.82	38.19	45.82
.84	⅛	.....	5.18	6.48	7.78	9.07	10.37	12.96	19.44	25.92	32.40	38.88	46.65
.85	¼	.....	5.28	6.60	7.92	9.23	10.55	13.19	19.79	26.38	32.98	39.57	47.49
.86	10⅜	.....	5.37	6.71	8.06	9.40	10.74	13.43	20.14	26.85	33.56	40.28	48.33
.87	½	.....	5.46	6.83	8.20	9.56	10.93	13.66	20.49	27.32	34.15	40.97	49.18
.89	⅝	.....	5.65	7.07	8.48	9.89	11.31	14.13	21.20	28.27	35.33	42.40	50.88
.90	¾	.....	5.75	7.19	8.62	10.06	11.50	14.37	21.56	28.75	35.93	43.12	51.74
.91	10⅞	.....	.....	7.31	8.77	10.23	11.69	14.61	21.92	29.23	36.53	43.84	52.61
.92	11	.....	.....	7.43	8.91	10.40	11.88	14.85	22.28	29.71	37.14	44.56	53.48
.93	⅛	.....	.....	7.55	9.06	10.57	12.08	15.10	22.65	30.19	37.74	45.29	54.35
.94	¼	.....	.....	7.67	9.20	10.74	12.27	15.34	23.01	30.68	38.35	46.02	55.23
.95	⅜	.....	.....	7.79	9.35	10.91	12.47	15.59	23.38	31.17	38.97	46.76	56.11
.96	11½	.....	.....	7.92	9.50	11.08	12.67	15.83	23.75	31.67	39.58	47.50	57.00
.97	⅝	.....	.....	8.04	9.65	11.26	12.87	16.08	24.12	32.16	40.20	48.24	57.89
.98	¾	.....	.....	8.17	9.80	11.43	13.06	16.33	24.49	32.66	40.83	48.99	58.79
.99	⅞	.....	.....	8.29	9.95	11.61	13.27	16.58	24.87	33.16	41.45	49.74	59.69
1.00	12	.....	.....	8.42	10.10	11.78	13.47	16.83	25.25	33.67	42.08	50.50	60.60

DISCHARGE OVER CIPPOLETTI'S TRAPEZOIDAL WEIR—*Continued*

For Various Lengths and Depths. Formula: $Q=3.3\frac{2}{3} LH^{\frac{3}{2}}$

Head "H" on Crest Measured in Still Water		Discharge in Cubic Feet per Second										
		Length of Weir Crest in Feet										
In feet	In inches	2½	3	3½	4	5	7½	10	12½	15	18	20
1.01	12⅛	8.54	10.25	11.96	13.67	17.09	25.63	34.17	42.72	51.26	61.51	68.35
1.02	¼	8.67	10.40	12.14	13.87	17.34	26.01	34.68	43.35	52.02	62.43	69.36
1.03	⅜	8.80	10.56	12.32	14.08	17.60	26.39	35.19	43.99	52.79	63.35	70.39
1.04	½	8.93	10.71	12.50	14.28	17.85	26.78	35.71	44.63	53.56	64.27	71.41
1.05	⅝	9.06	10.87	12.68	14.49	18.11	27.17	36.22	45.28	54.33	65.20	72.45
1.06	12¾	9.19	11.02	12.86	14.70	18.37	27.56	36.74	45.93	55.11	66.14	73.48
1.07	⅞	9.32	11.18	13.04	14.91	18.63	27.95	37.26	46.58	55.89	67.07	74.53
1.08	13	9.45	11.34	13.23	15.11	18.89	28.34	37.79	47.23	56.68	68.02	75.57
1.09	⅛	9.58	11.49	13.41	15.33	19.16	28.73	38.31	47.89	57.47	68.96	76.62
1.10	¼	9.71	11.65	13.59	15.54	19.42	29.13	38.84	48.55	58.26	69.91	77.68
1.11	13⅜	9.84	11.81	13.78	15.75	19.69	29.53	39.37	49.21	59.06	70.87	78.74
1.12	½	9.98	11.97	13.97	15.96	19.95	29.93	39.90	49.88	59.86	71.83	79.81
1.14	⅝	10.24	12.29	14.34	16.39	20.49	30.73	40.98	51.22	61.47	73.76	81.96
1.15	¾	10.38	12.46	14.53	16.61	20.76	31.14	41.52	51.90	62.28	74.73	83.04
1.16	13⅞	10.52	12.62	14.72	16.82	21.03	31.55	42.06	52.58	63.09	75.71	84.12
1.17	14	10.65	12.78	14.91	17.04	21.30	31.96	42.61	53.26	63.91	76.69	85.21
1.18	⅛	10.79	12.95	15.10	17.26	21.58	32.37	43.15	53.94	64.73	77.68	86.31
1.19	¼	10.93	13.11	15.30	17.48	21.85	32.78	43.70	54.63	65.56	78.67	87.41
1.20	⅜	11.06	13.28	15.49	17.70	22.13	33.19	44.26	55.32	66.38	79.66	88.51
1.21	14½	.....	13.44	15.68	17.92	22.41	33.61	44.81	56.01	67.22	80.66	89.62
1.22	⅝	.....	13.61	15.88	18.15	22.68	34.03	45.37	56.71	68.05	81.66	90.73
1.23	¾	.....	13.78	16.07	18.37	22.96	34.44	45.93	57.41	68.89	82.67	91.85
1.24	⅞	.....	13.95	16.27	18.59	23.24	34.87	46.49	58.11	69.73	83.68	92.97
1.25	15	.....	14.12	16.47	18.82	23.53	35.29	47.05	58.81	70.58	84.69	94.10
1.26	15⅛	.....	14.28	16.67	19.05	23.81	35.71	47.62	59.52	71.42	85.71	95.23
1.27	¼	.....	14.46	16.86	19.27	24.09	36.14	48.18	60.23	72.28	86.74	96.37
1.28	⅜	.....	14.63	17.06	19.50	24.38	36.57	48.75	60.94	73.13	87.76	97.51
1.29	½	.....	14.80	17.26	19.73	24.66	37.00	49.33	61.66	73.99	88.79	98.65
1.30	⅝	.....	14.97	17.47	19.96	24.95	37.43	49.90	62.38	74.85	89.82	99.80
1.31	15¾	.....	15.14	17.67	20.19	25.24	37.86	50.48	63.10	75.72	90.86	100.96
1.32	⅞	.....	15.32	17.87	20.42	25.53	38.29	51.06	63.82	76.59	91.90	102.12
1.33	16	.....	15.49	18.07	20.66	25.82	38.73	51.64	64.55	77.46	92.95	103.28
1.34	⅛	.....	15.67	18.28	20.89	26.11	39.17	52.22	65.28	78.33	94.00	104.45
1.35	¼	.....	15.84	18.48	21.12	26.40	39.61	52.81	66.01	79.21	95.05	105.62
1.36	16⅜	.....	16.02	18.69	21.36	26.70	40.05	53.40	66.74	80.09	96.11	106.79
1.37	½	.....	16.20	18.90	21.59	26.99	40.49	53.99	67.48	80.98	97.18	107.97
1.39	⅝	.....	16.55	19.31	22.07	27.59	41.38	55.17	68.97	82.76	99.31	110.35
1.40	¾	.....	16.73	19.52	22.31	27.88	41.83	55.77	69.71	83.65	100.38	111.54
1.41	16⅞	.....	16.91	19.73	22.55	28.18	42.28	56.37	70.46	84.55	101.46	112.74
1.42	17	.....	17.09	19.94	22.79	28.48	42.73	56.97	71.21	85.45	102.54	113.94
1.43	⅛	.....	17.27	20.15	23.03	28.79	43.18	57.57	71.96	86.36	103.63	115.14
1.44	¼	.....	17.45	20.36	23.27	29.09	43.63	58.18	72.72	87.26	104.72	116.35
1.45	⅜	.....	17.63	20.57	23.51	29.39	44.09	58.78	73.48	88.17	105.81	117.57
1.46	17½	.....	17.82	20.79	23.76	29.70	44.54	59.39	74.24	89.09	106.91	118.78
1.47	⅝	.....	18.00	21.00	24.00	30.00	45.00	60.00	75.00	90.01	108.01	120.01
1.48	¾	.....	18.19	21.22	24.25	30.31	45.46	60.62	75.77	90.93	109.11	121.23
1.49	⅞	.....	18.37	21.43	24.49	30.62	45.92	61.23	76.54	91.85	110.22	122.46
1.50	18	.....	18.55	21.65	24.74	30.92	46.39	61.85	77.31	92.77	111.33	123.70

DISCHARGE OVER CIPPOLETTI'S TRAPEZOIDAL WEIR—*Continued*

For Various Lengths and Depths. Formula: $Q=3.3\frac{2}{3}\ LH^{\frac{3}{2}}$

Head "H" on Crest Measured in Still Water		Discharge in Cubic Feet per Second								
		Length of Weir Crest in Feet								
In feet	In inches	3½	4	5	7½	10	12½	15	18	20
1.51	18 1/8	21.86	24.99	31.23	46.85	62.47	78.09	93.70	112.44	124.94
1.52	¼	22.08	25.24	31.55	47.32	63.09	78.86	94.64	113.56	126.18
1.53	⅜	22.30	25.49	31.86	47.79	63.71	79.64	95.57	114.69	127.43
1.54	½	22.52	25.74	32.17	48.26	64.34	80.43	96.51	115.81	128.68
1.55	⅝	22.74	25.99	32.48	48.73	64.97	81.21	97.45	116.94	129.94
1.56	18¾	22.96	26.24	32.80	49.20	65.60	82.00	98.40	118.08	131.19
1.57	⅞	23.18	26.49	33.11	49.67	66.23	82.79	99.34	119.21	132.46
1.58	19	23.40	26.75	33.43	50.15	66.86	83.58	100.29	120.35	133.73
1.59	⅛	23.62	27.00	33.75	50.62	67.50	84.37	101.25	121.50	135.00
1.60	¼	23.85	27.25	34.07	51.10	68.14	85.17	102.20	122.65	136.27
1.61	19⅜	24.07	27.51	34.39	51.58	68.78	85.97	103.16	123.80	137.55
1.62	½	24.30	27.77	34.71	52.06	69.42	86.77	104.13	124.95	138.84
1.64	⅝	24.75	28.28	35.35	53.03	70.71	88.38	106.06	127.27	141.42
1.65	¾	24.97	28.54	35.68	53.52	71.36	89.19	107.03	128.44	142.71
1.66	19⅞	25.20	28.80	36.00	54.00	72.00	90.01	108.01	129.61	144.01
1.67	20	25.43	29.06	36.33	54.49	72.66	90.82	108.98	130.78	145.31
1.68	⅛	25.66	29.32	36.66	54.98	73.31	91.64	109.97	131.96	146.62
1.69	¼	25.89	29.59	36.98	55.47	73.97	92.46	110.95	133.14	147.93
1.70	⅜	26.12	29.85	37.31	55.97	74.62	93.28	111.93	134.32	149.25
1.71	20½	26.35	30.11	37.64	56.46	75.28	94.10	112.92	135.51	150.57
1.72	⅝	26.58	30.38	37.97	56.96	75.94	94.93	113.92	136.70	151.89
1.73	¾	26.81	30.64	38.30	57.46	76.61	95.76	114.91	137.89	153.21
1.74	⅞	27.05	30.91	38.64	57.95	77.27	96.59	115.91	139.09	154.54
1.75	21	27.28	31.18	38.97	58.45	77.94	97.42	116.91	140.29	155.88
1.76	21⅛	27.51	31.44	39.30	58.96	78.61	98.26	117.91	141.50	157.22
1.77	¼	27.75	31.71	39.64	59.46	79.28	99.10	118.92	142.70	158.56
1.78	⅜	27.98	31.98	39.98	59.96	79.95	99.94	119.93	143.91	159.90
1.79	½	28.22	32.25	40.31	60.47	80.63	100.78	120.94	145.13	161.25
1.80	⅝	28.46	32.52	40.65	60.98	81.30	101.63	121.96	146.35	162.61
1.81	21¾	.....	32.79	40.99	61.49	81.98	102.48	122.97	147.57	163.96
1.82	⅞	.....	33.06	41.33	62.00	82.66	103.33	123.99	148.79	165.32
1.83	22	.....	33.34	41.67	62.51	83.34	104.18	125.02	150.02	166.69
1.84	⅛	.....	33.61	42.01	63.02	84.03	105.04	126.04	151.25	168.06
1.85	¼	.....	33.89	42.36	63.54	84.71	105.89	127.07	152.49	169.43
1.86	22⅜	.....	34.16	42.70	64.05	85.40	106.75	128.10	153.72	170.80
1.87	½	.....	34.44	43.05	64.57	86.09	107.61	129.14	154.97	172.18
1.89	⅝	.....	34.99	43.74	65.61	87.48	109.35	131.22	157.46	174.95
1.90	¾	.....	35.27	44.09	66.13	88.17	110.22	132.26	158.71	176.34
1.91	22⅞	.....	35.55	44.43	66.65	88.87	111.09	133.30	159.96	177.74
1.92	23	.....	35.83	44.78	67.18	89.57	111.96	134.35	161.22	179.14
1.93	⅛	.....	36.11	45.13	67.70	90.27	112.84	135.40	162.48	180.54
1.94	¼	.....	36.39	45.49	68.23	90.97	113.71	136.46	163.75	181.94
1.95	⅜	.....	36.67	45.84	68.76	91.68	114.59	137.51	165.02	183.35
1.96	23½	.....	36.95	46.19	69.29	92.38	115.48	138.57	166.29	184.76
1.97	⅝	.....	37.24	46.54	69.82	93.09	116.36	139.63	167.56	186.18
1.98	¾	.....	37.52	46.90	70.35	93.80	117.25	140.70	168.84	187.60
1.99	⅞	.....	37.80	47.26	70.88	94.51	118.14	141.77	170.12	189.02
2.00	24	.....	38.09	47.61	71.42	95.22	119.03	142.84	171.40	190.45

DISCHARGE OVER CIPPOLETTI'S TRAPEZOIDAL WEIR—*Continued*

For Various Lengths and Depths. Formula: $Q = 3.3\frac{2}{3} LH^{\frac{3}{2}}$

Head "H" on Crest Measured in Still Water		Discharge in Cubic Feet per Second							
		Length of Weir Crest in Feet							
In feet	In inches	4	5	7½	10	12½	15	18	20
2.01	24⅛	38.38	47.97	71.95	95.94	119.92	143.91	172.69	191.88
2.02	¼	38.66	48.33	72.49	96.66	120.82	144.98	173.98	193.31
2.03	⅜	38.95	48.69	73.03	97.37	121.72	146.06	175.27	195.75
2.04	½	39.24	49.05	73.57	98.09	122.62	147.14	176.57	196.19
2.05	⅝	39.53	49.41	74.11	98.82	123.52	148.23	177.87	197.63
2.06	24¾	39.82	49.77	74.66	99.54	124.43	149.31	179.17	199.08
2.07	⅞	40.11	50.13	75.20	100.27	125.33	150.40	180.48	200.53
2.08	25	40.40	50.50	75.75	100.99	126.24	151.49	181.79	201.99
2.09	⅛	40.69	50.86	76.29	101.72	127.15	152.58	183.10	203.45
2.10	¼	40.98	51.23	76.84	102.45	128.07	153.68	184.42	204.91
2.11	25⅜	.....	51.59	77.39	103.19	128.98	154.78	185.74	206.37
2.12	½	.....	51.96	77.94	103.92	129.90	155.88	187.06	207.84
2.14	⅝	.....	52.70	79.05	105.40	131.74	158.09	189.71	210.79
2.15	¾	.....	53.07	79.60	106.13	132.67	159.20	191.04	212.27
2.16	25⅞	.....	53.44	80.16	106.88	133.60	160.31	192.38	213.75
2.17	26	.....	53.81	80.71	107.62	134.52	161.43	193.71	215.24
2.18	⅛	.....	54.18	81.27	108.36	135.45	162.55	195.06	216.73
2.19	¼	.....	54.56	81.83	109.11	136.39	163.67	196.40	218.22
2.20	⅜	.....	54.93	82.39	109.86	137.32	164.79	197.75	219.72
2.21	26½	.....	55.30	82.96	110.61	138.26	165.91	199.10	221.22
2.22	⅝	.....	55.68	83.52	111.36	139.20	167.04	200.45	222.72
2.23	¾	.....	56.06	84.09	112.11	140.14	168.17	201.80	224.23
2.24	⅞	.....	56.43	84.65	112.87	141.09	169.30	203.16	225.74
2.25	27	.....	56.81	85.22	113.63	142.03	170.44	204.53	227.25
2.26	27⅛	.....	57.19	85.79	114.38	142.98	171.58	205.89	228.77
2.27	¼	.....	57.57	86.36	115.14	143.93	172.72	207.26	230.29
2.28	⅜	.....	57.96	86.93	115.91	144.88	173.86	208.63	231.81
2.29	½	.....	58.33	87.50	116.67	145.84	175.00	210.00	233.34
2.30	⅝	.....	58.72	88.08	117.43	146.79	176.15	211.38	234.87
2.31	27¾	.....	59.10	88.65	118.20	147.75	177.30	212.76	236.40
2.32	⅞	.....	59.48	89.23	118.97	148.71	178.45	214.14	237.94
2.33	28	.....	59.87	89.80	119.74	149.67	179.61	215.53	239.48
2.34	⅛	.....	60.26	90.38	120.51	150.64	180.77	216.92	241.02
2.35	¼	.....	60.64	90.96	121.28	151.60	181.93	218.31	242.57
2.36	28⅜	.....	61.03	91.54	122.06	152.57	183.09	219.71	244.12
2.37	½	.....	61.42	92.13	122.84	153.54	184.25	221.10	245.67
2.39	⅝	.....	62.20	93.30	124.39	155.49	186.59	223.91	248.79
2.40	¾	.....	62.59	93.88	125.17	156.47	187.76	225.31	250.35
2.41	28⅞	.....	.....	94.47	125.96	157.45	188.94	226.72	251.92
2.42	29	.....	.....	95.06	126.74	158.43	190.11	228.14	253.49
2.43	⅛	.....	.....	95.65	127.53	159.41	191.29	229.55	255.06
2.44	¼	.....	.....	96.24	128.32	160.40	192.48	230.97	256.63
2.45	⅜	.....	.....	96.83	129.11	161.38	193.66	232.39	258.21
2.46	29½	.....	.....	97.42	129.90	162.37	194.85	233.82	259.80
2.47	⅝	.....	.....	98.02	130.69	163.36	196.04	235.24	261.38
2.48	¾	.....	.....	98.61	131.49	164.36	197.23	236.67	262.97
2.49	⅞	.....	.....	99.21	132.28	165.35	198.42	238.11	264.56
2.50	30	.....	.....	99.81	133.08	166.35	199.62	239.54	266.16

DISCHARGE OVER CIPPOLETTI'S TRAPEZOIDAL WEIR—*Continued*

For Various Lengths and Depths. Formula: $Q=3.3\frac{2}{3} LH^{\frac{3}{2}}$

Head "H" on Crest Measured in Still Water		Discharge in Cubic Feet per Second					
		Length of Weir Crest in Feet					
In feet	In inches	7½	10	12½	15	18	20
2.51	30⅛	100.41	133.88	167.35	200.82	240.98	267.76
2.52	¼	101.01	134.68	168.35	202.02	242.42	269.36
2.53	⅜	101.61	135.48	169.35	203.22	243.87	270.96
2.54	½	102.21	136.29	170.36	204.43	245.31	272.57
2.55	⅝	102.82	137.09	171.36	205.64	246.76	274.18
2.56	30¾	103.42	137.90	172.37	206.85	248.22	275.80
2.57	⅞	104.03	138.71	173.38	208.06	249.67	277.41
2.58	31	104.64	139.52	174.40	209.28	251.13	279.04
2.59	⅛	105.25	140.33	175.41	210.49	252.59	280.66
2.60	¼	105.86	141.14	176.43	211.71	254.06	282.29
2.61	31⅜	106.47	141.96	177.45	212.94	255.53	283.92
2.62	½	107.08	142.77	178.47	214.16	256.99	285.55
2.64	⅝	108.31	144.41	180.52	216.62	259.94	288.83
2.65	¾	108.93	145.23	181.54	217.85	261.42	290.47
2.66	31⅞	109.54	146.06	182.57	219.09	262.90	292.11
2.67	32	110.16	146.88	183.60	220.32	264.39	293.76
2.68	⅛	110.78	147.71	184.63	221.56	265.97	295.41
2.69	¼	111.40	148.53	185.67	222.80	267.36	297.07
2.70	⅜	112.02	149.36	186.70	224.05	268.86	298.73
2.71	32½	112.65	150.19	187.74	225.29	270.35	300.39
2.72	⅝	113.27	151.03	188.78	226.54	271.85	303.05
2.73	¾	113.90	151.86	189.83	227.79	273.35	303.72
2.74	⅞	114.52	152.70	190.87	229.04	274.85	305.39
2.75	33	115.15	153.53	191.92	230.30	276.36	307.06
2.76	33⅛	115.78	154.37	192.96	231.56	277.87	308.74
2.77	¼	116.41	155.21	194.01	232.82	279.38	310.42
2.78	⅜	117.04	156.05	195.06	234.08	280.89	312.10
2.79	½	117.67	156.89	196.12	235.34	282.41	313.79
2.80	⅝	118.30	157.74	197.17	236.61	283.93	315.48
2.81	33¾	118.94	158.58	198.23	237.88	285.45	317.17
2.82	⅞	119.57	159.43	199.29	239.15	286.98	318.86
2.83	34	120.21	160.28	200.35	240.42	288.50	320.56
2.84	⅛	120.85	161.13	201.41	241.70	290.03	322.26
2.85	¼	121.49	161.98	202.48	242.97	291.57	323.96
2.86	34⅜	122.13	162.84	203.54	244.25	293.10	325.67
2.87	½	122.77	163.69	204.61	245.54	294.64	327.38
2.89	⅝	124.05	165.40	206.76	248.11	297.73	330.81
2.90	¾	124.70	166.26	207.83	249.40	299.27	332.53
2.91	34⅞	125.34	167.12	208.91	250.69	300.82	334.25
2.92	35	125.99	167.99	209.98	251.98	302.38	335.97
2.93	⅛	126.64	168.85	211.06	253.28	303.93	337.70
2.94	¼	127.29	169.72	212.14	254.57	305.49	339.43
2.95	⅜	127.94	170.58	213.23	255.87	307.05	341.16
2.96	35½	128.59	171.45	214.31	257.18	308.61	342.90
2.97	⅝	129.24	172.32	215.40	258.48	310.18	344.64
2.98	¾	129.89	173.19	216.49	259.79	311.74	346.38
2.99	⅞	130.55	174.06	217.58	261.09	313.31	348.13
3.00	36	131.20	174.94	218.67	262.41	314.89	349.87

DISCHARGE TABLE IN SECOND FEET FOR STANDARD SUBMERGED ORIFICE

$Q = 0.62 \sqrt{2gh} \times A$

Effective Head		Area of orifice in square feet								
In feet	In inches	¼	½	¾	1	1½	2	3	4	5
0.01	⅛	0.12	0.25	0.37	0.50	0.75	1.00	1.49	1.99	2.49
.02	¼	.18	.35	.53	.70	1.06	1.41	2.11	2.82	3.52
.03	⅜	.22	.43	.64	.86	1.29	1.72	2.58	3.44	4.30
.04	½	.25	.50	.75	.97	1.49	1.99	2.98	3.98	4.97
.05	⅝	.28	.56	.83	1.11	1.67	2.22	3.34	4.45	5.56
.06	¾	.30	.61	.91	1.22	1.83	2.44	3.65	4.87	6.09
.07	⅞	.33	.66	.99	1.32	1.97	2.63	3.95	5.26	6.58
.08	1	.35	.70	1.05	1.41	2.11	2.81	4.22	5.62	7.03
.09	⅛	.37	.75	1.12	1.49	2.24	2.98	4.48	5.97	7.46
.10	¼	.39	.79	1.18	1.57	2.36	3.14	4.72	6.29	7.86
.11	⅜	.41	.82	1.24	1.63	2.48	3.30	4.95	6.60	8.25
.12	½	.43	.86	1.29	1.72	2.58	3.44	5.17	6.89	8.61
.14	⅝	.46	.93	1.40	1.86	2.79	3.72	5.58	7.44	9.30
.15	¾	.48	.96	1.44	1.93	2.89	3.85	5.78	7.70	9.63
.16	⅞	.50	.99	1.49	1.99	2.98	3.98	5.96	7.95	9.94
.17	2	.51	1.02	1.54	2.05	3.08	4.10	6.15	8.20	10.25
.18	⅛	.53	1.06	1.58	2.11	3.16	4.22	6.33	8.44	10.55
.19	¼	.54	1.08	1.63	2.17	3.25	4.34	6.50	8.67	10.84
.20	⅜	.56	1.11	1.67	2.22	3.34	4.45	6.67	8.90	11.12
.21	½	.57	1.14	1.71	2.28	3.42	4.56	6.83	9.11	11.39
.22	⅝	.58	1.17	1.75	2.33	3.50	4.66	7.00	9.33	11.66
.23	¾	.60	1.19	1.79	2.38	3.58	4.77	7.15	9.54	11.92
.24	⅞	.61	1.22	1.83	2.44	3.65	4.87	7.31	9.74	12.18
.25	3	.62	1.24	1.86	2.49	3.73	4.97	7.46	9.94	12.43
.26	⅛	.63	1.27	1.90	2.54	3.80	5.07	7.61	10.14	12.68
.27	¼	.65	1.29	1.94	2.58	3.88	5.17	7.75	10.34	12.92
.28	⅜	.66	1.32	1.97	2.63	3.95	5.26	7.90	10.53	13.16
.29	½	.67	1.34	2.01	2.68	4.02	5.36	8.03	10.71	13.39
.30	⅝	.68	1.36	2.04	2.72	4.09	5.45	8.17	10.90	13.62
.31	¾	.69	1.38	2.08	2.77	4.15	5.54	8.30	11.07	13.84
.32	⅞	.70	1.41	2.11	2.81	4.22	5.62	8.44	11.25	14.06
.33	4	.72	1.44	2.15	2.87	4.29	5.74	8.57	11.48	14.35
.34	⅛	.73	1.45	2.18	2.90	4.35	5.80	8.70	11.60	14.50
.35	¼	.74	1.47	2.21	2.94	4.41	5.88	8.83	11.77	14.71
.36	⅜	.75	1.49	2.24	2.98	4.48	5.97	8.95	11.94	14.92
.37	½	.76	1.51	2.27	3.02	4.54	6.05	9.07	12.10	15.12
.39	⅝	.78	1.55	2.33	3.10	4.66	6.21	9.31	12.42	15.52
.40	¾	.79	1.57	2.36	3.14	4.72	6.29	9.43	12.58	15.72
.41	⅞	.80	1.59	2.39	3.18	4.78	6.37	9.55	12.74	15.92
.42	5	.81	1.61	2.42	3.22	4.83	6.44	9.67	12.89	16.11
.43	⅛	.82	1.63	2.44	3.26	4.89	6.52	9.78	13.04	16.30
.44	¼	.82	1.65	2.47	3.30	4.95	6.60	9.89	13.19	16.49
.45	⅜	.83	1.67	2.50	3.34	5.00	6.67	10.01	13.34	16.68
.46	½	.84	1.69	2.53	3.37	5.06	6.74	10.12	13.49	16.86
.47	⅝	.85	1.70	2.56	3.41	5.11	6.82	10.22	13.63	17.04
.48	¾	.86	1.72	2.58	3.44	5.17	6.89	10.33	13.78	17.22
.49	⅞	.87	1.74	2.61	3.48	5.22	6.96	10.44	13.92	17.40

DISCHARGE TABLE IN SECOND FEET FOR STANDARD SUBMERGED ORIFICE—*Continued*

EFFECTIVE HEAD		AREA OF ORIFICE IN SQUARE FEET								
In feet	In inches	¼	½	¾	1	1½	2	3	4	5
.50	6	.88	1.76	2.64	3.52	5.27	7.03	10.55	14.06	17.58
.51	⅛	.89	1.78	2.66	3.55	5.32	7.10	10.65	14.20	17.75
.52	¼	.90	1.79	2.69	3.59	5.38	7.17	10.76	14.35	17.93
.53	⅜	.90	1.81	2.72	3.62	5.43	7.24	10.86	14.48	18.10
.54	½	.91	1.83	2.74	3.65	5.48	7.31	10.96	14.62	18.27
.55	⅝	.92	1.84	2.77	3.69	5.53	7.38	11.06	14.75	18.44
.56	¾	.93	1.86	2.79	3.72	5.58	7.44	11.16	14.88	18.60
.57	⅞	.94	1.88	2.82	3.75	5.63	7.51	11.26	15.02	18.77
.58	7	.95	1.89	2.84	3.79	5.68	7.57	11.36	15.14	18.93
.59	⅛	.96	1.91	2.86	3.82	5.73	7.64	11.46	15.28	19.10
.60	¼	.96	1.93	2.89	3.85	5.78	7.70	11.56	15.41	19.36
.61	⅜	.97	1.94	2.91	3.88	5.83	7.77	11.65	15.54	19.42
.62	½	.98	1.96	2.94	3.92	5.87	7.83	11.75	15.66	19.58
.64	⅝	.99	1.99	2.98	3.98	5.97	7.96	11.93	15.91	19.89
.65	¾	1.00	2.01	3.01	4.01	6.01	8.02	12.02	16.03	20.04
.66	⅞	1.01	2.02	3.03	4.05	6.07	8.09	12.14	16.18	20.24
.67	8	1.02	2.04	3.05	4.07	6.10	8.14	12.21	16.28	20.36
.69	¼	1.03	2.06	3.10	4.13	6.20	8.26	12.39	16.52	20.64
.71	½	1.05	2.10	3.14	4.19	6.28	8.38	12.57	16.76	20.96
.73	¾	1.06	2.12	3.19	4.25	6.37	8.50	12.74	16.99	21.24
.75	9	1.08	2.15	3.23	4.31	6.46	8.61	12.92	17.22	21.52
.80	⅝	1.11	2.22	3.34	4.45	6.67	8.90	13.34	17.79	21.24
.85	10¼	1.15	2.29	3.44	4.58	6.88	9.17	13.75	18.34	22.92
.90	¾	1.18	2.36	3.54	4.72	7.07	9.43	14.15	18.86	23.58
.95	11⅜	1.21	2.42	3.63	4.85	7.27	9.69	14.54	19.38	24.24
1.00	12	1.24	2.49	3.73	4.97	7.46	9.94	14.92	19.89	24.86
1.05	⅝	1.27	2.55	3.82	5.10	7.64	10.19	15.29	20.38	25.48
1.10	13¼	1.30	2.61	3.91	5.22	7.82	10.43	15.65	20.86	26.08
1.15	¾	1.33	2.67	4.00	5.33	8.00	10.66	16.00	21.32	26.66
1.20	14⅜	1.36	2.72	4.08	5.45	8.17	10.89	16.34	21.78	27.24
1.25	15	1.39	2.78	4.17	5.56	8.34	11.12	16.68	22.24	27.80
1.30	⅝	1.42	2.84	4.25	5.67	8.50	11.34	17.01	22.68	28.36
1.35	16¼	1.44	2.89	4.33	5.78	8.66	11.55	17.33	23.10	28.88
1.40	¾	1.47	2.94	4.41	5.88	8.83	11.77	17.65	23.54	29.42
1.45	17⅜	1.50	2.99	4.49	5.99	8.98	11.98	17.96	23.96	29.94
1.50	18	1.52	3.04	4.57	6.09	9.14	12.18	18.27	24.36	30.44
1.60	19¼	1.57	3.14	4.72	6.29	9.44	12.58	18.87	25.16	31.44
1.70	20⅜	1.62	3.24	4.86	6.48	9.73	12.97	19.45	25.94	32.42
1.80	21⅝	1.67	3.34	5.00	6.67	10.01	13.34	20.02	26.68	33.36
1.90	22¾	1.71	3.43	5.14	6.85	10.28	13.71	20.56	27.42	34.28
2.00	24	1.76	3.52	5.27	7.03	10.55	14.06	21.10	28.12	35.16
3.00	36	.....	4.31	6.46	8.62	12.93	17.24	25.86	34.48	43.10
4.00	48	.....	4.96	7.44	9.92	14.88	19.84	29.76	39.68	49.60
5.00	60	.....	5.55	8.32	11.10	16.65	22.20	33.30	44.40	55.60
6.00	72	.....	.....	9.12	12.16	18.24	24.32	36.48	48.64	60.80
7.00	84	.....	.....	9.86	13.14	19.72	26.28	39.42	52.56	65.70
8.00	96	.....	.....	10.56	14.08	21.12	28.16	42.24	56.32	70.40
9.00	108	.....	.....	11.20	14.94	22.40	29.88	44.82	59.76	74.70
10.00	120	.....	.....	11.80	15.74	23.60	31.48	47.22	62.96	78.70

TABLE OF FREE-FLOW DISCHARGE FOR IMPROVED VENTURI FLUMES

Gage reading (Ha) inches	Gage reading (Ha) feet	Discharge in Cubic Feet per Second — Width of Crest								
		6 inches	1 foot	2 feet	3 feet	4 feet	5 feet	6 feet	7 feet	8 feet
1¼	0.10	0.05	.....	.....	.....	.....	.....	.....	.....	.....
⅜	.11	.06	.....	.....	.....	.....	.....	.....	.....	.....
½	.12	.07	.....	.....	.....	.....	.....	.....	.....	.....
⅝	.14	.09	.....	.....	.....	.....	.....	.....	.....	.....
¾	.15	.10	.....	.....	.....	.....	.....	.....	.....	.....
⅞	.16	.11	.....	.....	.....	.....	.....	.....	.....	.....
2	.17	.12	.....	.....	.....	.....	.....	.....	.....	.....
⅛	.18	.14	.....	.....	.....	.....	.....	.....	.....	.....
¼	.19	.15	.....	.....	.....	.....	.....	.....	.....	.....
⅜	.20	.16	.35	.66	.97	1.26	.....	.....	.....	.....
½	.21	.18	.37	.71	1.04	1.36	.....	.....	.....	.....
⅝	.22	.19	.40	.77	1.12	1.47	.....	.....	.....	.....
¾	.23	.20	.43	.82	1.20	1.58	.....	.....	.....	.....
⅞	.24	.22	.46	.88	1.28	1.69	.....	.....	.....	.....
3	.25	.23	.49	.93	1.37	1.80	2.22	2.63	.....	.....
⅛	.26	.25	.51	.99	1.46	1.91	2.36	2.80	.....	.....
¼	.27	.26	.54	1.05	1.55	2.03	2.50	2.97	.....	.....
⅜	.28	.28	.58	1.11	1.64	2.15	2.65	3.15	.....	.....
½	.29	.29	.61	1.18	1.73	2.27	2.70	3.33	.....	.....
⅝	.30	.31	.64	1.24	1.82	2.39	2.96	3.52	4.08	4.62
¾	.31	.32	.68	1.30	1.92	2.52	3.12	3.71	4.30	4.88
⅞	.32	.34	.71	1.37	2.02	2.65	3.28	3.90	4.52	5.13
4	.33	.36	.74	1.44	2.12	2.78	3.44	4.10	4.75	5.39
⅛	.34	.38	.77	1.50	2.22	2.92	3.61	4.30	4.98	5.66
¼	.35	.39	.80	1.57	2.32	3.06	3.88	4.50	5.22	5.93
⅜	.36	.41	.84	1.64	2.42	3.19	3.95	4.71	5.46	6.20
½	.37	.43	.88	1.72	2.53	3.34	4.13	4.92	5.70	6.48
⅝	.39	.47	.95	1.86	2.75	3.62	4.49	5.35	6.20	7.05
¾	.40	.48	.99	1.93	2.86	3.77	4.68	5.57	6.46	7.34
⅞	.41	.50	1.03	2.01	2.97	3.92	4.86	5.80	6.72	7.64
5	.42	.52	1.07	2.09	3.08	4.07	5.05	6.02	6.98	7.94
⅛	.43	.54	1.11	2.16	3.20	4.22	5.24	6.25	7.25	8.24
¼	.44	.56	1.15	2.24	3.32	4.38	5.43	6.48	7.52	8.55
⅜	.45	.58	1.19	2.32	3.44	4.54	5.63	6.72	7.80	8.87
½	.46	.61	1.23	2.40	3.56	4.70	5.83	6.96	8.08	9.19
⅝	.47	.63	1.27	2.48	3.68	4.86	6.03	7.20	8.36	9.51
¾	.48	.65	1.31	2.57	3.80	5.03	6.24	7.44	8.65	9.84
⅞	.49	.67	1.35	2.65	3.92	5.20	6.45	7.69	8.94	10.17

TABLE OF FREE-FLOW DISCHARGE FOR IMPROVED VENTURI FLUMES

Gage reading (Ha) inches	Gage reading (Ha) feet	Discharge in Cubic Feet per Second — Width of Crest								
		6 inches	1 foot	2 feet	3 feet	4 feet	5 feet	6 feet	7 feet	8 feet
6	0.50	0.69	1.39	2.73	4.05	5.36	6.66	7.94	9.23	10.51
⅛	.51	.71	1.44	2.82	4.18	5.53	6.87	8.20	9.53	10.85
¼	.52	.73	1.48	2.90	4.31	5.70	7.09	8.46	9.83	11.19
⅜	.53	.76	1.52	2.99	4.44	5.88	7.30	8.72	10.14	11.54
½	.54	.78	1.57	3.08	4.57	6.05	7.52	8.98	10.45	11.89
⅝	.55	.80	1.62	3.17	4.70	6.23	7.74	9.25	10.76	12.24
¾	.56	.82	1.66	3.26	4.84	6.41	7.97	9.52	11.07	12.60
⅞	.57	.85	1.70	3.35	4.98	6.59	8.20	9.79	11.39	12.96
7	.58	.87	1.75	3.44	5.11	6.77	8.43	10.07	11.71	13.33
⅛	.59	.89	1.80	3.53	5.25	6.96	8.66	10.35	12.03	13.70
¼	.60	.92	1.84	3.62	5.39	7.15	8.89	10.63	12.36	14.08
⅜	.61	.94	1.88	3.72	5.53	7.34	9.13	10.92	12.69	14.46
½	.62	.97	1.93	3.81	5.68	7.53	9.37	11.20	13.02	14.84
⅝	.64	1.02	2.03	4.01	5.97	7.91	9.85	11.78	13.70	15.62
¾	.65	1.04	2.08	4.11	6.12	8.11	10.10	12.08	14.05	16.01
⅞	.66	1.07	2.13	4.20	6.26	8.31	10.34	12.38	14.40	16.41
8	.67	1.10	2.18	4.30	6.41	8.51	10.59	12.68	14.75	16.81
⅛	.68	1.12	2.23	4.40	6.56	8.71	10.85	12.98	15.10	17.22
¼	.69	1.15	2.28	4.50	6.71	8.91	11.10	13.28	15.46	17.63
⅜	.70	1.17	2.33	4.60	6.86	9.11	11.36	13.59	15.82	18.04
½	.71	1.20	2.38	4.70	7.02	9.32	11.62	13.90	16.18	18.45
⅝	.72	1.23	2.43	4.81	7.17	9.53	11.88	14.22	16.55	18.87
¾	.73	1.26	2.48	4.91	7.33	9.74	12.14	14.53	16.92	19.29
⅞	.74	1.28	2.53	5.02	7.49	9.95	12.40	14.85	17.29	19.71
9	.75	1.31	2.58	5.12	7.65	10.16	12.67	15.17	17.66	20.14
⅛	.76	1.34	2.63	5.23	7.81	10.38	12.94	15.49	18.04	20.57
¼	.77	1.36	2.68	5.34	7.97	10.60	13.21	15.82	18.42	21.01
⅜	.78	1.39	2.74	5.44	8.13	10.81	13.48	16.15	18.81	21.46
½	.79	1.42	2.80	5.55	8.30	11.03	13.76	16.48	19.20	21.91
⅝	.80	1.45	2.85	5.66	8.46	11.25	14.04	16.81	19.59	22.36
¾	.81	1.48	2.90	5.77	8.63	11.48	14.32	17.15	19.99	22.81
⅞	.82	1.50	2.96	5.88	8.79	11.70	14.60	17.49	20.39	23.26
10	.83	1.53	3.02	6.00	8.96	11.92	14.88	17.83	20.79	23.72
⅛	.84	1.56	3.07	6.11	9.13	12.15	15.17	18.17	21.18	24.18
¼	.85	1.59	3.12	6.22	9.30	12.38	15.46	18.52	21.58	24.64
⅜	.86	1.62	3.18	6.33	9.48	12.61	15.75	18.87	21.99	25.11
½	.87	1.65	3.24	6.44	9.65	12.84	16.04	19.22	22.40	25.58
⅝	.89	1.71	3.35	6.68	10.00	13.31	16.62	19.93	23.24	26.54

TABLE OF FREE-FLOW DISCHARGE FOR IMPROVED VENTURI FLUMES

Gage reading (Ha) inches	Gage reading (Ha) feet	Discharge in Cubic Feet per Second — Width of Crest								
		6 inches	1 foot	2 feet	3 feet	4 feet	5 feet	6 feet	7 feet	8 feet
10 ¾	0.90	1.74	3.41	6.80	10.17	13.55	16.92	20.29	23.66	27.02
⅞	.91	1.77	3.46	6.92	10.35	13.79	17.22	20.65	24.08	27.50
11	.92	1.81	3.52	7.03	10.52	14.03	17.52	21.01	24.50	27.99
⅛	.93	1.84	3.58	7.15	10.71	14.27	17.82	21.38	24.93	28.48
¼	.94	1.87	3.64	7.27	10.89	14.51	18.13	21.75	25.36	28.97
⅜	.95	1.90	3.70	7.39	11.07	14.76	18.44	22.12	25.79	29.47
½	.96	1.93	3.76	7.51	11.26	15.00	18.75	22.49	26.22	29.97
⅝	.97	1.97	3.82	7.63	11.44	15.25	19.06	22.86	26.66	30.48
¾	.98	2.00	3.88	7.75	11.63	15.50	19.37	23.24	27.10	30.98
⅞	.99	2.03	3.94	7.88	11.82	15.75	19.68	23.62	27.55	31.49
12	1.00	.....	4.00	8.00	12.00	16.00	20.00	24.00	28.00	32.00
⅛	1.01	.....	4.06	8.12	12.19	16.25	20.32	24.38	28.45	32.52
¼	1.02	.....	4.12	8.25	12.38	16.51	20.64	24.77	28.90	33.04
⅜	1.03	.....	4.18	8.38	12.57	16.76	20.96	25.16	29.36	33.56
½	1.04	.....	4.25	8.50	12.76	17.02	21.28	25.55	29.82	34.08
⅝	1.05	.....	4.31	8.63	12.96	17.28	21.61	25.94	30.28	34.61
¾	1.06	.....	4.37	8.76	13.15	17.54	21.94	26.34	30.74	35.14
⅞	1.07	.....	4.43	8.88	13.34	17.80	22.27	26.74	31.20	35.68
13	1.08	.....	4.50	9.01	13.54	18.07	22.60	27.13	31.67	36.22
⅛	1.09	.....	4.56	9.14	13.74	18.34	22.93	27.53	32.14	36.76
¼	1.10	.....	4.62	9.27	13.93	18.60	23.26	27.94	32.62	37.30
⅜	1.11	.....	4.68	9.40	14.13	18.86	23.60	28.35	33.10	37.84
½	1.12	.....	4.75	9.54	14.33	19.13	23.94	28.76	33.58	38.39
⅝	1.14	.....	4.88	9.80	14.73	19.67	24.62	29.58	34.54	39.50
¾	1.15	.....	4.94	9.94	14.94	19.94	24.96	30.00	35.02	40.06
⅞	1.16	.....	5.01	10.07	15.14	20.22	25.31	30.41	35.51	40.62
14	1.17	.....	5.08	10.20	15.34	20.50	25.66	30.83	36.00	41.18
⅛	1.18	.....	5.15	10.34	15.55	20.78	26.01	31.25	36.50	41.75
¼	1.19	.....	5.21	10.48	15.76	21.05	26.36	31.68	37.00	42.32
⅜	1.20	.....	5.28	10.61	15.96	21.33	26.71	32.10	37.50	42.89
½	1.21	.....	5.34	10.75	16.17	21.61	27.06	32.53	38.00	43.47
⅝	1.22	.....	5.41	10.89	16.38	21.90	27.42	32.96	38.50	44.05
¾	1.23	.....	5.48	11.03	16.60	22.18	27.78	33.39	39.00	44.64
⅞	1.24	.....	5.55	11.17	16.81	22.47	28.14	33.82	39.51	45.22
15	1.25	.....	5.62	11.31	17.02	22.75	28.50	34.26	40.02	45.80
⅛	1.26	.....	5.69	11.45	17.23	23.04	28.86	34.70	40.54	46.38
¼	1.27	.....	5.76	11.59	17.44	23.33	29.22	35.14	41.05	46.97
⅜	1.28	.....	5.82	11.73	17.66	23.62	29.59	35.58	41.57	47.57
½	1.29	.....	5.89	11.87	17.88	23.92	29.96	36.02	42.09	48.17

TABLE OF FREE-FLOW DISCHARGE FOR IMPROVED VENTURI FLUMES

Gage reading (Ha) inches	Gage reading (Ha) feet	Discharge in Cubic Feet per Second — Width of Crest							
		1 foot	2 feet	3 feet	4 feet	5 feet	6 feet	7 feet	8 feet
15 5/8	1.30	5.96	12.01	18.10	24.21	30.33	36.47	42.62	48.78
3/4	1.31	6.03	12.16	18.32	24.50	30.70	36.92	43.14	49.38
7/8	1.32	6.10	12.30	18.54	24.80	31.07	37.37	43.67	49.99
16	1.33	6.18	12.44	18.76	25.10	31.44	37.82	44.20	50.60
1/8	1.34	6.25	12.59	18.98	25.39	31.82	38.28	44.73	51.22
1/4	1.35	6.32	12.74	19.20	25.69	32.20	38.74	45.26	51.84
3/8	1.36	6.39	12.89	19.42	25.99	32.58	39.20	45.80	52.46
1/2	1.37	6.46	13.03	19.64	26.30	32.96	39.66	46.35	53.08
5/8	1.39	6.60	13.33	20.10	26.90	33.72	40.58	47.44	54.33
3/4	1.40	6.68	13.48	20.32	27.21	34.11	41.05	47.99	54.95
7/8	1.41	6.75	13.63	20.55	27.52	34.50	41.52	48.54	55.58
17	1.42	6.82	13.78	20.78	27.82	34.89	41.99	49.09	56.22
1/8	1.43	6.89	13.93	21.01	28.13	35.28	42.46	49.64	56.86
1/4	1.44	6.97	14.08	21.24	28.45	35.67	42.94	50.20	57.50
3/8	1.45	7.04	14.23	21.47	28.76	36.06	43.42	50.76	58.14
1/2	1.46	7.12	14.38	21.70	29.07	36.46	43.89	51.32	58.78
5/8	1.47	7.19	14.54	21.94	29.38	36.86	44.37	51.88	59.43
3/4	1.48	7.26	14.69	22.17	29.70	37.26	44.85	52.45	60.08
7/8	1.49	7.34	14.85	22.41	30.02	37.66	45.34	53.02	60.74
18	1.50	7.41	15.00	22.64	30.34	38.06	45.82	53.59	61.40
1/8	1.51	7.49	15.16	22.88	30.66	38.46	46.31	54.16	62.06
1/4	1.52	7.57	15.31	23.12	30.98	38.87	46.80	54.74	62.72
3/8	1.53	7.64	15.47	23.36	31.30	39.28	47.30	55.32	63.38
1/2	1.54	7.72	15.62	23.60	31.63	39.68	47.79	55.90	64.04
5/8	1.55	7.80	15.78	23.84	31.95	40.09	48.28	56.48	64.71
3/4	1.56	7.87	15.94	24.08	32.27	40.51	48.78	57.06	65.38
7/8	1.57	7.95	16.10	24.32	32.60	40.92	49.28	57.65	66.06
19	1.58	8.02	16.26	24.56	32.93	41.33	49.78	58.24	66.74
1/8	1.59	8.10	16.42	24.80	33.26	41.75	50.28	58.83	67.42
1/4	1.60	8.18	16.58	25.05	33.59	42.17	50.79	59.42	68.10
3/8	1.61	8.26	16.74	25.30	33.92	42.59	51.30	60.02	68.79
1/2	1.62	8.34	16.90	25.54	34.26	43.01	51.81	60.62	69.48
5/8	1.64	8.49	17.22	26.04	34.93	43.86	52.83	61.82	70.86
3/4	1.65	8.57	17.38	26.29	35.26	44.28	53.34	62.42	71.56
7/8	1.66	8.65	17.55	26.54	35.60	44.70	53.86	63.03	72.26
20	1.67	8.73	17.72	26.79	35.94	45.13	54.38	63.64	72.96
1/8	1.68	8.81	17.88	27.04	36.28	45.56	54.90	64.25	73.66
1/4	1.69	8.89	18.04	27.30	36.62	46.00	55.42	64.86	74.37