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Submerged Weirs Formulas

Calculators! Examples! Conversions!

List of 17 Submerged Weirs Formulas

Submerged Weirs

1) Coefficient of Discharge given Discharge through Drowned Portion

Open Calculator

fx $$C_d = \frac{Q_2}{(L_w \cdot h_2) \cdot \sqrt{2 \cdot g \cdot (H_{Upstream} - h_2)}}$$

ex $$0.659966 = \frac{99.96\text{m}^3/\text{s}}{(3\text{m} \cdot 5.1\text{m}) \cdot \sqrt{2 \cdot 9.8\text{m/s}^2 \cdot (10.1\text{m} - 5.1\text{m})}}$$

2) Coefficient of Discharge given Discharge through Free Weir Portion

Open Calculator

fx $$C_d = \frac{3 \cdot Q_1}{2 \cdot L_w \cdot \sqrt{2 \cdot g} \cdot (H_{Upstream} - h_2)^{\frac{3}{2}}}$$

ex $$0.506086 = \frac{3 \cdot 50.1\text{m}^3/\text{s}}{2 \cdot 3\text{m} \cdot \sqrt{2 \cdot 9.8\text{m/s}^2} \cdot (10.1\text{m} - 5.1\text{m})^{\frac{3}{2}}}$$

3) Coefficient of Discharge if Velocity is Approached for Submerged Weir

Open Calculator

fx $$C_d = \frac{Q_2}{L_w \cdot h_2 \cdot \left(\sqrt{2 \cdot g \cdot (H_{Upstream} - h_2) + v_{su}^2}\right)}$$

ex $$0.60974 = \frac{99.96\text{m}^3/\text{s}}{3\text{m} \cdot 5.1\text{m} \cdot \left(\sqrt{2 \cdot 9.8\text{m/s}^2 \cdot (10.1\text{m} - 5.1\text{m}) + (4.1\text{m/s})^2}\right)}$$

4) Coefficient of Discharge if Velocity is Approached given Discharge through Free Weir

Open Calculator

fx $$C_d = \frac{3 \cdot Q_1}{2 \cdot L_w \cdot \sqrt{2 \cdot g} \cdot \left(\left((H_{Upstream} - h_2) + \left(\frac{v_{su}^2}{2 \cdot g}\right)\right)^{\frac{3}{2}} - \left(\frac{v_{su}^2}{2 \cdot g}\right)^{\frac{3}{2}}\right)}$$

ex $$0.422799 = \frac{3 \cdot 50.1\text{m}^3/\text{s}}{2 \cdot 3\text{m} \cdot \sqrt{2 \cdot 9.8\text{m/s}^2} \cdot \left(\left((10.1\text{m} - 5.1\text{m}) + \left(\frac{(4.1\text{m/s})^2}{2 \cdot 9.8\text{m/s}^2}\right)\right)^{\frac{3}{2}} - \left(\frac{(4.1\text{m/s})^2}{2 \cdot 9.8\text{m/s}^2}\right)^{\frac{3}{2}}\right)}$$

5) Discharge through Drowned Portion

Open Calculator

fx $$Q_2 = C_d \cdot (L_w \cdot h_2) \cdot \sqrt{2 \cdot g \cdot (H_{Upstream} - h_2)}$$

ex $$99.9651\text{m}^3/\text{s} = 0.66 \cdot (3\text{m} \cdot 5.1\text{m}) \cdot \sqrt{2 \cdot 9.8\text{m/s}^2 \cdot (10.1\text{m} - 5.1\text{m})}$$

6) Discharge through Drowned Portion given Total Discharge over Submerged Weir

Open Calculator

fx $$Q_2 = Q_T - Q_1$$

ex $$124.6\text{m}^3/\text{s} = 174.7\text{m}^3/\text{s} - 50.1\text{m}^3/\text{s}$$

7) Discharge through Free Weir if Velocity is Approached

Open Calculator

fx $$Q_1 = \left(\frac{2}{3}\right) \cdot C_d \cdot L_w \cdot \sqrt{2 \cdot g} \cdot \left(\left((H_{Upstream} - h_2) + \left(\frac{v_{su}^2}{2 \cdot g}\right)\right)^{\frac{3}{2}} - \left(\frac{v_{su}^2}{2 \cdot g}\right)^{\frac{3}{2}}\right)$$

ex $$78.20741\text{m}^3/\text{s} = \left(\frac{2}{3}\right) \cdot 0.66 \cdot 3\text{m} \cdot \sqrt{2 \cdot 9.8\text{m/s}^2} \cdot \left(\left((10.1\text{m} - 5.1\text{m}) + \left(\frac{(4.1\text{m/s})^2}{2 \cdot 9.8\text{m/s}^2}\right)\right)^{\frac{3}{2}} - \left(\frac{(4.1\text{m/s})^2}{2 \cdot 9.8\text{m/s}^2}\right)\right.$$

8) Discharge through Free Weir Portion

Open Calculator

fx $$Q_1 = \left(\frac{2}{3}\right) \cdot C_d \cdot L_w \cdot \sqrt{2 \cdot g} \cdot (H_{Upstream} - h_2)^{\frac{3}{2}}$$

ex $$65.33667\text{m}^3/\text{s} = \left(\frac{2}{3}\right) \cdot 0.66 \cdot 3\text{m} \cdot \sqrt{2 \cdot 9.8\text{m/s}^2} \cdot (10.1\text{m} - 5.1\text{m})^{\frac{3}{2}}$$

9) Discharge through Free Weir Portion given Total Discharge over Submerged Weir

Open Calculator

fx $$Q_1 = Q_T - Q_2$$

ex $$74.74\text{m}^3/\text{s} = 174.7\text{m}^3/\text{s} - 99.96\text{m}^3/\text{s}$$

10) Discharge through Submerged Weir if Velocity is Approached

Open Calculator

fx $$Q_2 = C_d \cdot L_w \cdot h_2 \cdot \left(\sqrt{2 \cdot g \cdot (H_{Upstream} - h_2) + v_{su}^2}\right)$$

ex $$108.1995\text{m}^3/\text{s} = 0.66 \cdot 3\text{m} \cdot 5.1\text{m} \cdot \left(\sqrt{2 \cdot 9.8\text{m/s}^2 \cdot (10.1\text{m} - 5.1\text{m}) + (4.1\text{m/s})^2}\right)$$

11) Head on Downstream Weir for Discharge through Free Weir Portion

Open Calculator

fx $$h_2 = -\left(\frac{3 \cdot Q_1}{2 \cdot C_d \cdot L_w \cdot \sqrt{2 \cdot g}}\right)^{\frac{2}{3}} + H_{Upstream}$$

ex $$5.911192\text{m} = -\left(\frac{3 \cdot 50.1\text{m}^3/\text{s}}{2 \cdot 0.66 \cdot 3\text{m} \cdot \sqrt{2 \cdot 9.8\text{m}/\text{s}^2}}\right)^{\frac{2}{3}} + 10.1\text{m}$$

12) Head on Upstream Weir for Discharge through Drowned Portion

Open Calculator

fx $$H_{Upstream} = \left(\frac{Q_2}{C_d \cdot L_w \cdot h_2}\right)^2 \cdot \left(\frac{1}{2 \cdot g}\right) + h_2$$

ex $$10.09949\text{m} = \left(\frac{99.96\text{m}^3/\text{s}}{0.66 \cdot 3\text{m} \cdot 5.1\text{m}}\right)^2 \cdot \left(\frac{1}{2 \cdot 9.8\text{m}/\text{s}^2}\right) + 5.1\text{m}$$

13) Head on Upstream Weir given Discharge through Free Weir Portion

Open Calculator

fx $$H_{Upstream} = \left(\frac{3 \cdot Q_1}{2 \cdot C_d \cdot L_w \cdot \sqrt{2 \cdot g}}\right)^{\frac{2}{3}} + h_2$$

ex $$9.288808\text{m} = \left(\frac{3 \cdot 50.1\text{m}^3/\text{s}}{2 \cdot 0.66 \cdot 3\text{m} \cdot \sqrt{2 \cdot 9.8\text{m}/\text{s}^2}}\right)^{\frac{2}{3}} + 5.1\text{m}$$

14) Length of Crest for Discharge through Drowned Portion

Open Calculator

fx $$L_w = \frac{Q_2}{C_d \cdot h_2 \cdot \left(\sqrt{2 \cdot g \cdot (H_{Upstream} - h_2) + v_{su}^2}\right)}$$

ex $$2.771547\text{m} = \frac{99.96\text{m}^3/\text{s}}{0.66 \cdot 5.1\text{m} \cdot \left(\sqrt{2 \cdot 9.8\text{m}/\text{s}^2 \cdot (10.1\text{m} - 5.1\text{m}) + (4.1\text{m}/\text{s})^2}\right)}$$

15) Length of Crest for Discharge through Free Weir

Open Calculator

$$L_w = \frac{3 \cdot Q_1}{2 \cdot C_d \cdot \sqrt{2 \cdot g} \cdot \left(\left((H_{Upstream} - h_2) + \left(\frac{v_{su}^2}{2 \cdot g} \right) \right)^{\frac{3}{2}} - \left(\frac{v_{su}^2}{2 \cdot g} \right)^{\frac{3}{2}} \right)}$$

ex
$$1.921813\text{m} = \frac{3 \cdot 50.1\text{m}^3/\text{s}}{2 \cdot 0.66 \cdot \sqrt{2 \cdot 9.8\text{m/s}^2} \cdot \left(\left((10.1\text{m} - 5.1\text{m}) + \left(\frac{(4.1\text{m/s})^2}{2 \cdot 9.8\text{m/s}^2} \right) \right)^{\frac{3}{2}} - \left(\frac{(4.1\text{m/s})^2}{2 \cdot 9.8\text{m/s}^2} \right)^{\frac{3}{2}} \right)}$$

16) Length of Crest for Discharge through Free Weir Portion

Open Calculator

$$L_w = \frac{3 \cdot Q_1}{2 \cdot C_d \cdot \sqrt{2 \cdot g} \cdot (H_{Upstream} - h_2)^{\frac{3}{2}}}$$

ex
$$2.300393\text{m} = \frac{3 \cdot 50.1\text{m}^3/\text{s}}{2 \cdot 0.66 \cdot \sqrt{2 \cdot 9.8\text{m/s}^2} \cdot (10.1\text{m} - 5.1\text{m})^{\frac{3}{2}}}$$

17) Total Discharge over Submerged Weir

Open Calculator

$$Q_T = Q_1 + Q_2$$

ex
$$150.06\text{m}^3/\text{s} = 50.1\text{m}^3/\text{s} + 99.96\text{m}^3/\text{s}$$

Variables Used

- **C_d** Coefficient of Discharge
- **g** Acceleration due to Gravity *(Meter per Square Second)*
- **h_2** Head on Downstream of Weir *(Meter)*
- **$H_{Upstream}$** Head on Upstream of Weir *(Meter)*
- **L_w** Length of Weir Crest *(Meter)*
- **Q_1** Discharge through Free Portion *(Cubic Meter per Second)*
- **Q_2** Discharge through Drowned Portion *(Cubic Meter per Second)*
- **Q_T** Total Discharge of Submerged Weir *(Cubic Meter per Second)*
- **v_{su}** Velocity over Submerged Weir *(Meter per Second)*

Constants, Functions, Measurements used

- Function: **sqrt**, sqrt(Number)
  A square root function is a function that takes a non-negative number as an input and returns the square root of the given input number.
- Measurement: **Length** in Meter (m)
  Length Unit Conversion
- Measurement: **Speed** in Meter per Second (m/s)
  Speed Unit Conversion
- Measurement: **Acceleration** in Meter per Square Second (m/s^2)
  Acceleration Unit Conversion
- Measurement: **Volumetric Flow Rate** in Cubic Meter per Second (m^3/s)
  Volumetric Flow Rate Unit Conversion

Check other formula lists

- Broad Crested Weir Formulas
- Flow Over a Trapizoidal and Triangular Weir or Notch Formulas
- Flow Over Rectangular Sharp Crested Weir or Notch Formulas
- Submerged Weirs Formulas
- Time Required to Empty a Reservoir with Rectangular Weir Formulas

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9/19/2024 | 10:14:16 AM UTC