Important Broad Crested Weir Formulas PDF

Formulas
Examples
with Units

List of 20
Important Broad Crested Weir Formulas

1) Actual Discharge over Broad Crested Weir Formula

Evaluate Formula

Formula

$$Q_a = C_d \cdot L_w \cdot h_c \cdot \sqrt{(2 \cdot g) \cdot (H - h_c)}$$

Example with Units

$$17.547\,\text{m}^3/\text{s} = 0.66 \cdot 3\,\text{m} \cdot 1.001\,\text{m} \cdot \sqrt{(2 \cdot 9.8\,\text{m/s}^2) \cdot (5\,\text{m} - 1.001\,\text{m})}$$

2) Additional Head given Head for Broad Crested Weir Formula

Evaluate Formula

Formula

$$h_a = H_{Upstream} - H$$

Example with Units

$$5.1\,\text{m} = 10.1\,\text{m} - 5\,\text{m}$$

3) Coefficient of Discharge for Max Discharge over Crested Weir Formula

Evaluate Formula

Formula

$$C_d = \frac{Q_{W(max)}}{1.70 \cdot L_w \cdot (H)^{\frac{3}{2}}}$$

Example with Units

$$0.6594 = \frac{37.6\,\text{m}^3/\text{s}}{1.70 \cdot 3\,\text{m} \cdot (5\,\text{m})^{\frac{3}{2}}}$$

4) Coefficient of Discharge given Actual Discharge over Broad Crested Weir Formula

Evaluate Formula

Formula

$$C_d = \frac{Q_a}{L_w \cdot h_c \cdot \sqrt{(2 \cdot g) \cdot (H - h_c)}}$$

Example with Units

$$0.6597 = \frac{17.54\,\text{m}^3/\text{s}}{3\,\text{m} \cdot 1.001\,\text{m} \cdot \sqrt{(2 \cdot 9.8\,\text{m/s}^2) \cdot (5\,\text{m} - 1.001\,\text{m})}}$$

5) Coefficient of Discharge given Discharge of Weir if Critical Depth is Constant Formula

Evaluate Formula

Formula

$$C_d = \frac{Q_w}{1.70 \cdot L_w \cdot \left(H \right)^{\frac{3}{2}}}$$

Example with Units

$$0.4665 = \frac{26.6\,\text{m}^3/\text{s}}{1.70 \cdot 3\,\text{m} \cdot \left(5\,\text{m} \right)^{\frac{3}{2}}}$$

6) Critical Depth due to Reduction in Area of Flow Section given Total Head Formula

Evaluate Formula

Formula

$$h_c = H - \left(\frac{v_f^{\,2}}{2 \cdot g} \right)$$

Example with Units

$$1.049\,\text{m} = 5\,\text{m} - \left(\frac{8.8\,\text{m/s}^{\,2}}{2 \cdot 9.8\,\text{m/s}^2} \right)$$

7) Discharge over Broad Crested Weir Formula

Evaluate Formula

Formula

$$Q_w = L_w \cdot h_c \cdot \sqrt{\left(2 \cdot [g] \right) \cdot \left(H - h_c \right)}$$

Example with Units

$$26.5954\,\text{m}^3/\text{s} = 3\,\text{m} \cdot 1.001\,\text{m} \cdot \sqrt{\left(2 \cdot 9.8066\,\text{m/s}^2 \right) \cdot \left(5\,\text{m} - 1.001\,\text{m} \right)}$$

8) Head for Broad Crested Weir Formula

Evaluate Formula

Formula

$$H_{Upstream} = \left(H + h_a \right)$$

Example with Units

$$10.01\,\text{m} = \left(5\,\text{m} + 5.01\,\text{m} \right)$$

9) Head if Velocity is considered for Discharge over Broad Crested Weir Formula

Evaluate Formula

Formula

$$H = \left(\frac{Q_{W(max)}}{1.70 \cdot C_d \cdot L_w} \right)^{\frac{2}{3}}$$

Example with Units

$$4.9971\,\text{m} = \left(\frac{37.6\,\text{m}^3/\text{s}}{1.70 \cdot 0.66 \cdot 3\,\text{m}} \right)^{\frac{2}{3}}$$

10) Length of Crest given Actual Discharge over Broad Crested Weir Formula

Evaluate Formula

Formula

$$L_w = \frac{Q_a}{C_d \cdot h_c \cdot \sqrt{\left(2 \cdot g \right) \cdot \left(H - h_c \right)}}$$

Example with Units

$$2.9988\,\text{m} = \frac{17.54\,\text{m}^3/\text{s}}{0.66 \cdot 1.001\,\text{m} \cdot \sqrt{\left(2 \cdot 9.8\,\text{m/s}^2 \right) \cdot \left(5\,\text{m} - 1.001\,\text{m} \right)}}$$

11) Length of Crest given Discharge over Weir Formula

Evaluate Formula

Formula

$$L_w = \frac{Q_w}{h_c \cdot \sqrt{(2 \cdot [g]) \cdot (H - h_c)}}$$

Example with Units

$$3.0005\,\text{m} = \frac{26.6\,\text{m}^3/\text{s}}{1.001\,\text{m} \cdot \sqrt{(2 \cdot 9.8066\,\text{m/s}^2) \cdot (5\,\text{m} - 1.001\,\text{m})}}$$

12) Length of Crest if Critical Depth is Constant for Discharge of Weir Formula

Evaluate Formula

Formula

$$L_w = \frac{Q_w}{1.70 \cdot C_d \cdot (H)^{\frac{3}{2}}}$$

Example with Units

$$2.1205\,\text{m} = \frac{26.6\,\text{m}^3/\text{s}}{1.70 \cdot 0.66 \cdot (5\,\text{m})^{\frac{3}{2}}}$$

13) Length of Crest over Broad Crested Weir for Max Discharge Formula

Evaluate Formula

Formula

$$L_w = \frac{Q_{W(max)}}{1.70 \cdot C_d \cdot (H)^{\frac{3}{2}}}$$

Example with Units

$$2.9974\,\text{m} = \frac{37.6\,\text{m}^3/\text{s}}{1.70 \cdot 0.66 \cdot (5\,\text{m})^{\frac{3}{2}}}$$

14) Max Discharge over Broad Crested Weir Formula

Evaluate Formula

Formula

$$Q_{W(max)} = 1.70 \cdot C_d \cdot L_w \cdot (H)^{\frac{3}{2}}$$

Example with Units

$$37.633\,\text{m}^3/\text{s} = 1.70 \cdot 0.66 \cdot 3\,\text{m} \cdot (5\,\text{m})^{\frac{3}{2}}$$

15) Maximum Discharge of Broad Crested Weir if Critical Depth is Constant Formula

Evaluate Formula

Formula

$$Q_{W(max)} = 1.70 \cdot C_d \cdot L_w \cdot (H)^{\frac{3}{2}}$$

Example with Units

$$37.633\,\text{m}^3/\text{s} = 1.70 \cdot 0.66 \cdot 3\,\text{m} \cdot (5\,\text{m})^{\frac{3}{2}}$$

16) Total Head above Weir Crest Formula

Evaluate Formula

Formula

$$H = h_c + \left(\frac{v_f^2}{2 \cdot g}\right)$$

Example with Units

$$4.952\,\text{m} = 1.001\,\text{m} + \left(\frac{8.8\,\text{m/s}^2}{2 \cdot 9.8\,\text{m/s}^2}\right)$$

17) Total Head for Actual Discharge over Broad Crested Weir Formula

Evaluate Formula

Formula

$$H = \left(\left(\left(\frac{Q_a}{C_d \cdot L_w \cdot h_c}\right)^2\right) \cdot \left(\frac{1}{2 \cdot g}\right)\right) + h_c$$

Example with Units

$$4.9968\,\text{m} = \left(\left(\left(\frac{17.54\,\text{m}^3/\text{s}}{0.66 \cdot 3\,\text{m} \cdot 1.001\,\text{m}}\right)^2\right) \cdot \left(\frac{1}{2 \cdot 9.8\,\text{m/s}^2}\right)\right) + 1.001\,\text{m}$$

18) Total Head for Maximum Discharge Formula

Evaluate Formula

Formula

$$H = \left(\frac{Q_{W(max)}}{1.70 \cdot C_d \cdot L_w}\right)^{\frac{2}{3}}$$

Example with Units

$$4.9971\,\text{m} = \left(\frac{37.6\,\text{m}^3/\text{s}}{1.70 \cdot 0.66 \cdot 3\,\text{m}}\right)^{\frac{2}{3}}$$

19) Total Head given Discharge over Weir Crest Formula

Evaluate Formula

Formula

$$H = \left(\left(\frac{Q_w}{L_w \cdot h_c}\right)^2\right) \cdot \left(\frac{1}{2 \cdot [g]}\right) + h_c$$

Example with Units

$$5.0014\,\text{m} = \left(\left(\frac{26.6\,\text{m}^3/\text{s}}{3\,\text{m} \cdot 1.001\,\text{m}}\right)^2\right) \cdot \left(\frac{1}{2 \cdot 9.8066\,\text{m/s}^2}\right) + 1.001\,\text{m}$$

20) Velocity of Flow given Head Formula

Evaluate Formula

Formula

$$v_f = \sqrt{(2 \cdot g) \cdot (H - h_c)}$$

Example with Units

$$8.8533\,\text{m/s} = \sqrt{(2 \cdot 9.8\,\text{m/s}^2) \cdot (5\,\text{m} - 1.001\,\text{m})}$$

Variables used in list of Broad Crested Weir Formulas above

- C_d Coefficient of Discharge
- **g** Acceleration due to Gravity *(Meter per Square Second)*
- **H** Total Head *(Meter)*
- h_a Additional Head *(Meter)*
- h_c Critical Depth of Weir *(Meter)*
- $H_{Upstream}$ Head on Upstream of Weir *(Meter)*
- L_w Length of Weir Crest *(Meter)*
- Q_a Actual Discharge over Broad Crested Weir *(Cubic Meter per Second)*
- Q_w Discharge Over Broad Crested Weir *(Cubic Meter per Second)*
- $Q_{W(max)}$ Max Discharge Over Broad Crested Weir *(Cubic Meter per Second)*
- v_f Velocity of Fluid for Weir *(Meter per Second)*

Constants, Functions, Measurements used in list of Broad Crested Weir Formulas above

- constant(s): **[g]**, 9.80665
  Gravitational acceleration on Earth
- Functions: **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/s²)
  Acceleration Unit Conversion
- Measurement: **Volumetric Flow Rate** in Cubic Meter per Second (m³/s)
  Volumetric Flow Rate Unit Conversion

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