



Flow Velocity in Straight Sewers Formulas

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List of 33 Flow Velocity in Straight Sewers Formulas

Flow Velocity in Straight Sewers 🗗

1) Area given Water Flow Equation 🗗

 $oldsymbol{A}_{
m cs} = rac{
m Q_{
m w}}{
m V_{\it c}}$

Open Calculator

$$ext{ex} 13.04464 ext{m}^2 = rac{14.61 ext{m}^3/ ext{s}}{1.12 ext{m/s}}$$

2) Conversion Factor given Flow Velocity

$$\mathbf{f}$$
 $\mathbf{C} = \left(rac{\mathbf{V_f}\cdot\mathbf{n_c}}{\left(\mathbf{S}^{rac{1}{2}}
ight)\cdot\mathbf{r_H^{rac{2}{3}}}}
ight)$

Open Calculator



3) Energy Loss given Flow Velocity

$$\mathbf{f}$$
 $\mathbf{S} = \left(rac{V_f \cdot n_c}{C \cdot r_r^{rac{2}{3}}}
ight)^2$

ex
$$2.027679 ext{J} = \left(\frac{1.12 ext{m/s} \cdot 0.017}{0.028 \cdot (0.33 ext{m})^{\frac{2}{3}}} \right)^2$$

4) Flow Velocity using Manning's formula



ex
$$1.112329 \mathrm{m/s} = \frac{0.028 \cdot (0.33 \mathrm{m})^{\frac{2}{3}} \cdot (2 \mathrm{J})^{\frac{1}{2}}}{0.017}$$
 5) Hydraulic Radius given Flow Velocity

$$\mathbf{f}_{\mathrm{H}} = \left(rac{V_{\mathrm{f}} \cdot n_{\mathrm{c}}}{C \cdot S^{rac{1}{2}}}
ight)^{rac{3}{2}}$$

ex
$$0.333419 \text{m} = \left(\frac{1.12 \text{m/s} \cdot 0.017}{0.028 \cdot (21)^{\frac{1}{2}}}\right)^{\frac{3}{2}}$$

Open Calculator 🗗



6) Roughness Coefficient using Flow Velocity

 $n_{c}=rac{C\cdot r_{H}^{rac{2}{3}}\cdot S^{rac{1}{2}}}{V_{f}}$

Open Calculator

ex $0.016884 = rac{0.028 \cdot (0.33 \mathrm{m})^{rac{2}{3}} \cdot (2 \mathrm{J})^{rac{1}{2}}}{1.12 \mathrm{m/s}}$

7) Velocity using Water Flow Equation

 $V_{
m f} = rac{Q_{
m w}}{A_{
m cs}}$

Open Calculator

 $ext{ex} 1.123846 ext{m/s} = rac{14.61 ext{m}^3/ ext{s}}{13 ext{m}^2}$

8) Water Flow Equation

fx $Q_{
m w} = A_{
m cs} \cdot V_{
m f}$

Open Calculator

 $ext{ex} \ 14.56 ext{m}^3/ ext{s} = 13 ext{m}^2 \cdot 1.12 ext{m/s}$



Controlling Sewer Water Flow

9) Area for Siphon Throat

 $oldsymbol{A_{
m siphon}} = rac{
m Q}{
m C_d \cdot (2 \cdot
m g \cdot
m H)^{rac{1}{2}}}$

Open Calculator 🗗

 $ext{ex} 0.093066 ext{m}^2 = rac{1.5 ext{m}^3/ ext{s}}{0.94 \cdot (2 \cdot 9.8 ext{m}/ ext{s}^2 \cdot 15 ext{m})^{rac{1}{2}}}$

10) Coefficient of Discharge given Area for Siphon Throat

 $\mathbf{K} \left[\mathrm{C_{d'}} = rac{\mathrm{Q}}{\mathrm{A_s \cdot (2 \cdot g \cdot H)^{rac{1}{2}}}}
ight]$

Open Calculator 🗗

 $oxed{ex} 0.729015 = rac{1.5 ext{m}^3/ ext{s}}{0.12 ext{m}^2 \cdot (2 \cdot 9.8 ext{m}/ ext{s}^2 \cdot 15 ext{m})^{rac{1}{2}}}$

11) Depth of Flow over Weir given Flow Diversion

 \mathbf{f} $\mathbf{h} = \left(rac{\mathrm{Q}}{3.32\cdot(\mathrm{L_{main}})^{0.83}}
ight)^{rac{1}{1.67}}$

Open Calculator 🖸

 $oxed{egin{aligned} \mathbf{ex} 0.801024 \mathrm{m} = \left(rac{1.5 \mathrm{m}^3/\mathrm{s}}{3.32 \cdot (0.60 \mathrm{m})^{0.83}}
ight)^{rac{1}{1.67}} \end{aligned}}$





12) Discharge given Area for Siphon Throat

 $Q = A_{
m s} \cdot C_{
m d} \cdot (2 \cdot {
m g} \cdot {
m H})^{rac{1}{2}}$

Open Calculator 🗗

 $\boxed{\textbf{ex}} \ 1.934117 \text{m}^{_{3}}/\text{s} = 0.12 \text{m}^{_{2}} \cdot 0.94 \cdot (2 \cdot 9.8 \text{m}/\text{s}^{_{2}} \cdot 15 \text{m})^{\frac{1}{2}}$

13) Flow Diversion for Side Weir

fx $m Q = 3.32 \cdot L_{weir}^{0.83} \cdot h^{1.67}$

Open Calculator

= 1.4968 $\mathrm{m}^{_{3}}/\mathrm{s}=3.32\cdot\left(0.60\mathrm{m}
ight)^{0.83}\cdot\left(0.80\mathrm{m}
ight)^{1.67}$

14) Head given Area for Siphon Throat

 $\mathbf{K} = \left(rac{\mathrm{Q}}{\mathrm{A_s \cdot C_d}}
ight)^2 \cdot \left(rac{1}{2 \cdot \mathrm{g}}
ight)^2$

Open Calculator

 $= \left(\frac{1.5 \text{m}^3/\text{s}}{0.12 \text{m}^2 \cdot 0.94} \right)^2 \cdot \left(\frac{1}{2 \cdot 9.8 \text{m/s}^2} \right)$

15) Length of Weir given Flow Diversion

 $\mathbf{L}_{\mathrm{weir}} = \left(rac{\mathrm{Q}}{3.32 \cdot \mathrm{h}^{1.67}}
ight)^{rac{1}{0.83}}$

ex $0.601546 \mathrm{m} = \left(\frac{1.5 \mathrm{m}^3/\mathrm{s}}{3.32 \cdot (0.80 \mathrm{m})^{1.67}} \right)^{\frac{1}{0.83}}$





Disposing of Storm Water 🗗

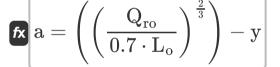
16) Area of Opening given Inlet Capacity for Flow Depth more than 1ft 5in

$$\mathbf{A}_{\mathrm{o}} = rac{\mathrm{Q_{i}}}{0.6\cdot\left(2\cdot\mathrm{g}\cdot\mathrm{D}
ight)^{rac{1}{2}}}$$

Open Calculator 🗗

$$= \frac{42 \text{m}^3/\text{s}}{0.6 \cdot (2 \cdot 9.8 \text{m/s}^2 \cdot 3 \text{m})^{\frac{1}{2}} }$$

17) Depression in Curb Inlet given Runoff Quantity with Full Gutter flow



Open Calculator 🗗

$$oxed{ex} 4.000442 {
m ft} = \left(\left(rac{329 {
m ft}^3/{
m s}}{0.7 \cdot 7 {
m ft}}
ight)^{rac{2}{3}}
ight) - 7.117 {
m ft}$$

18) Depth of Flow at Inlet given Inlet Capacity for Flow Depth up to 4.8in

fx
$$y = \left(\frac{Q_w}{3 \cdot P}\right)^{\frac{2}{3}}$$

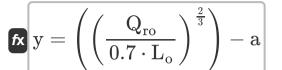
Open Calculator

ex
$$7.117831 ext{ft} = \left(rac{14.61 ext{m}^3/ ext{s}}{3 \cdot 5 ext{ft}}
ight)^{rac{2}{3}}$$





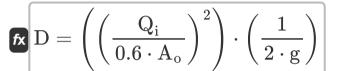
19) Depth of Flow at Inlet given Runoff Quantity with Full Gutter Flow



Open Calculator 🚰

 $\boxed{7.117442 \mathrm{ft} = \left(\left(\frac{329 \mathrm{ft^3/s}}{0.7 \cdot 7 \mathrm{ft}} \right)^{\frac{2}{3}} \right) - 4 \mathrm{ft}}$

20) Depth of Flow given Inlet Capacity for Flow Depth more than 1ft 5in



o than 1ft 5in (2)

Open Calculator (3)

 $= \left(\left(\frac{42 \text{m}^3/\text{s}}{0.6 \cdot 9.128 \text{m}^2} \right)^2 \right) \cdot \left(\frac{1}{2 \cdot 9.8 \text{m}/\text{s}^2} \right)$

21) Inlet Capacity for Flow Depth 🕜

fx
$$\left[\mathrm{Q_w}=3\cdot\mathrm{P}\cdot\mathrm{y}^{rac{3}{2}}
ight]$$

Open Calculator 🗗

 $ext{ex} \left[14.60744 ext{m}^3/ ext{s} = 3 \cdot 5 ext{ft} \cdot (7.117 ext{ft})^{rac{3}{2}}
ight]$

22) Inlet Capacity for Flow Depth more than 1ft 5in

$$\boxed{\textbf{fx}} Q_i = 0.6 \cdot A_o \cdot \left((2 \cdot g \cdot D)^{\frac{1}{2}} \right)$$

Open Calculator

 $ext{ex} \ 41.99674 ext{m}^3/ ext{s} = 0.6 \cdot 9.128 ext{m}^2 \cdot \left((2 \cdot 9.8 ext{m}/ ext{s}^2 \cdot 3 ext{m})^{rac{1}{2}}
ight)$



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Open Calculator

Open Calculator G

23) Length of Opening given Runoff Quantity with Full Gutter Flow 🗗

Open Calculator 2

fx $m L_o = rac{Q_{ro}}{0.7\cdot(a+y)^{rac{3}{2}}}$

 $extbf{ex} 7.000417 ext{ft} = rac{329 ext{ft}^3/ ext{s}}{0.7 \cdot \left(4 ext{ft} + 7.117 ext{ft}
ight)^{rac{3}{2}}}$

24) Perimeter when Inlet Capacity for Flow Depth is up to 4.8 inches

 $\left| ext{P}
ight| ext{P} = rac{ ext{Q}_{ ext{w}}}{3 \cdot ext{v}^{rac{3}{2}}}$

 $extbf{ex} 5.000876 ext{ft} = rac{14.61 ext{m}^3/ ext{s}}{3\cdot (7.117 ext{ft})^{rac{3}{2}}}$

25) Runoff Quantity with Full Gutter Flow 🛂

fx $m Q_{ro} = 0.7 \cdot L_o \cdot (a+y)^{rac{3}{2}}$

 $ext{ex} \, 328.9804 ext{ft}^3/ ext{s} = 0.7 \cdot 7 ext{ft} \cdot (4 ext{ft} + 7.117 ext{ft})^{rac{3}{2}}$

Required Flow Velocity

26) Coefficient of Roughness given Flow Quantity of Full Flowing Sewer

 $\mathbf{n}_{\mathrm{c}} = rac{0.463\cdot\mathrm{S}^{rac{1}{2}}\cdot\mathrm{d_{i}}^{rac{8}{3}}}{\mathrm{Q}_{\mathrm{w}}}$

Open Calculator 🚰

 $extbf{ex} 587.436 = rac{0.463 \cdot (2 ext{J})^{rac{1}{2}} \cdot (35 ext{m})^{rac{8}{3}}}{14.61 ext{m}^3/ ext{s}}$

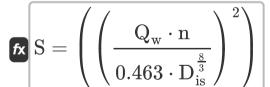
27) Coefficient of Roughness given Full Flow Velocity in Sewer

 $n_{\mathrm{c}} = rac{0.59 \cdot d_{\mathrm{i}}^{rac{2}{3}} \cdot S^{rac{1}{2}}}{V_{\mathrm{f}}}$

Open Calculator

 $7.971273 = rac{0.59 \cdot (35 ext{m})^{rac{2}{3}} \cdot (2 ext{J})^{rac{1}{2}}}{1.12 ext{m/s}}$

28) Energy Loss given Flow Quantity for Full Flowing Sewer



Open Calculator 🗗

ex $3553.701 ext{J} = \left(\left(\frac{14.61 ext{m}^3/ ext{s} \cdot 0.012}{0.463 \cdot (150 ext{mm})^{rac{8}{3}}}
ight)^2
ight)$





29) Energy Loss given Full Flow Velocity in Sewer 🚰

 $\mathbf{K} \mathbf{S} = \left(rac{V_f \cdot n_c}{0.59 \cdot d_i^{rac{2}{3}}}
ight)^2$

Open Calculator

 $\texttt{ex} \ 9.1 \texttt{E^--6J} = \left(\frac{1.12 \text{m/s} \cdot 0.017}{0.59 \cdot (35 \text{m})^{\frac{2}{3}}}\right)^2$

30) Flow Quantity for Full Flowing Sewer

 ${f Q}_{
m w} = rac{0.463 \cdot S^{rac{1}{2}} \cdot d_{
m i}^{rac{8}{3}}}{n_{
m c}}$

Open Calculator 🗗

 $ext{ex} 504849.4 ext{m}^3/ ext{s} = rac{0.463 \cdot (2 ext{J})^{rac{1}{2}} \cdot (35 ext{m})^{rac{8}{3}}}{0.017}$

31) Full flow velocity in sewer

 $V_{\mathrm{f}}=rac{0.59\cdot d_{\mathrm{i}}^{rac{2}{3}}\cdot S^{rac{1}{2}}}{n_{\mathrm{c}}}$

Open Calculator 🗗

 $ext{ex} \left[525.1662 ext{m/s} = rac{0.59 \cdot (35 ext{m})^{rac{2}{3}} \cdot (2 ext{J})^{rac{1}{2}}}{0.017}
ight]$



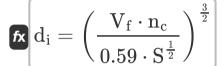
32) Inside Diameter given Flow Quantity for Full Flowing Sewer

 \mathbf{f} $d_i = \left(rac{Q_w \cdot n_c}{0.463 \cdot S^{rac{1}{2}}}
ight)^{rac{3}{8}}$

Open Calculator 🗗

$$\mathbf{ex} \ 0.695226 m = \left(\frac{14.61 m^3/s \cdot 0.017}{0.463 \cdot \left(2J \right)^{\frac{1}{2}}} \right)^{\frac{3}{8}}$$

33) Inside Diameter given Full Flow Velocity in Sewer 🗗



Open Calculator 🗗

ex
$$0.003447 \mathrm{m} = \left(\frac{1.12 \mathrm{m/s} \cdot 0.017}{0.59 \cdot (\mathrm{2J})^{\frac{1}{2}}} \right)^{\frac{3}{2}}$$



Variables Used

- a Depression in Curb Inlet (Foot)
- A_{CS} Cross-Sectional Area (Square Meter)
- An Area of Opening (Square Meter)
- A_S Area for Siphon Throat (Square Meter)
- Asiphon Siphon Throat Area (Square Meter)
- C Conversion Factor
- C_d Coefficient of Discharge
- C_{d'} Discharge Coefficient
- **D** Depth (Meter)
- d_i Inner Diameter (Meter)
- **D**_{is} Inner Diameter of Sewer (Millimeter)
- g Acceleration due to Gravity (Meter per Square Second)
- **h** Depth of Flow Over Weir (Meter)
- **H** Head of Liquid (*Meter*)
- L_o Length of Opening (Foot)
- Lweir Length of Weir (Meter)
- n Manning's Roughness Coefficient
- n_c Roughness Coefficient of Conduit Surface
- P Perimeter of Grate Opening (Foot)
- Q Volume Flow Rate (Cubic Meter per Second)
- **Q**_i Inlet Capacity (Cubic Meter per Second)
- Q_{ro} Runoff Quantity (Cubic Foot per Second)





- Qw Water Flow (Cubic Meter per Second)
- **r**_H Hydraulic Radius (Meter)
- S Energy Loss (Joule)
- **V**_f Flow Velocity (Meter per Second)
- **y** Depth of Flow at Inlet (Foot)





Constants, Functions, Measurements used

- Measurement: Length in Meter (m), Foot (ft), Millimeter (mm)

 Length Unit Conversion
- Measurement: Area in Square Meter (m²)

 Area 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: Energy in Joule (J)
 Energy Unit Conversion
- Measurement: Volumetric Flow Rate in Cubic Meter per Second (m³/s),
 Cubic Foot per Second (ft³/s)
 Volumetric Flow Rate Unit Conversion





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