# Rectangular Sedimentation Basin: Size, Detention, Reynolds and Froude

Surface area and length from overflow rate, detention time, horizontal velocity and the Reynolds and Froude number checks of a rectangular sedimentation basin.

## Input parameters

Unit system: SI

| Parameter | Value | Unit |
|---|---|---|
| Design (maximum day) flow | 0.20000 | $m^3/s$ |
| Average flow | 0.15000 | $m^3/s$ |
| Overflow rate (critical settling velocity) | 1.5000 | m/h |
| Number of basins | 2.0000 | |
| Basin width | 8.0000 | m |
| Water depth | 3.5000 | m |
| Flow channels per basin (longitudinal baffles + 1) | 1.0000 | |
| Water dynamic viscosity (10 °C 1.31 mPa·s, 20 °C 1.00) | 1.0000 | mPa·s |
| Water density | 998.20 | $kg/m^3$ |

## Calculated results

| Parameter | Value | Unit |
|---|---|---|
| Total surface area | 480.00 | $m^2$ |
| Basin length | 30.000 | m |
| Length to width ratio | 3.7500 | |
| Length to depth ratio | 8.5714 | |
| Detention time at design flow | 2.3333 | h |
| Detention time at average flow | 3.1111 | h |
| Horizontal velocity | 0.21429 | m/min |
| Hydraulic radius of a channel | 1.8667 | m |
| Reynolds number (keep below 20,000) | 6,654.7 | |
| Froude number (keep above $10^{-5}$) | 6.9678e-07 | |

**Notes for this case**

- Guidance: L/W at least 4–5, L/h at least 15, detention 1.5–4 h, horizontal velocity 0.3–1.1 m/min, Re below 20,000 and Fr above $10^{-5}$.
- Fr is below $10^{-5}$: the flow is prone to density currents; narrower channels help.

## Formula and method

$$A = \frac{Q}{v_c}, \quad L = \frac{A}{n_b W}, \quad v_f = \frac{Q}{n_b W h}$$

$$R_h = \frac{(W/n_c)h}{W/n_c + 2h}, \quad Re = \frac{\rho v_f R_h}{\mu}, \quad Fr = \frac{v_f^2}{g R_h}$$

### Variables

| | | |
|---|---|---|
| $Q$ | Design (maximum day) flow | $m^3/s$ |
| $Q_{avg}$ | Average flow | $m^3/s$ |
| $v_c$ | Overflow rate (critical settling velocity) | m/s |
| $n_b$ | Number of basins | - |
| $W$ | Basin width | m |
| $h$ | Water depth | m |
| $n_c$ | Flow channels per basin (longitudinal baffles + 1) | - |
| $\mu$ | Water dynamic viscosity (10 °C 1.31 mPa·s, 20 °C 1.00) | Pa·s |
| $\rho$ | Water density | $kg/m^3$ |
| $A$ | Total surface area | $m^2$ |
| $L$ | Basin length | m |
| $L/W$ | Length to width ratio | - |
| $L/h$ | Length to depth ratio | - |
| $t_d$ | Detention time at design flow | s |
| $t_{avg}$ | Detention time at average flow | s |
| $v_f$ | Horizontal velocity | m/s |
| $R_h$ | Hydraulic radius of a channel | m |
| $Re$ | Reynolds number (keep below 20,000) | - |
| $Fr$ | Froude number (keep above $10^{-5}$) | - |

### Method and standards

Ideal-basin overflow rate design with hydraulic stability checks.

### Assumptions and limits

- Ideal settling at the overflow rate; even flow distribution.

## Report details

| | |
|---|---|
| Report reference | FCC-NJ3S-RSAA (the same inputs always give the same reference) |
| Generated | 23 November 2026, 17:34 UTC |
| Calculator | Rectangular Sedimentation Basin: Size, Detention, Reynolds and Froude |
| Method last reviewed | 17 November 2026 |
| Software release | FireCAD Calc, release of 22 November 2026 |
| Release checks | 3 reference cases of this calculator, computed independently, are checked on every release |

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

### This calculator online

https://calc.firecad.com/environmental/drinking-water/rectangular-sedimentation-basin-check

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.