Cumberland calculations

1. Determination of the maximum depth of water for infiltration system

EQ. 25.1 Determination of maximum depth of water for plane infiltration systems

$$h_{max} = \frac{D\,(R\,i - q)}{n}$$

where:

- h_{max} = maximum head of water above base of infiltration component
- R = ratio of the drained area to the infiltration area, $R = \frac{A_D}{A_b}$
- q = infiltration coefficient, from percolation test (m/h), adjusted by the appropriate factor of safety
- i,D = intensity and duration of rainfall events with the required return period at the site location (m/h, h)
- A_b = base area of infiltration system (m²)
- A_D = area to be drained (m²)
- n = porosity of fill material (voids volume/total volume)

Figure 1 – Table 25.1 from CIRIA report C753 -The SuDS Manual

Data

- $\boldsymbol{A_d = 420m^2}$
- $\boldsymbol{A_b = 16m^2}$
- $\boldsymbol{D = 24h}$
- $\boldsymbol{n = 0.95}$

Calculations

- $R = \frac{A_D}{A_b} = \frac{420}{16} = 26.25$
- $q = 7.658x10^{-5}\frac{m}{s} = 0.276\frac{m}{h} + FoS = 0.028\,m/h$
- Considering Climate Change, $i = \frac{140}{24}\ mm/h = 0.006m/h$

$$h_{max} = \frac{24h*(26.25*0.06\frac{m}{h} - \frac{0.028m}{h})}{0.95} = 3.27\,m$$

NEED INFILTRATION THROUGH WALLS

2. Determination of maximum depth of water for 3D infiltration system

EQ. 25.4 Determination of maximum depth of water for 3D infiltration systems

$$h_{max} = a\left[e^{(-bD)} - 1\right]$$

Where:

$$a = \frac{A_b}{P} - i\frac{A_D}{P\,q}$$

P = perimeter of the base of the infiltration system (m).

$$b = \frac{P\,q}{n\,A_b}$$

Figure 2 - Table 25.4 from CIRIA report C753 -The SuDS Manual

Data

- $\boldsymbol{P = 16m}$
- $\boldsymbol{A_d = 420m^2}$
- $\boldsymbol{A_b = 16m^2}$
- $\boldsymbol{D = 24h}$
- $\boldsymbol{n = 0.95}$
- $\boldsymbol{i = 0.006m/h}$
- $\boldsymbol{n = 0.95}$
- $\boldsymbol{R = 26.25}$
- $\boldsymbol{q = 0.028\ m/h}$

Calculations

$$a = \frac{16m^2}{16m} - 0.006\ m/h * \frac{420m^2}{16m * 0.028\ m/h} = -4.625$$

$$b = \frac{16m * 0.028\ m/h}{0.95 * 16m^2} = 0.03$$

$$h_{max} = -4.625 * \left(e^{(-0.03*24)} - 1\right) = 2.37m$$