Attenuation Tanks 1 and 2 ($72m^2$) Buoyancy Calculations – 99 Unit Scheme

Buoyancy check – Uplift (UPL) limit state design

$G_{dst;d} + Q_{dst;d} \leq G_{stb;d} + R_d$

Design Destabilising Actions ≤ Design Stabilising Actions

Destabilising Actions

*Assumed water table is above tank through saturated ground conditions

Thus, Volume of water displaced by tank = 1m x 1m x 0.8m deep = $0.8m^3$;

Density of water = $1000\ kg/m^3 \times 9.81 \times 10^{-3} = 9.81\ kN/m^3$

Therefore, characteristic uplift force acting on the tank is:

$Q_{dst;k} = 0.8m^3 \times 9.81\ kN/m^3 = 7.85\ kN$

Design Uplift force, $Q_{dst;k} \times \gamma Q_{dst;d} = 7.85\ kN \times 1.1 = 8.64\ kN$

Stabilising Actions

* Shear resistance of tank assumed to be negligible; $R_d = 0$

Self-weight of the tank

Modular units = Approx. $57\ kg/m^3$

$G_{stb;d}$; Modular Units = $57\ kg/m^3 \times 9.81 \times 10^{-3} \times 1m^2 \times 0.8m = 0.44\ kN$

Self-weight of the soil above tank

Density of soil, $P_{soil} = 17.6kN/m^3$;

Depth of soil over tank = 0.90m

$G_{stb;d}$; soil = $17.6kN/m^3 \times (0.90m \times 1m^2) = 15.84kN$

Design Permanent Stabilising Force

($G_{stb;d}$; Modular Units + $G_{stb;d}$; soil) x $\gamma G_{dst;d}$

$G_{stb;d} = (0.44\ kN + 15.84kN) \times 0.9$

$G_{stb;d} = 14.652kN$

The design inequality for UPL can now be ascertained, thus:

8.64 kN ≤ 14.652kN; OK

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