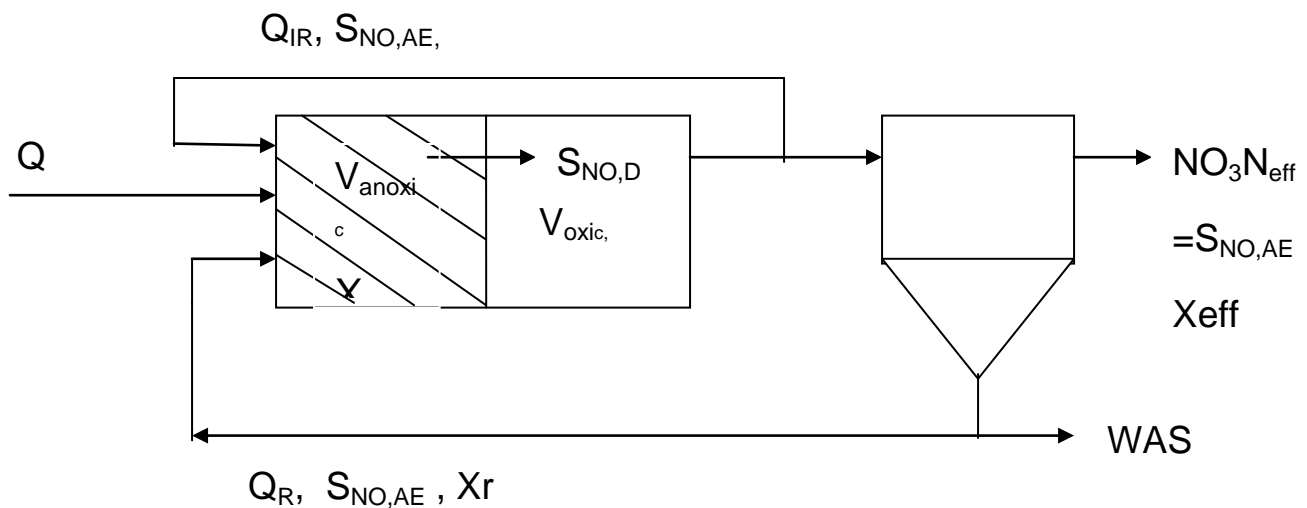


# Derivation of Dependence of $S_{NO_3N_{eff}}$ on Internal Recirculation (IR)

$$TN_{in} = TKN_{in} + NO_3N_{in}$$

Assume  $NO_3N_{in} = 0$

TKN nitrogen to be oxidized =  $(TN_{in} - TKN_{eff}) - X_{orgN,WAS} = (1 + R + IR)(S_{NO,AE} - S_{NO,D})$



$$IR = \frac{(TKN_{in} - TKN_{eff} - X_{orgN,WAS})}{S_{NO,AE} - S_{NO,D}} - (1 + R)$$

Assume optimized anoxic volume and  $S_{NO,D} = 0$

$$IR = \frac{NO_x}{NO_3N_{eff}} - (1 + R)$$

Nitrate to be denitrified =  $Q(R+IR) \cdot NO_3N_{eff}$