M&E BNR DESIGN IN A NUTSHELL

$$\mu_A = \hat{\mu}_A = \left(\frac{S_{NH}}{K_{NH} + S_{NH}}\right)\left(\frac{S_0}{K_{0,n} + S_0}\right) - b_A$$

$$\hat{\mu}_{A,T} = \mu_{A,20}(1.07)^{T-20}$$

$$SRT_a = \frac{1}{\mu_{A,T} * SF}$$

$$S = K_s \frac{(1 + b_{H,T} SRT_a)}{SRT_a(\mu_{H,T} - b_{H,T}) - 1}$$

$b_{H,T} = b_{H,20}(1.04)^{T-20}$

$$\mu_{H,T} = \mu_{H,20}(1.07)^{T-20}$$

$$P_{x,bio} = \underbrace{QY_H \frac{(S_0 - S)}{1 + b_{H,T} SRT_a}}_{P_{X,}} + \underbrace{QY_H f_d b_{H,T} \frac{SRT_a(S_0 - S)}{1 + b_{H,T} SRT_a}}_{\text{P}_X\text{-particulates formed from decay of heterotrophs}} + \underbrace{QY_A \frac{NO_X}{(1 + b_{A,T} SRT_a)}}$$

NO_X = Oxidized TKN = $\underbrace{TKN_{in} - TKN_{eff}}_{TKN_{oxi}} - \underbrace{0.12(P_{x,bio}/Q)}_{X_{orgN,WA}}$

$$P_{X,TSS} = \frac{P_{X,bio}}{0.85} + Q.nbVSS + Q(TSS_0 - VSS_0)$$

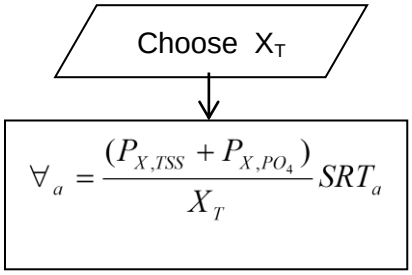
$$\frac{MLVSS}{MLSS} = \frac{P_{X,VSS}}{P_{X,TSS}}$$

$$nbVSS = (1 - \frac{bpCOD}{pCOD})VSS$$

$$VSS_0 = 0.65TSS_0$$

bpCOD=27%

pCOD = 40%



$X_R = 2X$ $\left\{ \quad \frac{X}{X_R} = \frac{R}{1+R}, R = 1 \right.$

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

$$SDNR_{20} = 0.19 \frac{gNO_3N/d}{gMLVSS}$$

$$MLVSS_{biomass} = \frac{Y_H SRT_a Q(S_0 - S)}{\forall_a (1 + b_{H,T} SRT_a)}$$

Total NO_3N recirculated is denitrified.

Required NO_3N removal = $Q(R+IR).NO_3N_{eff}$

Assume a retention time for anoxic tank, $t_{R,DN}$

$$\forall_{DN} = \frac{Q}{24} * t_{R,DN}$$

NO_3N removed = $\forall_{DN}$ *$SNDR_T$*$MLVSS_{biomass}$

$$\forall_T = \forall_{DN} + \forall_a$$

$$SRT_T = \frac{X_T * \forall_T}{P_{X,TSS}}$$