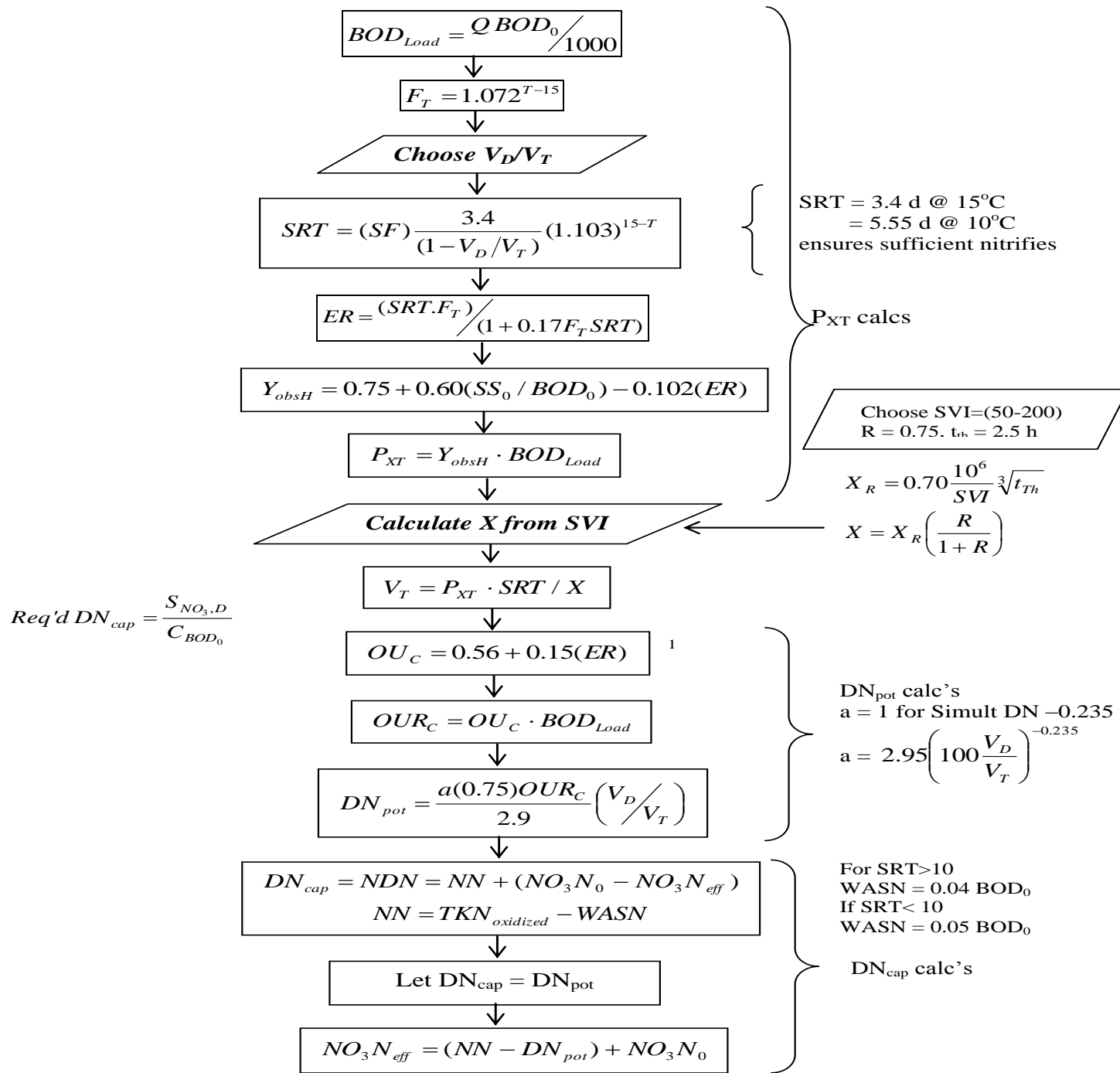


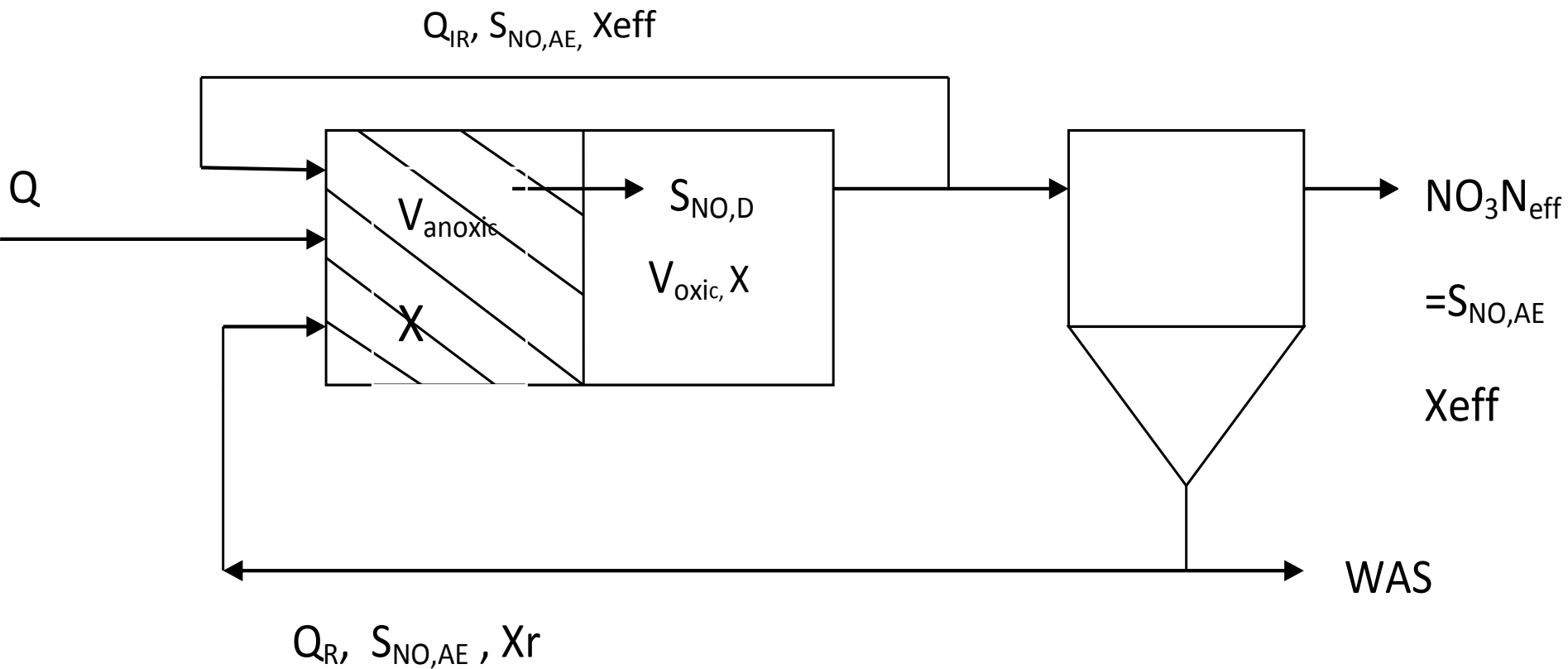
Comparison of ATV 131 & M&E

Dr. A. Saatci

ATV in a Nutshell



S & X Mass Balances in Pre-DN



A. Calculating Aerobic Sludge Age (SRT_a)

Writing in terms of ASM Model Notations

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

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

$$SRT_a = \frac{1}{\hat{\mu}_{A,T} * SF}$$

A. Biological Sludge Production ($P_{x,bio}$)

Effluent BOD Concentrations, S :

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

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

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

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

$$NO_x = \text{Oxidized TKN} = \underbrace{TKN_{in} - TKN_{eff}}_{TKN_{oxid}} - \underbrace{0.12(P_{x,bio}/Q)}_{X_{OrgN,WAS}}$$

A. Total Sludge Production ($P_{X,TSS}$)

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

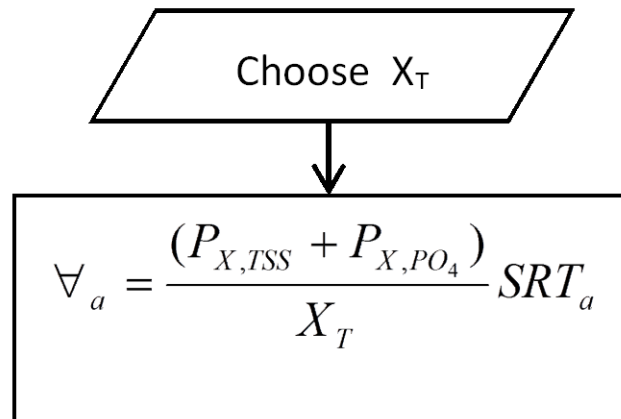
$$\frac{MLVSS}{MLSS} = \frac{P_{X,VSS}}{P_{X,TSS}}$$

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

$$VSS_0 = 0.65TSS_0$$

$$bpCOD = 27\%$$

$$pCOD = 40\%$$



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

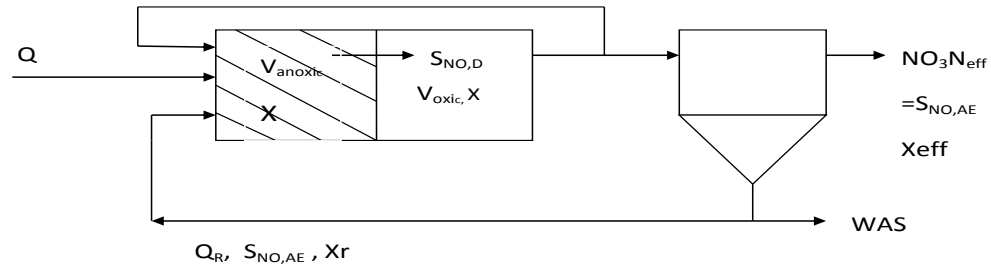
$$IR = \frac{NO_X}{S_{NO_3N_{eff}}} - (1 + R)$$

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

$$SDNR_T = SDNR_{20} (1.026)^{T-20}$$

$$\frac{1}{(F/M)_a} = \frac{\nabla_a \cdot MLVSS_{biomass}}{Q(S_0 - S)} = Y_H \frac{SRT_a}{1 + b_{H,T} SRT_a}$$

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



Total NO_3N recirculated is denitrified.

$$\text{Required } NO_3N \text{ removal} = Q(R+IR) \cdot NO_3N_{eff}$$

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

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

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

$$V_T = V_{DN} + V_a$$

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