LIST OF SYMBOLS AND ABBREVIATIONS

In this book a naming convention is used in which (1) the number of characters required to identify a unique parameter is minimized and (2) the description of the parameter can be deducted in a logical way from its individual constituents. Thus in general a parameter is constructed from a combination of one or more main identifiers (either in capital- or in normal font) and one or more subscripts (both capital- and normal font).

The main identifiers indicate the class of the parameter, such as daily applied load or production (M), substrate (S), solids (X) or constants (K), while the subscripts specify the type involved, such as ($_v$) = volatile, ($_t$) = total, et cetera. Thus for example MS_{ti} is defined as the total ($_t$) daily applied mass (M) of organic material (S) in the influent ($_i$).

In most cases a specific letter will therefore have more than one meaning. However, it is easy to deduct this from the context where it is used. As such the amount of characters required to uniquely identify a specific parameter is reduced to the minimum. In the remainder of this section the following lists will be presented:

- Common abbreviations;
- Specific parameters that fall outside the naming convention;
- Main classes (capital/normal font);
- Indices.

List of common abbreviations

APT	= activated primary tank
AT	= aeration tank
ATV	= abwasser technik verband
CIP	= cleaning in place
CSTR	= completely mixed reactor
DWF	= dry weather flow
PF	= plug flow
DSVI	= diluted sludge volume index
EGSB	= expanded granular sludge bed
EPA	= environmental protection agency
GSBR	= granulated sludge bed reactor
HUSB	= hydrolysis upflow sludge blanket
MBR	= membrane bioreactor
OUR	= oxygen uptake rate
PAO	= phosphate accumulating organisms
PHB	= poly-hydroxy-butyrates
RWF	= rainwater flow
$SSVI_{3.5}$	= stirred sludge volume index (determined at 3.5 $g.l^{-1}$)
STORA	= stichting toegepast onderzoek naar de reiniging van afvalwater (Dutch foundation of applied water research)
STOWA	= stichting toegepast onderzoek waterbeheer (Dutch foundation of applied water research)
SVI	= sludge volume index
TMP	= trans membrane pressure
TKN	= total Kjeldahl nitrogen
TOC	= total carbon concentration
TSS	= total suspended solids
VFA	= volatile fatty acids
VSS	= volatile suspended solids
UCT	= university of Cape Town
ZSV	= zone settling velocity

List of parameters not included in naming convention

a	= recirculation factor (-)
$a_{i,n}$	= annualisation factor (-)
c_p	= proportionality constant ($DSVI/SSVI_{3.5}$)
C_r	= active sludge mass per unit daily applied biodegradable COD
D_{C1}/D_{C3}	= denitrification capacity in pre-D respectively post-D anoxic zone
f	= fraction remaining as endogenous residue
F/M	= feed/mass ratio (mg $COD.mg^{-1}$ $VSS.d^{-1}$)
I	= investment costs (US$)
i	= interest rate
k	= Vesilind constant ($l.g^{-1}$ TSS)
k_{la}	= oxygen transfer coefficient (h^{-1})
$K_{1,2,3}$	= denitrification constant (mg $N.mg^{-1}$ $X_a.d^{-1}$)
$k_{1,2}$	= thermodynamic constants in the carbonic acid system
K_a	= adsorption rate constant (h^{-1})
K_H	= Henry constant (-)
K_{mp}	= specific utilisation rate of adsorbed organic material (mg $COD.mg^{-1}$ $VSS.d^{-1}$)
K_{ms}	= specific utilisation rate of easily biodegradable organic material (mg $COD.l^{-1}$)
K_n	= half saturation constant for nitrification (mg $N.l^{-1}$)
K_o	= half saturation constant for oxygen (mg $O_2.l^{-1}$)
K_{sp}	= half rate (Monod) constant for S_{pa} (mg $COD.mg^{-1}$ VSS)
K_{ss}	= half rate (Monod) constant for S_{bs} (mg $COD.l^{-1}$)
k_w	= dissociation constant for water
m	= gradient
n	= expected economical lifetime (years)
p_m	= energy dissipation per unit volume ($W.m^{-3}$)
r	= anoxic recycle factor (bio-P system)
R	= annualised financing costs ($US\$.year^{-1}$)
R_{si}	= minimum sludge age where $N_{av1} = D_{c1}$ (d)
R_{sm}	= minimum sludge age required to allow for anoxic zones, i.e. when $N_{ae} = N_{ad}$ (d)
R_{sn}	= minimum sludge age required for establishment of nitrification (d)
R_{so}	= minimum sludge age where $f_x = f_m$ (d)
v_0	= Vesilind constant ($m.d^{-1}$)
u	= downward velocity in final settler ($m.h^{-1}$)
v	= upward velocity in final settler ($m.h^{-1}$)
ν	= viscosity
α	= alpha factor in aeration (-), gradient ($m.m^{-1}$)
β	= beta factor in aeration (-)
θ	= temperature dependency

List of main parameters

A = area
Alk = alkalinity
B = recovery factor
b = decay rate
C = cost per unit measure
C = concentration
D = diameter
DO = dissolved oxygen concentration
E = excess sludge production
F = mass flux
f = fraction, mass fraction or ratio
H = unit depth/height
h = liquid depth/height
I = index
k, K = constant
M = system mass, daily load or production (generic)
m = mass per unit daily applied influent COD effluent
mw = molar weight (generic)
N = nitrogen
N = number
O = oxygen demand
OC = oxygenation capacity
P = phosphorus
P = power or energy dissipation
p = pressure
Q = influent flow rate
q = excess sludge flow rate
R = residence time
R = removal efficiency
r = reaction rate
S = organic substrate
s = sludge recycle factor
s_f = safety factor
T = temperature
T = hydraulic loading rate
V = volume
X = solids
Y = yield
η = efficiency, productivity
μ = growth rate

List of indices

a = ammonium/ammonia (N)
a = active sludge (X)
a = actual conditions (OC, DO)
a = adsorption/storage (S, r)
abs = absorption (OUR, k)
ac = additional cost (f)
ad = desired concentration (N, P)
ad = adiabatic compression (P, η)
ae = aerator (η)
air = air (Q)
am = ammonification (Alk)
an = ammon. oxidation (Y, b, K, μ)
an = anaerobic (f, Y, b)
an = anoxic sludge mass fraction (f)
ao = ammonium oxidizer (Y, b, K, μ)
ap = active sludge bio-P (X)
ap = apparent (Y)
at = ratio active/total sludge (f)
av = available nitrate (N)
av = average (F, Q, X)
av = ratio active/volatile sludge (f)
b = biodegradable (f, S)
b = buffer (X, V, H, h)
BOD = biological oxygen demand (k)
c = capacity (D, N)
c = conversion to VFA (k)
c = critical (s, X)
c = fermentation (K)
c = oxidation of org. material (O)
chem = chemical removal (P)
cv = ratio COD/VSS (f)
d = decay (r)
d = denitrified (Alk, N)
d = digested (S, N, P)
d = divalent ion (f)
d = drying (T)
d = final settler (A, V, H, C)
da = aerobic digester (V, R)
di = anaerobic digester (V, R, C)
dif = diffusor height (H)
dis = discharge (p)
diss = dissipated (P, p)
dl = discharge levies (C)
dn = denitrification (f)
dsv = diluted sludge volume index (I)
Ds = nitrate removal with S_{bs} (N, r)
Dp = nitrate removal with S_{bp} (N, r)
e = effluent (dissolved) (X, S, N, P)
e = endogenous residue (X)
e = excess sludge production (r)
el = electrical (P, η), electrons (N)
en = endogenous (O)
ep = endogenous bio-P (X)
eq = equivalent (O, N)

ex = exogenous (O)
g = gross (F)
g = growth (X, r)
h = heating (C)
h = heterotropic (b, Y, X)
h = hydraulic (R, OUR)
H = Henry
hi = hydrolysed/hydrolysis (r)
i = inert (X, S)
i = influent (Q, S, N, P)
i = investment (f)
inh = inhabitant (V, S)
k = Kjeldahl (N)
k = in reactor "k"
l = demand for excess sludge (N, P)
l = in mixed liquor (DO)
l = limiting (F, X)
liq = liquid height (h)
le = demand in stabiliz. sludge (N, P)
lex = demand for excess sludge, corrected for effluent loss (N, P)
m = maintenance (I)
m = maximum (f)
m = membranes (A)
m = minimum (X, F)
m = monovalent ion (f)
m = motor (P)
max = maximum (f)
mb = metabolised (S)
Me = metal salt (M)
me = methane (V)
min = minimum (C)
mod = module (A, V)
N = N^{th} reactor
n = insurance (I)
n = net (F)
n = nitrate (N)
n = nitrification (Alk, O)
n = nitrifiers (N, P, X, Y, b)
n = nitrogen (f)
n = nitrogenous material (B)
n = non biodegradable (f, S)
no = nitrate oxidizers (b, K, μ)
no_2 = nitrite (N, r)
nxa = inactive sludge
o = operational (I)
o = nitrogen (N)
o = oxidized (S, r)
O_2 = aeration (C), oxgen (P)
p = particle (K)
p = particulate (S)
p = bio-P organism (b, f, X)
p = primary sludge (E,X)
p = nitrification potential (N)
p = permeate (Q)
p = personnel (I)
p = phosphate (P)
p = phosphorus (f)
p = pressure (DO)
pd = denitrifying fraction (f)
pf = peak flow (Q, f)
pr = phosphate release (f)
pu = putrescible (f)
r = reactor (aeration tank) (V, C)
r = recycle (Q, X)
rc = recirculation (Q, X)
ref = reference conditions (P)
s = saturation (DO)
s = soluble (S, f)
s = sludge age (R)
s = standard conditions (OC, DO, p)
s = superficial (T)
sd = sludge disposal (C)
sol = solids loading (F)
seq = sequestered (S)
spec = specific (A)
ssv = stirred volume index (I)
t = temperature
t = total
te = total effluent (S, N, P)
th = thickened (X)
th = thickener (V, A)
u = recycle sludge abstraction (F)
u = utilized/utilization (r)
u = UASB (C, R, S, V)
v = volatile (f, X)
v = settling velocity (F)
vfa = volatile fatty acids (S)
vx = sludge volume (T)
w = water vapour (p)
x = sludge mass fraction (f)
xa = active sludge
xv = volatile sludge
0, 1 = initial; primary or pre
2, 3 = secondary, tertiary or post
20 = 20°C
∞ = infinity (for limits)