



Parameter	Selected/ Calculated	Unit	Acceptable Range
EQUALIZATION TANK (EQ)			
Probability of Influent Flow Rate Control	100		
Effective Tank Volume	870.0	m ³	
Required Flow Rate	17386.6	L/hr	
Days (Leaving) Capacity	90.4		
OFFLINE SLUDGE STORAGE TANK (OFF-SS)			
Effective Tank Volume	11.3	m ³	17.26
Maximum Hydraulic Retention Time (Empty Tank)	6.1	hr	
Minimum Hydraulic Retention Time (Full Tank)	4.6	hr	
Overflow Rate	5.7	m ³ /m ² /d	
Dry Biomass Accumulation Rate	71.0	kg SS/d	1.0
Sludge Storage Capacity	0.44	month(s)	1 to 4
Stored Sludge Dry Solids	0.27	kg SS	0.8 to 2.5, Ave. 1.3
Max Sludge Level before Sludge Pump-Out	60	%	
ONLINE SLUDGE STORAGE TANK (ON-SS)			
Effective Tank Volume	126.6	m ³	
Maximum Hydraulic Retention Time (Empty Tank)	6.2	hr	
Minimum Hydraulic Retention Time (Full Tank)	4.7	hr	
Overflow Rate	10.9	m ³ /m ² /d	
Dry Sludge Accumulation Rate	128.8	kg SS/d	1 to 4
Sludge Storage Capacity	0.87	month(s)	1 to 4
Stored Sludge Dry Solids	3	kg SS	2 to 4, Ave. 4
Max Sludge Level before Sludge Pump-Out	80	%	
PRIMARY CLARIFIER (PC)			
Effective Tank Volume	48.0	m ³	
Maximum Hydraulic Retention Time (Empty Tank)	2.9	hr	
Minimum Hydraulic Retention Time (Full Tank)	1.7	hr	
Overflow Rate	24.0	m ³ /m ² /d	
Sludge Slides Level before Sludge Pump-Out	15	%	
BIOREACTOR (BB)			
Effective Tank Volume	105.3	m ³	
Hydraulic Retention Time	4.5	hr	
Carrier Volume	48.0	hr	
Surface Area Removal Rate (SARR) (in Reactors)	8.0	g BOD/m ² /d	
Peak Specific Surface Area of Carrier	800.0	m ² /m ³	
Pl of Carrier	427.321		30 to 60
Dissolved Oxygen	3	mg/L	≥ 0.4
Temperature	18	°C	
Residual Production Rate	71.0	kg VSS/d	

FINAL CLARIFIER (FCL)			
Effective Tank Volume	109.1	m ³	
Total Surface Area	58.8	m ²	
Hydraulic Retention Time	4.5	hr	
Overflow Rate	15.1	m ³ /m ² /d	1 to 16 (B)
Solids Loading	0.090	kg/m ² /h	< 1
FINAL PUMP TANK (FPT)			
Effective Tank Volume	11/A	m ³	
Received Flow Rate	17583.6	L/hr	
Total Balancing Capacity	11/A	hr	



	DESIGNATION	DESIGN STORAGE VOLUME (m³)	DESIGN STORAGE VOLUME (m³)	DESIGN STORAGE VOLUME (m³)	DESIGN STORAGE VOLUME (m³)	DESIGN STORAGE VOLUME (m³)
TANK(S)	DESIGN #1	DESIGN #2	DESIGN #3	DESIGN #4	DESIGN #5	DESIGN #6
	DESIGN #1	DESIGN #2	DESIGN #3	DESIGN #4	DESIGN #5	DESIGN #6
TOTAL EFFECTIVE VOLUME (m³)	81.47	126.82	47.95	105.33	109.10	0.00
TOTAL EFFECTIVE SURFACE (m²)	29.38	45.99	17.25	31.42	35.79	0.00
AVERAGE WATER DEPTH (m)	0.72	0.72	0.72	0.67	0.74	0.00
HYDRAULIC RETENTION TIME (hr)	6.85 Min	2.83 Min	1.82 Min	4.71	4.85	0.00
OVERFLOW RATE (m³/m²-d)	3.89	11.76	31.06		13.82	
MEDIA				34.76		
				MBBR C-0101		
PUMPS	4" Liberty KLE1M-2				17" Q=0.02 LPS3	2" TSD
	Diaphragm				Simplex	Diaphragm
DOSING CHEMICAL						
BLOWERS				2" BMT-10-TH-48		
				Simplex		
TUBE DIFFUSER						

Signoff	Version Info
	Assumptions
	Calculations

Characterization

Influent Wastewater Characteristics

BOD	250 mg/L
TSS	360 mg/L
TSS	15 mg/L
AS	2.3 MGD
WWF	9 MGD
WWF	5.9 MGD
WWF	16.5 MGD
WWF	2.17
WWF	2.87
WWF	1.17
WWF	2.5
WWF	6.78 MGD

Wastewater Model Influent

Flow	5.15
COD - Total mgCOD/L	550
V - Total Kjeldahl Nitrogen mgN/L	35
P - Total P mgP/L	6.5
S - Total S mgS/L	10
N - Nitrate mgN/L	1.5
Alkalinity mgCaCO3/L	340
SS Total mgSS/L	52
Water Soluble - Calcium mg/L	8
Water Soluble - Magnesium mg/L	10
Calc - Dissolved oxygen mg/L	8

Wastewater Model WWT Characterization

Parameter	Default	Value
Rate - Readily biodegradable biodegradable	0.16	0.05
Rate - Volatile fatty acids (g VFA COD/g)	0.15	0.3450
Rate - Ammonia (gCOD/g NVA COD/g)	1	
Rate - Non-volatile slowly biodegradable	0.75	0.0590
Rate - Unbiodegradable volatile (gCOD)	0.05	0.03
Rate - Unbiodegradable particulate (gC)	0.13	0.13
Rate - Cellulose fraction of unbiodegradable	0.5	0.5
Rate - Ammonia (gN/kgN/gN)	0.46	0.46
Rate - Particulate organic nitrogen (gN)	0.5	0.5
Rate - Soluble unbiodegradable TN	0.02	0.02
Rate - N-COD rate for unbiodegradable	0.07	0.07
Rate - Phosphate (gP4-P/gP)	0.5	0.5
Rate - P-COD rate for unbiodegradable	0.02	0.02
Rate - Reduced sulfur (gS) (gS/g)	0.15	0.15
Rate - Cellulose biodegradable COD fraction	0.02	0.02
Rate - Methanogenic COD fraction (g)	1.00E-04	1.00E-04
Rate - Ammonia oxidizing COD fraction	1.00E-04	1.00E-04
Rate - Nitrite oxidizing COD fraction (g)	1.00E-04	1.00E-04
Rate - Ammonia nitrifying COD fraction	1.00E-04	1.00E-04
Rate - Phosphate accumulating COD	1.00E-04	1.00E-04
Rate - Propionic acidogenic COD fraction	1.00E-04	1.00E-04
Rate - Acetate biodegradable COD	1.00E-04	1.00E-04
Rate - Hydrogenotrophic methanogenic	1.00E-04	1.00E-04
Rate - Sulfur oxidizing COD fraction (g)	1.00E-04	1.00E-04
Rate - Sulfur reducing propionic acids	1.00E-04	1.00E-04
Rate - Sulfur reducing acetogenic COD	1.00E-04	1.00E-04
Rate - Sulfur reducing hydrogenotrophic	1.00E-04	1.00E-04
Rate - Endogenous respiration COD fraction	0	0

1.100
100000000

Dimensions

EQ

Volume	1.00 MGD
Depth	9.97 ft
Width	9.97 ft

On-SSE1

Volume	0.31 MGD
Depth	9.97 ft
Width	9.97 ft

On-SSE2

Volume	0.70 MGD
Depth	9.97 ft
Width	9.97 ft

PCW

Volume	0.50 MGD
Depth	9.97 ft
Width	9.97 ft

PCW

Volume	0.50 MGD
Depth	9.97 ft
Width	9.97 ft

On-SSE1

Volume	0.31 MGD
Depth	9.97 ft
Width	9.97 ft

On-SSE2

Volume	0.70 MGD
Depth	9.97 ft
Width	9.97 ft

WBSR1 Media

Volume	0.31 MGD
Specific Area	152.4 ft ² /ft ³
Specific Volume	0.427 ft ³ /ft ³
N F3	45 ft

WBSR2 Media

Volume	0.31 MGD
Specific Area	152.4 ft ² /ft ³
Specific Volume	0.427 ft ³ /ft ³
N F3	45 ft

WBSR3 Media

Volume	0.31 MGD
Specific Area	152.4 ft ² /ft ³
Specific Volume	0.427 ft ³ /ft ³
N F3	45 ft

WBSR4 Media

Volume	0.31 MGD
Specific Area	152.4 ft ² /ft ³
Specific Volume	0.427 ft ³ /ft ³
N F3	45 ft

WBSR5 Media

Volume	0.31 MGD
Specific Area	152.4 ft ² /ft ³
Specific Volume	0.427 ft ³ /ft ³
N F3	45 ft

WBSR6 Media

Volume	0.31 MGD
Specific Area	152.4 ft ² /ft ³
Specific Volume	0.427 ft ³ /ft ³
N F3	45 ft

WBSR7 Media

Volume	0.31 MGD
Specific Area	152.4 ft ² /ft ³
Specific Volume	0.427 ft ³ /ft ³
N F3	45 ft

WBSR8 Media

Volume	0.31 MGD
Specific Area	152.4 ft ² /ft ³
Specific Volume	0.427 ft ³ /ft ³
N F3	45 ft

WBSR9 Media

Volume	0.31 MGD
Specific Area	152.4 ft ² /ft ³
Specific Volume	0.427 ft ³ /ft ³
N F3	45 ft

WBSR10 Media

Volume	0.31 MGD
Specific Area	152.4 ft ² /ft ³
Specific Volume	0.427 ft ³ /ft ³
N F3	45 ft

WBSR11 Media

Volume	0.31 MGD
Specific Area	152.4 ft ² /ft ³
Specific Volume	0.427 ft ³ /ft ³
N F3	45 ft

WBSR12 Media

Volume	0.31 MGD
Specific Area	152.4 ft ² /ft ³
Specific Volume	0.427 ft ³ /ft ³
N F3	45 ft

WBSR13 Media

Volume	0.31 MGD
Specific Area	152.4 ft ² /ft ³
Specific Volume	0.427 ft ³ /ft ³
N F3	45 ft

WBSR14 Media

Volume	0.31 MGD
Specific Area	152.4 ft ² /ft ³
Specific Volume	0.427 ft ³ /ft ³
N F3	45 ft

WBSR15 Media

Volume	0.31 MGD
Specific Area	152.4 ft ² /ft ³
Specific Volume	0.427 ft ³ /ft ³
N F3	45 ft

WBSR16 Media

Volume	0.31 MGD
Specific Area	152.4 ft ² /ft ³
Specific Volume	0.427 ft ³ /ft ³
N F3	45 ft

HRT 5 hrs
Volume 1.44 MGD

BSR 1000 gpd/ft²
SA 8790 ft²

HRT 5 hrs
Volume 1.23 MGD

BSR 1000 gpd/ft²
SA 4790 ft²

BSR 400 gpd/ft²
SA 800 ft²

Calculations

Unit Geometry and Surface Areas

Unit	Volume	Length	Surface Area
EQ Basin	1.00 MGD	9.97	2.481
On-SSE1	0.31 MGD	9.97	0.792
On-SSE2	0.70 MGD	9.97	1.775
PCW	0.50 MGD	9.97	1.250
PCW	0.50 MGD	9.97	1.250
Final Clarifier	4.7773	811.93	8100.94
MBBR1	0.31 MGD	9.97	0.792
MBBR2	0.31 MGD	9.97	0.792
MBBR3	0.31 MGD	9.97	0.792
MBBR4	0.31 MGD	9.97	0.792
MBBR5	0.31 MGD	9.97	0.792
MBBR6	0.31 MGD	9.97	0.792
MBBR7	0.31 MGD	9.97	0.792
MBBR8	0.31 MGD	9.97	0.792
MBBR9	0.31 MGD	9.97	0.792
MBBR10	0.31 MGD	9.97	0.792
MBBR11	0.31 MGD	9.97	0.792
MBBR12	0.31 MGD	9.97	0.792
MBBR13	0.31 MGD	9.97	0.792
MBBR14	0.31 MGD	9.97	0.792
MBBR15	0.31 MGD	9.97	0.792
MBBR16	0.31 MGD	9.97	0.792
MBBR17	0.31 MGD	9.97	0.792
MBBR18	0.31 MGD	9.97	0.792
MBBR19	0.31 MGD	9.97	0.792
MBBR20	0.31 MGD	9.97	0.792
MBBR21	0.31 MGD	9.97	0.792
MBBR22	0.31 MGD	9.97	0.792
MBBR23	0.31 MGD	9.97	0.792
MBBR24	0.31 MGD	9.97	0.792
MBBR25	0.31 MGD	9.97	0.792
MBBR26	0.31 MGD	9.97	0.792
MBBR27	0.31 MGD	9.97	0.792
MBBR28	0.31 MGD	9.97	0.792
MBBR29	0.31 MGD	9.97	0.792
MBBR30	0.31 MGD	9.97	0.792
MBBR31	0.31 MGD	9.97	0.792
MBBR32	0.31 MGD	9.97	0.792
MBBR33	0.31 MGD	9.97	0.792
MBBR34	0.31 MGD	9.97	0.792
MBBR35	0.31 MGD	9.97	0.792
MBBR36	0.31 MGD	9.97	0.792
MBBR37	0.31 MGD	9.97	0.792
MBBR38	0.31 MGD	9.97	0.792
MBBR39	0.31 MGD	9.97	0.792
MBBR40	0.31 MGD	9.97	0.792
MBBR41	0.31 MGD	9.97	0.792
MBBR42	0.31 MGD	9.97	0.792
MBBR43	0.31 MGD	9.97	0.792
MBBR44	0.31 MGD	9.97	0.792
MBBR45	0.31 MGD	9.97	0.792
MBBR46	0.31 MGD	9.97	0.792
MBBR47	0.31 MGD	9.97	0.792
MBBR48	0.31 MGD	9.97	0.792
MBBR49	0.31 MGD	9.97	0.792
MBBR50	0.31 MGD	9.97	0.792
MBBR51	0.31 MGD	9.97	0.792
MBBR52	0.31 MGD	9.97	0.792
MBBR53	0.31 MGD	9.97	0.792
MBBR54	0.31 MGD	9.97	0.792
MBBR55	0.31 MGD	9.97	0.792
MBBR56	0.31 MGD	9.97	0.792
MBBR57	0.31 MGD	9.97	0.792
MBBR58	0.31 MGD	9.97	0.792
MBBR59	0.31 MGD	9.97	0.792
MBBR60	0.31 MGD	9.97	0.792
MBBR61	0.31 MGD	9.97	0.792
MBBR62	0.31 MGD	9.97	0.792
MBBR63	0.31 MGD	9.97	0.792
MBBR64	0.31 MGD	9.97	0.792
MBBR65	0.31 MGD	9.97	0.792
MBBR66	0.31 MGD	9.97	0.792
MBBR67	0.31 MGD	9.97	0.792
MBBR68	0.31 MGD	9.97	0.792
MBBR69	0.31 MGD	9.97	0.792
MBBR70	0.31 MGD	9.97	0.792
MBBR71	0.31 MGD	9.97	0.792
MBBR72	0.31 MGD	9.97	0.792
MBBR73	0.31 MGD	9.97	0.792
MBBR74	0.31 MGD	9.97	0.792
MBBR75	0.31 MGD	9.97	0.792
MBBR76	0.31 MGD	9.97	0.792
MBBR77	0.31 MGD	9.97	0.792
MBBR78	0.31 MGD	9.97	0.792
MBBR79	0.31 MGD	9.97	0.792
MBBR80	0.31 MGD	9.97	0.792
MBBR81	0.31 MGD	9.97	0.792
MBBR82	0.31 MGD	9.97	0.792
MBBR83	0.31 MGD	9.97	0.792
MBBR84	0.31 MGD	9.97	0.792
MBBR85	0.31 MGD	9.97	0.792
MBBR86	0.31 MGD	9.97	0.792
MBBR87	0.31 MGD	9.97	0.792
MBBR88	0.31 MGD	9.97	0.792
MBBR89	0.31 MGD	9.97	0.792
MBBR90	0.31 MGD	9.97	0.792
MBBR91	0.31 MGD	9.97	0.792
MBBR92	0.31 MGD	9.97	0.792
MBBR93	0.31 MGD	9.97	0.792
MBBR94	0.31 MGD	9.97	0.792
MBBR95	0.31 MGD	9.97	0.792
MBBR96	0.31 MGD	9.97	0.792
MBBR97	0.31 MGD	9.97	0.792
MBBR98	0.31 MGD	9.97	0.792
MBBR99	0.31 MGD	9.97	0.792
MBBR100	0.31 MGD	9.97	0.792
MBBR101	0.31 MGD	9.97	0.792
MBBR102	0.31 MGD	9.97	0.792
MBBR103	0.31 MGD	9.97	0.792
MBBR104	0.31 MGD	9.97	0.792
MBBR105	0.31 MGD	9.97	0.792
MBBR106	0.31 MGD	9.97	0.792
MBBR107	0.31 MGD	9.97	0.792
MBBR108	0.31 MGD	9.97	0.792
MBBR109	0.31 MGD	9.97	0.792
MBBR110	0.31 MGD	9.97	0.792
MBBR111	0.31 MGD	9.97	0.792
MBBR112	0.31 MGD	9.97	0.792
MBBR113	0.31 MGD	9.97	0.792
MBBR114	0.31 MGD	9.97	0.792
MBBR115	0.31 MGD	9.97	0.792
MBBR116	0.31 MGD	9.97	0.792
MBBR117	0.31 MGD	9.97	0.792
MBBR118	0.31 MGD	9.97	0.792
MBBR119	0.31 MGD	9.97	0.792
MBBR120	0.31 MGD	9.97	0.792
MBBR121	0.31 MGD	9.97	0.792
MBBR122	0.31 MGD	9.97	0.792
MBBR123	0.31 MGD	9.97	0.792
MBBR124	0.31 MGD	9.97	0.792
MBBR125	0.31 MGD	9.97	0.792
MBBR126	0.31 MGD	9.97	0.792
MBBR127	0.31 MGD	9.97	0.792
MBBR128	0.31 MGD	9.97	0.792
MBBR129	0.31 MGD	9.97	0.792
MBBR130	0.31 MGD	9.97	0.792
MBBR131	0.31 MGD	9.97	0.792
MBBR132	0.31 MGD	9.97	0.792
MBBR133	0.31 MGD	9.97	0

[illegible]

Tabelle 1	
Variable	0,000
Constante	0,000

Tabelle 2	
Variable	0,000
Constante	0,000

80

Concrete Volume to Cast: Foot	192.000	63	
Rebarbed Dimension			1.00 x 2.1
Area	16.276	52	
Depth	0.817	6	
Width	98.127	6	
Length	100	6	
Wall Surface Area			
A-wall	0.973	52	
Wall Volume			
V-wall	4.801	53	
Rebar Wall Surface Area			
A-wall	0.78	52	
Rebar Wall Volume			
V-wall	1.142	53	
Total Concrete Volume	0.000	54	

EQ Book Volume	
Clarifier Footprint Area	19,274 sq
Base Book Volume (with 2 ft thickness)	
Base Volume	38,548 sq

Tank depth = 5.075
Above ground = 2.0
Below ground = 5.07 - 2 = 3.075
Excavation slope = 1 vertical : 2 horizontal

Excavation Depth	
Depth (meters)	0.87 Slope = 1.2, α for safety 0.97, 0 depth, reduced 13.343 k reduced on each side

Excavation Parameters	
Ballast (kN/m ²)	Length 100 k
	Width 30.17 k
Top Soil (kN/m ²)	Length 200 k
	Width 130.38 k
Average Soil	Length 20.285 k
	Width 21.759 k
Excavation Volume	V excavation 100,007 k3