

CONTENTS

Prefac	Preface			
Chap	ter 1 Wastewater Engineering: An Overview	1		
Description .	Wastewater Treatment	2		
	Sludge Disposal and Reuse	8		
	Wastewater Reclamation and Reuse	9		
1-4	Effluent Disposal	10		
1-5	The Role of the Engineer	11		
Chap	ter 2 Wastewater Flowrates	15		
2-1	Components of Wastewater Flows	15		
2-2	Estimating Wastewater Flowrates from Water Supply Data	16		
2-3	Wastewater Sources and Flowrates	26		
2-4	Analysis of Wastewater Flowrate Data	35		
2-5	Reduction of Wastewater Flowrates	41		
Chap	ter 3 Wastewater Characteristics	47		
3-1	Physical, Chemical, and Biological Characteristics of Wastewater	47		
3-2	Physical Characteristics: Definition and Application	50		
3-3	Chemical Characteristics: Definition and Application	64		
3-4	Biological Characteristics: Definition and Application	90		
3-5	Wastewater Composition	108		
3-6	Wastewater Characterization Studies	111		
Chap	ter 4 Wastewater Treatment Objectives, Methods, and Implementation Considerations	12		
4-1	Wastewater Treatment Objectives and Regulations	122		
4-2	Classification of Wastewater Treatment Methods	125		
4-3	Application of Treatment Methods	126		
4-4	Selection of Treatment-Process Flow Diagrams	130		
4-5	Implementation of Wastewater Management Programs	137		
4-6	Financing	142		

Chap	ter 5 Introduction to Wastewater Treatment Plant Design	147
5-1	Impact of Flowrate and Mass-Loading Factors on Design	148
5-2	Evaluation and Selection of Design Flowrates	148
5-3	Evaluation and Selection of Design Mass Loadings	153
5-4	Process Selection	166
5-5	Elements of Conceptual Process Design	181
Chap	eter 6 Physical Unit Operations	193
6-1	Flow Measurement	195
6-2	Screening	200
6-3	Flow Equalization	203
6-4	Mixing	212
6-5	Sedimentation	220
6-6	Accelerated Gravity Separation	240
6-7	Flotation	242
6-8	Granular-Medium Filtration	248
6-9	Gas Transfer	276
6-10	Volatilization and Gas Stripping of Volatile Organic Compounds	
	(VOCs) from Wastewater Management Facilities	287
Chap	ter 7 Chemical Unit Processes	301
7-1	Chemical Precipitation	302
7-2	Adsorption	314
7-3	Disinfection	324
7-4	Disinfection with Chlorine	332
7-5	Dechlorination	343
7-6	Disinfection With Chlorine Dioxide	345
7-7	Disinfection With Bromine Chloride	347
7-8	Disinfection With Ozone	349
7-9	Disinfection With Ultraviolet Light	351
7-10	Other Chemical Applications	352
Chap	eter 8 Biological Unit Processes	359
8-1	Overview of Biological Wastewater Treatment	359
8-2	Introduction to Microbial Metabolism	360
8-3	Important Microorganisms in Biological Treatment	364
8-4	Bacterial Growth	367
8-5	Kinetics of Biological Growth	369
8-6	Biological Treatment Processes	377
8-7	Aerobic Suspended-Growth Treatment Processes	378
8-8	Aerobic Attached-Growth Treatment Processes	403
8-9	Anaerobic Suspended-Growth Treatment Processes	420
8-10	Anaerobic Attached-Growth Treatment Processes	428
8-11	Biological Nutrient Removal	429
8-12	Pond Treatment Processes	434

12-4	Sludge and Scum Pumping	779
12-5	Preliminary Operations	796
12-6	Thickening (Concentration)	801
12-7	Stabilization	810
12-8	Anaerobic Sludge Digestion	813
12-9	Aerobic Sludge Digestion	835
12-10	Composting	842
12-11	Conditioning	850
12-12	Disinfection	854
12-13	Dewatering	855
12-14	Heat Drying	877
12-15	Thermal Reduction	88
12-16	Preparation of Solids Mass Balances	891
12-17	Land Application of Sludge	903
12-18	Other Beneficial Uses of Sludge	914
12-19	Final Sludge and Solids Conveyance, Storage, and Disposal	915
12-13	That bludge and bolids bothveyance, blorage, and bisposar	310
Chap	ter 13 Natural Treatment Systems	927
13-1	Development of Natural Treatment Systems	928
13-2	Fundamental Considerations in the Application of Natural Treatment	320
10-2	Systems Systems	938
13-3	Slow-Rate Systems	944
13-4	Rapid Infiltration Systems	967
13-5	Overland-Flow Systems	982
13-6	Constructed Wetlands	992
13-7	Floating Aquatic Plant Treatment Systems	1002
10-7	Trouting Aquatic Frant Treatment Systems	1002
Chap	ter 14 Small Wastewater Treatment Systems	1017
14-1	Special Problems Faced by Small Communities	1017
14-2	Small System Flowrates and Wastewater Characteristics	1019
14-3	Types of Small Wastewater Management Systems	1021
14-4	Onsite Systems for Individual Residences and Other Community	102
	Facilities in Unsewered Areas	1024
14-5	Selection and Design of Onsite Systems	1041
14-6	Onsite Wastewater Management Districts	1070
14-7	Wastewater Collection Systems for Small Communities	1072
14-8	Small Systems for Clusters of Homes and Very Small Communities	
14-9	Systems with Package (Pre-Engineered) Treatment Plants	1076
14-10		1080
14-10	Individually Designed Treatment Facilities	1088
14-11	Septage and Septage Disposal	1090
Chan	ter 15 Management of Wastewater	
Unap	from Combined Sewers	1103
45.4		
15-1	History of Combined Sewer Systems	1104
15-2	Components of Combined Sewer Systems	1105
15-3	Combined Sewer Flowrates and Wastewater Characteristics	1112

		CONTENTS	XI
15-			125
15-			129
15-	6 Future Directions in the Management of Combined Sewer Overflo	WS 1	131
Ch	apter 16 Wastewater Reclamation and Reuse	1	137
16-	Wastewater Reclamation and Reuse: An Introduction		137
16-			142
16-			174
16-	4 Planning Considerations in Wastewater Reclamation and Reuse	1	184
Ch	napter 17 Effluent Disposal	1	195
17-	1 Water Quality Parameters and Criteria	1	196
17-			198
17-	The state of the s		209
17-	The state of the s		213
17-	5 Ocean Disposal		225
AP	PENDIXES		
Ä	Conversion Factors	1	241
В	Physical Properties of Air	1	249
C	Physical Properties of Water	1	251
D	Solubility of Gases Dissolved in Water	1	255
E	Dissolved-Oxygen Concentration in Water		
	as a Function of Temperature, Salinity,		
	and Barometric Pressure	1	257
F	MPN Tables and Their Use	1	261
G	General Solution Procedure for		
	Materials-Balance Equations for a Batch,		
	Complete-Mix, and Plug-Flow Reactor	1	265
H	Determination of Kinetic Coefficients	1	275
1	Moody Diagrams for the Analysis of		
	Flow in Pipes	1	281
IN	DEXES		
	ime Index	-	285
6	The second secon		291
130	biect Index		231