

CONTENTS

	Page
Preface	xi
1. Physical Phenomena	1
1.1 Transport	1
1.2 Gas Transfer	7
1.3 Thermal Phenomena	13
1.4 Sedimentation	25
1.5 Continuous-Flow Models	31
2. Chemical Phenomena	39
2.1 Solution Equilibria	39
2.2 Reaction Kinetics	45
2.3 Carbonate Equilibria	49
2.4 Thermochemistry	58
2.5 Colloidal Behavior	61
3. Biologic Phenomena	70
3.1 Organic Materials	70
3.2 Microorganisms	76
3.3 Growth Kinetics	80
3.4 Biochemical Oxygen Demand	84
3.5 Anaerobic Decomposition	87
3.6 Photosynthesis	89
3.7 Food Chains	91
4. Ecological Systems	99
4.1 Models	99
4.2 Analytic Solutions	102
4.3 Time-Domain Simulation	104
4.4 Continuous-Flow Microbiological Systems	106
4.5 Pesticide Concentration	111
4.6 Eutrophication	113
5. Natural Transport Systems	138
5.1 Basic Models	138
5.2 Dissolved-Oxygen System	142
5.3 Streams	146
5.4 Estuaries	154
5.5 Transport in the Air Environment	165
6. Planning Factors	170
6.1 Water-Quality Criteria and Standards	170
6.2 Air Pollution and Its Control	176
6.3 Radiological Health	181
6.4 Environmental Impact Statements	186
6.5 Population-Growth Models	194
6.6 Regional-Growth Model	197
6.7 Time-Capacity Expansion of Systems	208
7. Time Series	214
7.1 Trend, Frequency, and Random Components	214
7.2 Time-Series Analysis	222

7.3 Synthetic Stream-Flow Sequences	236
7.4 Storage-Yield Relationships	243
7.5 Predicting Minimum Stream Flows	247
8. Management Systems	254
8.1 Water-Quality Management	254
8.2 Solid-waste Management	265
8.3 Waste-Water Reuse Systems	272
9. Engineered Transport Systems	280
9.1 Pipe Network Analysis	280
9.2 Water Distribution Systems	290
9.3 Open-Channel Flow	296
9.4 Domestic Waste-Water Collection Systems	307
9.5 Storm-Water Collection Systems	311
10. Water Treatment and Renovation Systems	318
10.1 Treatment Trains	318
10.2 Lagoon Systems	326
10.3 Individual Household Systems	331
11. Processes Used in Gross-Particulate Removal Trains	335
11.1 Screening Processes	335
11.2 Sedimentation Processes	336
11.3 Grit Chambers	343
11.4 Primary Sedimentation Basins	344
11.5 Flotation Processes	346
12. Processes Used in Suspended-Particulate Removal Trains	353
12.1 Activated-Sludge Processes	353
12.2 Trickling-Filter Processes	366
12.3 Rapid-Sand-Filter Process	371
13. Processes Used in Dissolved – Materials Removal Trains	380
13.1 Aeration Processes	380
13.2 Carbon-Adsorption Processes	382
13.3 Chemical-Precipitation Processes	383
13.4 Ion-Exchange Processes	389
13.5 Membrane-Separation Processes	393
13.6 Disinfection Processes	396
14. Processes Used in Sludge Treatment Trains	404
14.1 Thickening Processes	404
14.2 Anaerobic Digestion	412
14.3 Conditioning Processes	418
14.4 Dewatering Processes	420
14.5 Drying and Incineration Processes	424
Index	437