

# Contents

## I HEALTH AND WATER QUALITY

<b>1 Health Aspects of Water Supplies in Tropical Countries</b>	<b>3</b>
<i>David J. Bradley</i>	
1.1 The Need for Understanding Health Aspects . . .	3
1.2 The Ways in which Water Supplies Affect Health	5
1.3 Classification of Water-related Infections . . .	6
1.4 Water-borne Diseases . . . . .	9
1.5 Water-washed Diseases . . . . .	
1.6 Water-based Diseases . . . . .	13
1.7 Water-related Insect Vectors of Disease . . . . .	14
1.8 Diseases of Defective Sanitation . . . . .	15
1.9 Conclusion . . . . .	16
1.10 References . . . . .	17
<b>2 The Health Implications of Irrigation Schemes and Man-made Lakes in Tropical Environments</b>	<b>18</b>
<i>David J. Bradley</i>	
2.1 Introduction . . . . .	18
2.2 Health Protection for Project Staff and Labourers . . . . .	19
2.3 Health Risks to Displaced People and Immigrants . . . . .	20
2.4 Vector-borne Diseases . . . . .	21
2.5 References . . . . .	29
<b>3 Microbiological Criteria for Tropical Water Quality</b>	<b>30</b>
<i>Lilian M. Evison and A. James</i>	
3.1 Introduction . . . . .	30
3.2 Microbiology of Natural Waters in Hot Climates . . . . .	31
3.3 Microbiology of Abstracted Waters in Hot Climates . . . . .	37
3.4 Concluding Remarks . . . . .	49
3.5 References . . . . .	49
<b>4 Surface Water Quality Criteria for Tropical Developing Countries</b>	<b>52</b>
<i>M. B. Pescod</i>	
4.1 Introduction . . . . .	52
4.2 Water and Wastewater Quality Criteria . . . . .	57

4.3	Characteristics and Assimilation Capacity of Tropical Surface Waters .. .. .	54
4.4	Major Water Uses and Quality Constraints .. ..	56
4.5	Rational Water and Wastewater Quality Criteria ..	60
4.6	The Technology of Water Pollution Control .. ..	67
4.7	Pollution Control Policy Alternatives .. .. .	70
4.8	Conclusions .. .. .	71
4.9	References .. .. .	72

## II WATER SUPPLIES FOR LOW-INCOME COMMUNITIES

<b>5</b>	<b>Water Supplies for Low-income Communities: Resource Allocation, Planning and Design for a Crisis Situation</b>	<b>75</b>
	<i>Richard G. Feachem</i>	
5.1	The Nature of the Crisis .. .. .	75
5.2	The Need for Defined Goals .. .. .	76
5.3	The Need for Complementary Inputs .. .. .	78
5.4	The Design Benefit Concept .. .. .	79
5.5	The Water Collection Journey .. .. .	80
5.6	Water-related Diseases .. .. .	81
5.7	The Quality–Quantity Dilemma .. .. .	85
5.8	Risk-taking Design .. .. .	91
5.9	Applications of the Method .. .. .	92
5.10	References .. .. .	95
<b>6</b>	<b>Patterns of Domestic Water Use in Low-income Communities</b>	<b>96</b>
	<i>Anne U. White</i>	
6.1	Volume of Domestic Water Use .. .. .	96
6.2	The Population Involved .. .. .	98
6.3	Settlement Patterns .. .. .	98
6.4	Water Use in Different Types of Community .. ..	101
6.5	Factors Affecting Water Use Patterns .. .. .	108
6.6	References .. .. .	111
<b>7</b>	<b>Water Supply and Community Choice</b>	<b>113</b>
	<i>Anne Whyte and Ian Burton</i>	
7.1	Introduction .. .. .	113
7.2	Community Frames of Reference .. .. .	115
7.3	The Role of Water in the Community .. .. .	121
7.4	Community Choice .. .. .	124
7.5	Conclusion: The Design of User-choice Schemes	127
7.6	References .. .. .	129

<b>8 The Economics of Community Water Supply</b>	<b>130</b>
<i>Ian Carruthers and David Browne</i>	
8.1 Introduction .. .. .	130
8.2 Status of Water Supplies .. .. .	131
8.3 Key Economic Concepts .. .. .	133
8.4 Sectoral Allocations, Objectives and Criteria	136
8.5 Benefits of Rural Water Supplies .. .. .	137
8.6 Cost-Benefit and Cost-effectiveness Analysis	143
8.7 Appropriate Standards and Design Criteria	144
8.8 Selection Criteria .. .. .	152
8.9 Questions Raised by Self-help .. .. .	155
8.10 Finance of Water Supplies .. .. .	156
8.11 References .. .. .	160
<b>9 Water Treatment in Developing Countries</b>	<b>162</b>
<i>John Pickford</i>	
9.1 Why Treat Water? .. .. .	162
9.2 Water Fit for Use .. .. .	163
9.3 Impurities in Raw Water .. .. .	166
9.4 Protection and Treatment at Source and Intake	169
9.5 Storage and Sedimentation .. .. .	175
9.6 Aeration .. .. .	178
9.7 Filtration .. .. .	181
9.8 Disinfection .. .. .	185
9.9 Plans and Programmes .. .. .	188
9.10 References .. .. .	190
<b>III INSTITUTIONAL DEVELOPMENT</b>	
<b>10 Institutional Development for Sanitation and Water Supply</b>	<b>195</b>
<i>Michael G. McGarry</i>	
10.1 Background .. .. .	195
10.2 Urban Sanitation and Water Supplies .. .. .	196
10.3 Manpower Development .. .. .	198
10.4 Health and Conditions of the Rural Poor .. .. .	200
10.5 Village Sanitation and Water Supply .. .. .	202
10.6 Primary Health Care and the Improvement of Rural Sanitation .. .. .	207
10.7 Conclusions .. .. .	210
10.8 References .. .. .	211
<b>11 Progress in the Rural Water Programmes of Latin America</b>	<b>213</b>
<i>David Donaldson</i>	
11.1 Introduction .. .. .	213

11.2	Current Goals and Approaches	215
11.3	Current and Future Problems .	223
11.4	References .. .. .	227

## IV SANITATION

<b>12</b>	<b>Sanitation and Low-cost Housing</b>	<b>231</b>
	<i>Gerrit van R. Marais</i>	
12.1	Introduction .. .. .	231
12.2	Determination of 'Housing' Needs	235
12.3	Evaluation of Sanitation Systems	236
12.4	Conclusions.. .. .	238
12.5	References .. .. .	238
<b>13</b>	<b>Waste Collection in Hot Climates: A Technical and Economic Appraisal</b>	<b>239</b>
	<i>Michael G. McGarry</i>	
13.1	Introduction: The Problem .. .. .	239
13.2	Why Sanitation?.. .. .	239
13.3	Approach to Design .. .. .	241
13.4	Rural Sanitation .. .. .	243
13.5	Urban Wastewater Collection .. .. .	248
13.6	The Technology Choice: An Economic Comparison	259
13.7	Conclusions.. .. .	262
13.8	References .. .. .	263
<b>14</b>	<b>Wastewater Treatment in Hot Climates</b>	<b>264</b>
	<i>D. D. Mara</i>	
14.1	Introduction .. .. .	264
14.2	Principles of Waste Treatment ..	266
14.3	Waste Stabilization Ponds.. ..	269
14.4	Aerated Lagoons .. .. .	276
14.5	Oxidation Ditches .. .. .	278
14.6	Process Selection .. .. .	280
14.7	Nightsoil Treatment .. .. .	282
14.8	References .. .. .	282
<b>15</b>	<b>Entomological and Helminthological Aspects of Sewage Treatment in Hot Climates</b>	<b>284</b>
	<b>PART A—Insect Breeding in Relation to Sanitation and Waste Disposal .. .. .</b>	<b>284</b>
	<i>B. R. Laurence</i>	
15.1	Introduction .. .. .	284

15.2	The Identification of Flies .. .. .	285
15.3	The Life History of Flies .. .. .	286
15.4	The Families of Flies Associated with Waste Disposal	287
15.5	Other Insects .. .. .	294
15.6	Control Measures .. .. .	294
15.7	References .. .. .	296

**PART B—Helminthological Aspects of Sewage Treatment in Hot  
Climates .. .. . 299**

*Mark Shephard*

15.8	Introduction .. .. .	299
15.9	General Biology of Helminths .. .. .	299
15.10	The Transmission of Helminths .. .. .	301
15.11	The Effect of Sewage Treatment .. .. .	303
15.12	The Agricultural Utilization of Sewage .. .. .	307
15.13	The Possibilities of Control .. .. .	308
15.14	References .. .. .	309

*Rural Sanitation: Editorial Introduction*

**16 Problems of Village Sanitation in India 312**

*R. N. Shelat and M. G. Mansuri*

16.1	Introduction .. .. .	312
16.2	Survey of Existing Conditions .. .. .	313
16.3	Problems of Village Sanitation .. .. .	314
16.4	Excreta Collection, Treatment and Disposal .. .. .	317
16.5	Conclusions .. .. .	319
16.6	Reference .. .. .	319

**17 Solid Waste in Hot Climates 320**

*John Pickford*

17.1	Introduction .. .. .	320
17.2	Solid Waste Data .. .. .	320
17.3	The Effects of Solid Waste Mismanagement .. .. .	325
17.4	On-site Storage and Collection .. .. .	328
17.5	Treatment and Disposal of Refuse .. .. .	331
17.6	Land Reclamation by Controlled Tipping .. .. .	334
17.7	Composting .. .. .	339
17.8	Other Treatment Processes .. .. .	341
17.9	Conclusions .. .. .	342
17.10	References .. .. .	343

## V EFFLUENT RE-USE AND RECLAMATION

<b>18 Domestic Wastes as an Economic Resource: Biogas and Fish Culture</b>	<b>347</b>
<i>Michael G. McGarry</i>	
18.1 The Biogas Plant .. .. .	347
18.2 The Reclamation Fish Pond .. .. .	355
18.3 Biogas Bibliography .. .. .	363
18.4 Fish Culture Bibliography.. .. .	363
<b>19 Public Health Considerations in Wastewaters and Excreta Re-use for Agriculture</b>	<b>365</b>
<i>H. I. Shuval</i>	
19.1 Introduction .. .. .	365
19.2 Types of Contaminants .. .. .	366
19.3 Health Aspects of Various Types of Agricultural Re-use ..	369
19.4 Summary and Conclusions .. .. .	379
19.5 References .. .. .	380
 <i>Problems of Domestic Wastewater Reclamation: Editorial Introduction</i>	
<b>20 Planning and Construction of Wastewater Reclamation Schemes as an Integral Part of Water Supply</b>	<b>383</b>
<i>G. J. Stander and A. J. Clayton</i>	
20.1 Introduction .. .. .	383
20.2 Internal Re-use of Water by Industries .. .. .	384
20.3 Reclamation of Effluents .. .. .	386
20.4 Conclusions.. .. .	390
<b>Index</b>	<b>393</b>