Contents

Foreword to the First Edition *vii*
Preface to the Fourth Edition *ix*
Preface to the First Edition *xi*

PART I : WATER SUPPLY ENGINEERING

1. Introduction

General 3; Impure water 7; Need of protected water supply 7; Points to be considered for public water supply 8; Arrangements for distribution of water 9; Financing of public water supply 9; Appendices 1.1 to 1.4 , 17.

2. Sources of Water Supply and their Study

General 19; Ground water 20; Surface water 33; Determination of average runoff of a catchment 33; Methods of determining the maximum discharge 33; Mass diagram 35; Impounding reservoir 35; Choice of the dam 37; Selection of the source 38.

3. Quantity of Water

General 40; Estimation of demand 40; Variation in demand from average 43; Population and rate of consumption 45; Population forecast 46; Density of population 48; Zoning 49; Advantages and disadvantages of metering 49.

4. Intake Works

General 52; Selection of site 52; Other classifications of intakes 53.

5. Quality of Potable Water

General 59; Water-borne diseases 60; Testing of water 60; Taking water samples for tests 60; Sample tests for detecting dangerous matters in water 69; Standards for purified water 70.

6. Treatment of Water: Screening, Plain Sedimentation and Coagulation followed by Sedimentation

General 73; Surface water 73; Ground water 74; Sea water 74; Screening 74; Plain

sedimentation 75; Design of settling tanks 76; Coagulation followed by sedimentation 79; Mixing basins 81; Combined coagulation-sedimentation chambers 83; Comparison of mechanically operated and baffle type basins 84; Alum *VS* iron salts (as coagulants) 84; Factors which affect the coagulation 85; Functions of coagulation 85; Dosage of coagulants 85; Coagulation of prechlorinated water 86.

7. Treatment of Water–Filtration

General 90; sand 91; Gravel 91; Actions 91; Types of filters 92; Roughing filters and double filtration 99; Portable filters and purifiers 99; Using bituminous coal as a substitute filter media for anthracite 100.

8. Disinfection, Softening, Aeration and Other Miscellaneous Treatments

Disinfection 105; Softening 110; Aeration 114; Other miscellaneous treatments 114.

9. Conveyance of Water

General 119; Cast iron pipes 119; Wrought iron (WI) pipes 120; Steel pipes 120; Galvanized pipes 121; Cement lines iron or steel pipes 121; Copper pipes 121; Lead pipes 121; Concrete pipes 122; Wooden pipes 122; RCC pipes 122; Asbestos cement (AC) pipes 122; Polythene and polyvinyl chloride (PVC) pipes 122; Pipe joints 123; Laying the pipelines 127; Precautions in laying the pipelines 129.

10. Clear Water and Service Reservoirs and Distribution System

Clear water reservoir 131; Service reservoirs 131, Systems of supply 138; Layout of distribution system 138; Necessity of boosting 141; Pressures in the pipes 141; Water hammer in distribution system 141; Pipe work for water supply in buildings 142; Design of distribution system 144; Use of nomograms 146; Anslysis of pipe network 147; Sand pipes 151.

11. Valves, Fittings and Taps, Fire Hydrants, Detection and Prevention of Waste and Meters

Valves 154; Fittings and taps 158; Fire hydrants 159; Stand posts and drinking fountains 162; Detection and prevention of waste 163; Water meters 165; Testing the new pipelines 168.

12. Water Pumping Machinery

Necessity of pumping 171; Considerations for installing pumps 171; Selection of site for pumping station 172; Types of pumps 172; Suction lift 179; Power required for working pumps 181; choice of a pump 184; Automatic devices of pump control 185.

13. Preparing Water Supply Schemes

General 188; Relationship between water supply and sanitary engineering 188; Factors to be considered for water supply project 188; Project estimate 191; Project

drawings 191; Project reports 192; Typical water supply scheme 192; Details of particular projects 194.

14. Village Water Supply

General 207; Village water supply 209; Distribution by pipes 209; Rahat 210; Design for improving insanitary village wells 211; Design of Banki Village piped water supply scheme 212; Design of individual and community hand pumps 213.

15. Desalination of Brackish and Sea Water

Introduction 214; Composition and characteristics of sea water 215; Characteristics of brackish waters 216; Desalination 216; Various desalination techniques 217; Problems and difficulties 224; Research work 225; Future of desalted water in India 226; Conclusion 226.

PART II : SANITARY ENGINEERING

16. Introduction

General 229; Definition and importance 229; Historical background 230; Systems of sewage disposal 230; Combined *vs* separate system 233; Suitability of separate sewerage schemes for India and similar countries 233; Urban sewerage 235.

17. Quantity of Sewage, Storm Water and Designing Sewers

General 236; Quantity of Sewage 236; Quantity of storm water 237; Runoff 238; Intensity of rainfall 238; Time of concentration 239; Design of sewers 239; Flow diagrams 240; Partial flow diagrams 241.

18. Materials, Shapes and Cleaning of Sewers

Materials for sewer pipes 249; Shape of sewers 250; Laying the sewers 252; Cleaning of sewers 256.

19. Breakdown of Organic Constituents of Sewage

General 258; Aerobic reactions 258; Anaerobic reactions 260; Significance of anaerobic reaction 261.

20. Sewer Appurtenances

General 262; Manhole 262; Drop Manhole 264; Lampholes 264; Street inlets 265; Catch basins 265; Flushing devices 266; Grease and sand traps 267; Inverted siphon 268; Storm overflows and stormwater regulators 273; Sewer outlets 275.

21. Pumping of Sewage

General 277; Types of pumps 278.

22. Design and Layout of Sewerage System

General 284; Method of design 284; Ventilation 285.

23. Characteristics of Sewage

General 287; Characteristics of Sewage 287.

24. Testing of Sewage

Analysis of sewage 289; Method of taking samples 289; Tests 289.

25. Disposal of Sewage

General 298; Disposal by dilution 298; Treatment of sewage on land 304; Artificial methods 306; Disposal of screenings, grit, sludge, etc. 306.

26. Preliminary Treatment

General 308; Screening 308; Skimming tanks 311; Grit chamber or detritus tanks 312; Sedimentation 313.

27. Sewage Filtration

General 319; Principle 319; Intermittent sand filter 320; Contact beds 321; Percolating or trickling filter 322; Advantages and disadvantages of trickling filters 326; Humus tanks 327; Contact aerators 329.

28. Activated Sludge Process and Oxidation Ditches

General 332; Theory and design considerations of activated sludge process 333; Merits and demerits of activated sludge system 342; Oxidation ditches 344.

29. Disposal of Sewage from Isolated Buildings–Septic and Imhoff Tanks

General 350; Septic tanks 350; Imhoff tank 367.

30. Oxidation or Waste Stabilization Ponds

Oxidation ponds 373.

31. Plumbing–House Drainage, Domestic Sanitary Installations and Indian Standards for Sanitary Conveniences

General 383; Terms 384; Design considerations 387; Flushing devices 395; Traps 396; Sanitary appliances of fittings 398; Chemical toilet 407.

32. Industrial Waste Disposal

General 414; Legal position 414; Pollution by industrial wastes 415; Methods of disposal of industrial effluents and standards of quality to control water pollution 415;

Treatment methods of industrial wastes 417; Wastes from different industries and the alternative treatment methods 418; Details of 6 310 m^3/d effluent treatment plant for Synthetic Drugs Project, Hyderabad 431.

33. Sludge Disposal

General 439; Methods of sludge diposal 440; Methods of pretreatment 442; Methods of sludge filtration 448; Methods of sludge drying 450; Incineration of the sludge 454; Beloit-Passavant 'sludge-all' system 454.

34. Disposal of Refuse

General 458; Composition of refuse 458; Storage of refuse 459; Collection of refuse 461; Disposal of refuse 462; Refuse disposal studies at Kolkata by NEERI 470.

35. Sanitation and Drainage in Villages

General 474; Proper housing facilities 475; Protected water supply 475; Drainage of sullage and stormwater 476; Disposal of house refuse and animal waste 477; Disposal of nightsoil 477.

36. Environmental Sanitation

General 483; Insect control 484; Rodent control 487; Food control 488; Control of air pollution 492; Housing, ventilation and air conditioning 493; Lighting 502; Eradication of nuisances 503; Radiological protection 504; Plans to tackle Indian environmental pollution 505.

37. Design, Planning and Financing of Sewerage Schemes

General 513; Project report 513; Particular examples of sewerage schemes 519.

Bibliography *539*

Addendum: Indian Environmental Management *545*