

## Contents

Ch. 1. Introduction -- 1.1. Background -- 1.2. The World's Freshwater Resources -- 1.3. Water Use in the United States -- 1.4. Systems of Units -- 1.5. The Future of Water Resources -- 1.6. Water-energy Nexus -- ch. 2. Water Resources Sustainability -- 2.1. What is Water Resources Sustainability? -- 2.2. Challenges to Water Resources Sustainability -- 2.3. Surface Water System: the Colorado River Basin -- 2.4. Groundwater Systems: the Edwards Aquifer, Texas -- 2.5. Water Budgets -- 2.6. Examples of Water Resources Unsustainability -- ch. 3. Hydraulic Processes: Flow and Hydrostatic Forces -- 3.1. Principles -- 3.2. Control Volume Approach for Hydrosystems -- 3.3. Continuity -- 3.4. Energy -- 3.5. Momentum -- 3.6. Pressure and Pressure Forces in Static Fluids -- 3.7. Velocity Distribution -- ch. 4. Hydraulic Processes: Pressurized Pipe Flow -- 4.1. Classification of Flow -- 4.2. Pressurized (Pipe) Flow -- 4.3. Headlosses -- 4.4. Forces in Pipe Flow -- 4.5. Pipe Flow in Simple Networks -- ch. 5. Hydraulic Processes: Open-Channel Flow -- 5.1. Steady Uniform Flow -- 5.2. Specific Energy, Momentum, and Specific Force -- 5.3. Steady, Gradually Varied Flow -- 5.4. Gradually Varied Flow for Natural Channels -- 5.5. Rapidly Varied Row -- 5.6. Discharge Measurement -- ch. 6. Hydraulic Processes: Groundwater Flow -- 6.1. Groundwater Concepts -- 6.2. Saturated Flow -- 6.3. Steady-State One-Dimensional Flow -- 6.4. Steady-State Well Hydraulics -- 6.5. Transient Well Hydraulics: Confined Conditions -- 6.6. Transient Well Hydraulics: Unconfined Conditions -- 6.7. Transient Well Hydraulics: Leaky Aquifer Conditions -- 6.8. Boundary Effects: Image Well Theory -- 6.9. Simulation of Groundwater Systems -- ch. 7. Hydrologic Processes -- 7.1. Introduction to Hydrology -- 7.2. Precipitation (Rainfall) -- 7.3. Evaporation -- 7.4. Infiltration -- ch. 8. Surface Runoff -- 8.1. Drainage Basins and Storm Hydrographs -- 8.2. Hydrologic Losses, Rainfall Excess, and Hydrograph Components -- 8.3. Rainfall-Runoff Analysis Using Unit Hydrograph Approach -- 8.4. Synthetic Unit Hydrographs -- 8.5. S-Hydrographs -- 8.6. NRCS (SCS) Rainfall-Runoff Relation -- 8.7. Curve Number Estimation and Abstractions -- 8.8. NRCS (SCS) Unit Hydrograph Procedure -- 8.9. Kinematic-Wave Overland Flow Runoff Model -- 8.10. Computer Models for Rainfall-Runoff Analysis -- ch. 9. Reservoir and Stream Flow Routing -- 9.1. Routing -- 9.2. Hydrologic Reservoir Routing -- 9.3. Hydrologic River Routing -- 9.4. Hydraulic (Distributed) Routing -- 9.5. Kinematic Wave Model for Channels -- 9.6. Muskingum-Cunge Model -- 9.7. Implicit Dynamic Wave Model -- ch. 10. Probability, Risk, and Uncertainty Analysis for Hydrologic and Hydraulic Design -- 10.1. Probability Concepts -- 10.2. Commonly Used Probability Distributions -- 10.3. Hydrologic Design for Water Excess Management -- 10.4. Hydrologic Frequency Analysis -- 10.5. U.S. Water Resources Council Guidelines for Flood Flow Frequency Analysis -- 10.6. Analysis of Uncertainties -- 10.7. Risk Analysis: Composite Hydrologic and Hydraulic Risk -- 10.8. Computer Models for Floodflow Frequency Analysis -- ch. 11. Water Distribution -- 11.1. Introduction -- 11.2. System Components -- 11.3. System Configuration and Operation -- 11.4. Hydraulics of Simple Networks -- 11.5. Pump Systems Analysis -- 11.6. Network Simulation -- 11.7. Modeling Water Distribution Systems -- 11.8. Hydraulic Transients -- ch. 12. Stormwater Control: Storm Sewers and Detention -- 12.1. Stormwater Management -- 12.2. Storm Sewer Systems -- 12.3. Stormwater Drainage Channels -- 12.4. Stormwater Detention -- ch. 13. Stormwater Control: Street and Highway Drainage and Culverts -- 13.1. Drainage of Street and Highway Pavements -- 13.2. Hydraulic Design of Culverts -- ch. 14. Design of Spillways and Energy Dissipation for Flood Control Storage and Conveyance Systems -- 14.1. Hydrologic Considerations -- 14.2. Dams -- 14.3. Spillways -- 14.4. Hydraulic-Jump-Type Stilling Basins and Energy Dissipators -- ch. 15. Sedimentation and Erosion Hydraulics -- 15.0. Introduction -- 15.1. Properties of Sediment -- 15.2. Bed Forms and

Flow Resistance -- 15.3. Sediment Transport -- 15.4. Bed Load Formulas -- 15.5. Suspended Load -- 15.6. Total Sediment Load (Bed Material Load Formulas) -- 15.7. Bridge Scour -- ch. 16. Water Resources Management for Sustainability -- 16.1. Integrated Water Resources Management for Sustainability -- 16.2. Water Law: Surface and Groundwater Management Aspects -- 16.3. Sustainable Water Supply Methodologies for Arid and Semi-Arid Regions -- 16.4. Water Resources Economics -- 16.5. Water Resource Systems Analysis -- 16.6. Life Cycle Assessment (LCA) -- 16.7. Water-Wise cities in the future -- Appendix A. Newton-Raphson method.

Online course chapters (not in book): OC Supplemental Chapter 15, section 15.8. Watershed sediment Yield -- 15.9. Reservoir Sedimentation -- 15.10. Stream Stability at Highway Structures -- OC Chapter 17. Water Withdrawals and Uses -- OC Chapter 18. Water for Hydroelectric Generation -- OC Chapter 19. Flood Control.