The endless circulation of water between ocean, atmosphere, and land, known as the hydrologic cycle presents the opportunity to capture water, to retain it for desired times, and then to use the water for both domestic and industrial applications, including irrigation and public supplies.

Since 1856, when Henry Darcy published a report on the water supply of the city of Dijon, France, the flow of water into and out of underground areas (aquifers) has been considered a science. While Darcy concentrated on the flow of water through sand grains, clay particles or rock fragments with other media has been studied by others. This, in essence, is the thrust of the book, supplemented by impoundment and management of underground systems.

The chemical evolution of natural groundwater presents information on the different bases, from carbonate to crystalline rocks and sedimentary systems. The importance of aquifers is stressed, and the exploration for aquifers and their response to pumping, as in well systems, is examined. The fact that geotechnical problems may arise, as in dams and tunnels and eventually into excavations is outlined in some detail. The genesis of economic mineral deposits and implications for geochemical exploration conclude the main text, while several appendices on topics covered by the text are given, with references. It is unfortunate that the references are not as up-to-date as they should be; the copy at hand was published in 1979. A thorough updating would be noted with interest.

Overall, the volume, even in its present form, is a valuable resource and reference, and was designed for use as a text in introductory courses normally taught in the junior or senior year of undergraduate geology, geological engineering, or civil engineering curricula. Elementary calculus is used frequently in several of the chapters, but, in context, this is highly desirable. Doubtlessly, the present volume will be cited as a classic for this little-appreciated aspect of water containment and use.

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Stormwater: Best Management Practices and Detention for Water Quality, Drainage, and CSO Management, by Ben Urbonas and Peter Stahre, PTR Prentice Hall, Englewood Cliffs, NJ 07632, 1993, ISBN 0-13-847492-3, 449 pp., $52.00 (plus postage).

Urban stormwater engineering and management have made much advancement in recent years, and a heavy rain or "flood" is not tolerated if preventable. In addition, the question of the contamination which stormwater can spread, as well as the legal aspects, can no longer be ignored. Dr. Urbonas is with the Urban Flood Control District in Denver, Colorado, while Dr. Stahre, the co-author, is with the Malmo Water and Sewer Works in Malmo, Sweden. This international cooperation has produced a very useful and practical volume.

Essential though water is to life, it must be contained or at least directed. Depending on the predicted quantity, water may enter into storm sewer systems, or, if properly planned and engineered, into combined sewer overflows (CSO). Traditionally, local disposal of stormwater by infiltration or percolation follows nature's own way to smaller streams. Ponds that have a permanent supply of water offer a relief to stormwater, and can be used as "fire" or irrigation ponds as well as for recreational purpose.

Loss analysis of embankments is recommended and discussed, including adequate maintenance as part of the system.

Concrete basins are often considered in spite of their expense if they are properly designed, especially if they are combined with a spillway for large volumes of overloads. Another approach is to use "pipe packages" of large underground pipes for storage. Another approach is a conveyance tunnel for storms or combined sewage flow, but care must be taken to over-design it, so that significant excess volume may be stored, when needed.

Where storage treatments are available, the inflow can exhibit considerable variations over time. The flow out of the basin is then regulated through the use of either automated gates or pumps.

Another section of the book discusses how to estimate storage volumes by considering the basic principles. Methods of calculation for infiltration and percolation are discussed both by graphs and mathematics. Darcy's Law, which applies to groundwater flow in saturated soils, is applied to less-than-saturated soils. Roadside swales, or borrow ditches, are another practical approach, especially on rural roads.

The use of the computer is introduced by discussions of several systems now in use for water engineering: ILLUDAS (Illinois Urban Drainage Area Simulator), the SWMM (Storm Water Management Model), by the U.S. EPA, and MOUSE (Modeling of Urban Sewers) developed by Denmark, and widely used in Europe, Australia and New Zealand. Other systems are in active use worldwide.

The fundamentals of sedimentation are discussed, including the note that the smallest particle settling size is believed to be about 10 microns. The design of water quality basins for stormwater is explored, which relate to size as well as to the chemistry, physics, and biology of the water. Wetlands are an increasingly popular area, since they remove nitrogen and phosphorous compounds, metals, organics, and suspended solids, as well as nutrients from the water.

Best Management Practices (BMP) considers the volume, which, beyond good housekeeping and public education, requires sound engineering as suggested in this treatment plus intelligent management.

The volume is outstanding for its clear and detailed drawings and numerous photographs. The references are up-to-date. While written with the practicing engineer and stormwater manager in mind, the material would be most appropriate as a textbook for college or training courses in urban stormwater engineering. It is clear, specific, and practical.

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