

1-1-2005

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Christina Valerio, Book Note, Thomas V. Cech, Principles of Water Resources: History, Development, Management, and Policy, 8 U. Denv. Water L. Rev. 618 (2005).

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Thomas V. Cech, Principles of Water Resources: History, Development,
Management, and Policy

American West is one of the fastest growing regions of the country and the growth trend does not appear to be slowing down. The authors present conjunctive management as a feasible tool for water managers in the face of increased need for water from expanding urban communities, sensitive environmental concerns, and downstream flow obligations. The book does not merely point out the flaws in the existing infrastructures and propose idealistic models and goals. Instead, the authors attempt to balance the reality of competing water users and suggest realistic improvements each state could strive for in order to fully realize the benefits of conjunctive management.

David B. Oakley

THOMAS V. CECH, PRINCIPLES OF WATER RESOURCES: HISTORY, DEVELOPMENT, MANAGEMENT, AND POLICY, John Wiley & Sons, Inc., (2005); 468 pp; List Price \$93.95; ISBN 0-471-48475-X, hard-cover.

Principles of Water Resources outlines the complex field of water resources. Mr. Cech's textbook interprets water terminology, data, viewpoints, and complex topics in terms understandable to the layperson. *Principles of Water Resources* provides illustrative charts and graphs, along with a glossary and clear subheadings. Each chapter highlights policy issues, giving the reader an idea of the big picture involved in water resource issues. Additionally, Cech provides the reader with the key concepts and questions for discussion.

The textbook begins with the historical context of simple and complex water resources issues. Early civilizations obtained water and constructed irrigation projects with a wide variety of methods, all easily outlined. From the ganats, the underground water delivery system created by ancient well diggers in Africa, to the Roman cisterns and aqueducts, the book describes early water delivery systems in detail. Cech also depicts the irrigation systems of Egypt, China, the Middle East, India, Spain, Portugal, and North America. The textbook describes each country's initial stages of development, along with the intricacies of transportation and hydropower needs.

The next few chapters outline the natural physical processes of water, including climate and weather patterns, surface and groundwater processes, and the interaction between surface and groundwater hydrology. While Doppler radar, snow tubes, snow cores and snow pillows measure precipitation, evaporation is measured with Class A evaporation pans and by using a pan coefficient. Dendrochronology, which is studying tree rings, along with studying ice rings and ocean coral, all monitor climate change. Cech educates the reader about weather patterns, especially drought and floods, and how they can affect a water supply. Then, Cech explains the paramount physiographic

terms in surface and groundwater hydrology, along with the ecologic features that govern their storage and use.

Cech continues by explaining the primary components of water quality, especially those affecting human and ecosystem health. The book describes in detail the water treatment process, along with types of pollution, and how they affect the human population. Cech outlines the typical pollutants, including heavy metals, inorganic and organic chemicals and nutrients. He then goes through the transportation of pollutants in the water stream, particularly fate and transport, which describe plumes in both surface and groundwater, as well, as how the United States manages pollution, problems and the models used for testing and control.

The next four chapters objectively delineate municipal and irrigation water development. In contrast to the earlier chapters that dealt with the beginnings of irrigation, this chapter starts with the birth of community development and "improved" society. Cech believes that public water supply systems embody the ideals of economic growth and reliable communities. However, he is quick to point out that along with development comes environmental devastation that society must deal with. We are provided with case studies of three cities, Los Angeles, Lincoln, Nebraska, and New York City that illustrate how arid or extremely large communities can outgrow their boundaries and water supplies but that water engineers will still find ingenious ways to irrigate crops and provide domestic water. Cech then reports on irrigation techniques including gravity, wild flood, furrow, and drip.

Cech transitions into discussing dams, their impacts, navigational uses and a cost-benefit analysis. He outlines all the vital statistics of United States dams, their principal components, and types. A case study on Hoover Dam provides insight into the costs, necessary construction materials, and storage capacities of a \$165 million dam. Another case study on Kingsley Dam and Lake McConaughy in Nebraska furnishes information on earthen dams, as opposed to the concrete Hoover Dam.

Next, Cech breaks water allocation law down into historical time periods, 1200-1799, 1800-1847, 1848-1899, and 1900-present. The reader acquires a great sense for early water conflicts and how the earliest human civilizations developed water law, such as the Babylonian civilization of King Hammurabi. Cech then describes the origins of riparian and prior appropriation laws, along with the laws of the Native American pueblos, and English common law. He characterizes groundwater doctrines, interstate compacts, and other, more modern legal systems, along with federal reserved water rights.

The textbook next describes federal, local, regional, state, and multi-state water agencies, along with their duties and development. Cech discusses the United States Army Corp of Engineers and its navigation duties and flood control progression through pictures, key

terms, and the many statutes enacted under their auspices over the years. He also lays out the role of the National Park Service, Federal Energy Regulatory Commission, and the Environmental Protection Agency. Finally, the book chronicles local and municipal departments, which are somewhat more complicated, along with their irrigation districts, sewer districts, mutual irrigation and ditch companies, and surface or groundwater management districts.

Cech then forays into the uses of water. Drinking water, wastewater treatment, natural habitat for aquatic wildlife, and the economics of water all affect how we manage and mismanage our water supplies. The details of desalinization, the Safe Water Drinking Act, septic tanks and leaching fields all affect human life, along with fish and wildlife. While laws and landmark events such as the National Environmental Policy Act, the Endangered Species Act, and Earth Day have improved the quality of our water supplies, the destruction of wetlands and other habitats jeopardize the sandhill crane migration corridor, snail darter fish in Tennessee and salmon in the Columbia River. The economics of water, including privatization, water affordability, marketing, banking, and pollution fees and credits, is based on the allocation of the resources among different uses. Clean drinking water for humans and clean rivers for wildlife have different economic values and affect the way in which people distribute and sell water.

Lastly, Cech describes the most recent water resource issues—water use conflicts and emerging water issues. Water and conflict have been linked quite frequently in the last few years, in the Middle East, California, and China. Population growth and poor water quality continue to apply pressure on usable water supplies. Traditional water conflicts have grown more complicated over time in areas like the Tigris and Euphrates, the Texas Panhandle and the Ogallala Aquifer, and the Jordan River. This lack of usable water contributes to emerging issues such as lack of wastewater treatment in third world countries, groundwater recharge, and the privatization of water delivery. Cech provides information about a wealth of organizations that promote water conservation, education, ethical information, and cooperation among humans to protect a resource without which people cannot live.

Christina Valerio