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Pollutant Discharge and Water Quality in Urbanisation

 Springer

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Preface

In the last decade, there have been several attempts in developing a systematic approach in determination of appropriate interventions and/or measures for water quality control. One of the challenging approaches is to derive the pollution loading and its relationships to other socioeconomic factors in a given aquatic environment. This book encompasses an interesting initiative on the application of pollutant discharge per capita (PDC) as a key determinant of strategic development for water quality management and control. Not only theoretical considerations of PDC approach are given, the field experiences on PDC applications in several case studies in Japan and other developing countries are illustrated in the book chapters, which allow readers to realize the salient features of PDC as well as its advantages and limitations. The relationships of technological interventions and socioeconomic implications are clearly explained together with roles of potential stakeholders in implementing the recommended measures. Readers of the book will mainly benefit from a systematic understanding through integrative approach for water quality control.

Thammarat Koottatep

Acknowledgments

Most ambient water quality monitoring is conducted to evaluate water quality conformity with the ambient water quality standards. This is mostly for the administrative purpose. Chronological water quality alternations can be found from long-term water quality monitoring. Both horizontal and vertical water quality profiles in water bodies are important and interesting to understand the existence of pollutants and their distributions in the water environment. Water quality monitoring data can also be applied to estimate and evaluate pollutant load in the rivers. Land-based pollutants flowing into estuary and coastal sea can be evaluated using pollutant discharge parameters.

This book is based on several of my existing works and lecture notes. The lecture notes have been prepared for lectures in the Japan International Cooperation Agency (JICA) training course of water quality monitoring with participants from developing and middle-developed countries. My existing works include two chapter manuscripts and several scientific papers. One is on water quality profiles in urbanization (Tsuzuki 2010), another is on sanitation development and roles of Japan (Tsuzuki 2011). Scientific papers which contents are included in this book have been published in several journals including *Science of the Total Environment*, *Journal of Environmental Sciences*, *Journal of Hydrology*, *Ecological Indicators*, *Water, Soil, and Air Pollution*, *Water Science and Technology*, and *Ecological Economics*. The contents of the papers include basic concepts on municipal wastewater treatment, the Social Experiment Program in the Yamatogawa River Basin, Japan, and relationship between economic development and pollutant discharge. The Social Experiment Program includes dissemination of soft measures in households to reduce pollutant discharge and to improve water environment. Quantitative evaluations have been conducted on several aspects including the effects of the soft and hard measures on river water quality improvement, and costs and benefits of the measures.

Contents of this book are (1) water quality in the rivers and coastal areas, (2) pollutant load and water quality, (3) soft measures in households, (4) relationship between economic development and pollutant discharge per capita (PDC), (5) municipal wastewater pollutant discharge control, and (6) water and sanitation in developing countries. During the processes and development of the research, some specific terminologies have been modified and different words have been applied for the same meanings. For example, “soft interventions” have been

changed to “soft measures.” “Environmental accounting housekeeping (EAH) books” have been changed to “pollutant discharge calculators.” The research contents are mostly relevant to environmental engineering, while some research topics are relevant to river engineering, water quality sciences, or environmental economics. For the integrated river environment management, a comprehensive research in these fields is considered to be necessary. This book is useful to understand comprehensively a framework of river environment management especially the research on pollutant discharge and water quality related to urbanization.

The author has conducted lecture in the JICA training course from 2008 to 2012. The lecture note has been updated every year to include the latest research works. A book chapter has been published from NOVA Science Publisher in 2010 (Tsuzuki 2010), which has been prepared based on the JICA lecture note in 2008. A part of the contents of this book is based on the latest lecture note in 2012. The author has conducted the lecture by 2012 because the author has moved to Australia since 2013.

Anticipated readers are from university undergraduate and graduate students in the fields of environment engineering, environment economics, development economics, environment policy and related fields, and professionals and specialists in these fields. Some statistical data and information have been collected using the Internet. This will help readers to easily find further references in English and in Japanese. Some URL of the references may be different at the time of publication. Then, the readers can use authors’ name and titles of references to search literatures and documents. For Japanese references, the readers should know authors’ name and titles in Japanese when they try to find by using search engines. The readers can freely contact the author by e-mail in such cases. Moreover, a reference list in Japanese will be uploaded on the author’s URL¹ after publication of the book.

These works have been conducted with supports to conduct research from many people especially when the author was in Japan as a Researcher at Shimane University in 2004–2007, and several positions at Toyo University in 2007–2009. First of all, I would like to thank Prof Tomonori Matsuo, Dr Takashi Mino, Prof Kiyoshi Toda and Assoc Prof Hisao Ohtake, the University of Tokyo (at that time), for supervising my study and research when I was a student in Japan, as well as the academics at The University of Queensland, Australia, especially Profs Hubert Chanson and David Lockington and Dr Badin Gibbes. I appreciate miscellaneous kinds of supports from many academics, researchers, students, administrative officers, government officers, industries, and environmental nongovernment organizations (NGOs) in Japan, Thailand, and Bangladesh, especially for Prof Hidenobu Kunii and Prof Yasushi Seike, Shimane University, Japan, Prof Minoru Yoneda, Kyoto University, Japan, Prof Hidetoshi Kitawaki and Prof Toshiya Aramaki, Toyo University, Japan, Prof Suraphong Wattanachira, Chiang Mai University, Thailand, Assoc Prof Thammarat Koottatep, Asian Institute of

¹ <https://sites.google.com/site/yoshiakitsuzuki/>.

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Brisbane, December 2013

Yoshiaki Tsuzuki

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Abbreviations

BOD	Biological oxygen demand <i>or</i> Biochemical oxygen demand
CJ	Combined <i>johkasou</i> (<i>johkasou</i>) (<i>gappei-shori johkasou</i> in Japanese)
CO ₂	Carbon dioxide
COD	Chemical oxygen demand
DO	Dissolved oxygen
E. coli	Escharchia coliform
EAH (book)	Environmental accounting housekeeping (book)
EKC	Environmental Kuznets curve
FC (F. coli)	Fecal (faecal) coliform
Habitat	United Nations Centre for Human Settlements, UNCHS
IDIJ	Infrastructure Development Institute of Japan
IWA	International Water Association
JECES	Japan Education Centre of Environmental Sanitation
JICA	Japan International Cooperation Agency
JSCE	Japan Society of Civil Engineers
JSWE	Japan Society on Water Environment
MDGs	Millennium Development Goals
MFA	Material flux (flow) analysis
MLIT	Ministry of Land, Infrastructure, Transport and Tourism of Japan
NGO	Non-government organization
NST (system)	Night soil treatment (system) (<i>kumitori-benjo</i> in Japanese)
PCD	Pollution Control Department, Thailand
PDC	Pollutant discharge per capita
PGC	Pollutant generation per capita
PLC _{wb}	Pollutant load per capita flowing into water body
POPs	Persistent organic pollutants
PPP-GNI	Purchase power parity based gross national income
PROSANEAR	National sewerage strategy project of Brazil funded by the World Bank
SJ	Simple <i>johkasou</i> (<i>tandoku-shori johkasou</i> in Japanese)
SSL	Seepage and septage of septic tank and leachate of composting
TC (T. coli)	Total coliform
TEPCO	Tokyo Electric Power Co. Ltd

TMDL	Total maximum daily load
TN	Total nitrogen
TP	Total phosphorus
UASB	Upflow anaerobic sludge blanket
UNCHS	United Nations Centre for Human Settlements (Habitat)
UNEP	United Nations Environment Programme
UNICEF	United Nations Children’s Fund (former the United Nations International Children’s Emergency Fund)
USA	United States of America
US-EPA	Environment Protection Agency of the USA
WHO	World Health Organization
WPCF	Water Pollution Control Federation
WWTPs	Waste water treatment plants