MULTISOURCE

Publication of open-access textbook on NBS^{WT}

Deliverable 4.5

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Author(s)	Jaime Nivala
Primary Contact and Email	Jaime Nivala, jaime.nivala@inrae.fr
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TABLE OF CONTENTS

Executive Summary

Authored by Scott D. Wallace, Jaime Nivala, Guenter Langergraber, Pascal Molle, Marcos von Sperling, and Kela Weber, and published by CRC Press, **Treatment Wetlands, Third Edition** focuses exclusively on **Subsurface Flow (SSF) Wetlands: Process, Design, and Implementation**.

This book is presented as a companion to "Treatment Marshes" (Kadlec, 2020), which covers surface flow wetlands. Treatment Wetlands, Third Edition provides state-of-the-art coverage of SSF wetlands for treating various wastewater types, including municipal and industrial wastewater, combined sewer overflows (CSO), and sludge. It significantly updates previous editions, with an estimated 80 to 90% new material. The book is intended for a wide audience including researchers, teachers, students (from upper-division undergraduate to PhD), and practitioners from diverse fields such as environmental, sanitary, civil, and chemical engineering, as well as environmental science, biology, ecology, and chemistry.

The book is structured to balance theory and practice, with chapters dedicated to the fundamentals of wastewater treatment in SSF wetlands (covering hydrology, vegetation, energy flows, chemical interactions, and microbiology) and others providing the basis for implementation, including design, operation, and maintenance. It includes content presented at basic, intermediate, and advanced levels to cater to its broad readership. Notable new or entirely rewritten chapters cover topics such as Microbiology, Wetlands as Biological Reactors, Assessing Wetland Performance, Statistical Interpretation of Monitoring Data, Micropollutants, General Basis for Selection and Design, French Vertical Flow Wetlands, Aerated Wetlands, Fill-and-Drain Wetlands, Combined Sewer Overflow Wetlands, and Sludge Treatment Wetlands.

A strong didactic approach is employed to facilitate learning. The book is in color and features numerous summary tables, illustrations, photographs, charts, and practical examples. It includes fully worked-out application and design examples for main wetland types, supported by free, open-structure Microsoft® Excel spreadsheets available for download. A key feature promoting accessibility and knowledge sharing is the availability of the e-book version as a free online open access resource.

At the time of writing this report, the book is in its final stages of production and should be available before the end of 2025. All text has been written; final formatting of artwork and the reference list are expected to be finished by 31/05/2025.

Update 09/10/2025: All files for the book (text, figures, tables, references) have been submitted to the publisher Taylor and Francis. The book is currently being formatted in production by the publisher. The estimated timeline for this process is 3 – 6 months. The open access fee of 16,000 EUR has been paid in early 2025 before the project closing date. The 1,500 page book will be available as open access, free to download, as soon as it is finalized by the publisher.

1. Introduction

Treatment wetlands are a well-recognized and established form of wastewater treatment, with tens of thousands of systems in operation worldwide. They are included in the category of "*nature-based solutions*", which aim at providing water pollution control and environmental protection with a focus on sustainability. New developments and innovations have allowed for the evolving and expanding applicability of treatment wetlands. This upward trend is accompanied by interest from a growing number of researchers, students and practitioners, who add new layers of knowledge, but also are confronted with new and challenging questions that require clear, organized and answers based on experience and performance data that meets scientific standards for analysis and replicability.

2. Description of the book

Treatment wetlands are in a rapid phase of innovation and technology development, and the number of scientific papers published in the field has grown exponentially since the late 1970's (Kadlec and Knight, 1996; Kadlec and Wallace, 2009). In many ways, the last 20 years have been the "golden age" of wetland technology development and innovation due to parallel advances in academia and the private sector.

Researchers have been able to more accurately define fundamental wetland processes, such as systems ecology (Chapter 3), energy flows (Chapter 5), evapotranspiration (Chapters 3 and 5), and microbiology (Chapter 6). In conjunction with the academic community, most innovations and new wetland types were developed in the private sector, driven by a desire to solve environmental problems and a realization that certain wetland processes can only be accurately represented in full-scale systems (Chapter 8).

The role of the private sector has been the main driver for the development of French Vertical Flow Wetlands (Chapter 21), Sludge Treatment Wetlands (Chapter 25), Aerated Wetlands (Chapter 22), Fill-and-Drain Wetlands (Chapter 23), and systems treating combined sewer overflows (CSO Wetlands – Chapter 24). Each design chapter contains explicit design examples and accompanying information. A separate chapter is dedicated to the implementation and operation and maintenance of treatment wetlands. The book front cover is provided in Annex 1. The back cover will contain the project logo and EU logo. The full table of contents for the book is provided in Annex 2.

Treatment wetland systems are unique in their complexity (chemical, biological, geological, and hydraulic). Cross-disciplinary knowledge and approaches are required by those working, studying or researching and advancing treatment wetlands. As a result, reference books on this treatment process need to be comprehensive and cover a wide variety of disciplines in order to be truly useful. This is the approach that has driven the previous and current editions of this book.

3. Dissemination plan

This textbook is highly anticipated by the international treatment wetland community. Thanks to the funding from MULTISOURCE, the e-book will be open access on the first day of publication. The print copy will be available for purchase. The preview of the book was presented at the WETPOL conference in Brugges, Belgium in September 2023, followed by a release of the unformatted preview of the table of contents and draft Chapter 1 at the International IWA Specialist Group on Wetlands for Water Control in Fort-de-France, Martinique in November 2024. The South American organization on treatment wetlands INCT SbN have volunteered to translate the book into Spanish; another group of treatment wetland academics in China have offered to translate the book into Chinese. The fact that the e-book will be open access from day one of publication (no embargo, no cost to download) will ensure its widespread uptake in the international treatment wetland community.

The MULTISOURCE project has also applied to the Horizon Europe Booster programme for assistance in dissemination of our results (this book, as well as other scientific publications) that will come to fruition after the official closure of the project on 31/05/2025.

As coordinator, I (Jaime Nivala), have a permanent position at INRAE which also allows me flexibility to spend time on ensuring widespread dissemination of the new textbook, which has been submitted to the IWA Water and Development Congress which is to be held in Bangkok, Thailand in December 2025. This event draws approximately 10,000 participants per event, and the concept of bringing the book to this conference is to solicit volunteers to translate the text into multiple other languages (specifically, Japanese, Hindi, Portuguese, French, and Arabic and Bengali; achieving translations in the top eight languages spoken in the world).

4. References

Kadlec R.H. (2020) Treatment Marshes for Runoff and Polishing. Boca Raton, Florida, USA: CRC Press.
Kadlec R.H., Knight R.L. (1996) Treatment Wetlands, First Edition. Boca Raton, Florida: CRC Press.
Kadlec R.H., Wallace S.D. (2009) Treatment Wetlands, Second Edition. Boca Raton, Florida: CRC Press.

5. Annexes

5.1. Annex 1 – Book Cover

5.2. Annex 2 – Treatment Wetlands, Third Edition (Table of Contents)

5.3. Annex 3 – Treatment Wetlands, Third Edition (First Chapter)

The overall goal of MULTISOURCE is to, together with local, national, and international stakeholders, demonstrate a variety of about Enhanced Natural Treatment Solutions (ENTS) treating a wide range of urban waters and to develop innovative tools, methods, and business models that support citywide planning and long-term operations and maintenance of nature-based solutions for water treatment, storage, and reuse in urban areas worldwide. The project includes seven pilots treating a wide range of urban waters. Two individual municipalities (Girona, Spain; Oslo, Norway), two metropolitan municipalities (Lyon, France; Milan, Italy), and international partners in Brazil, Vietnam, and the USA will contribute to each of the main project activities: ENTS pilots, risk assessment, business models, technology selection, and the MULTISOURCE Planning Platform. The use of urban archetypes in the Planning Platform will enable users to quickly classify regions (in both developed or developing countries) suitable for the application of nature-based solutions for water treatment (NBSWT) and compare scenarios both with and without NBSWT.

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enhanced natural treatment solutions

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