Design Manual for Waste Stabilization Ponds in Mediterranean Countries

Design Manual for WASTE STABILIZATION PONDS in Mediterranean Countries

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Facultative pond at Ben Slimane,
Morocco (see Section 5.4)

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The European Investment Bank and the European Union bear no responsibility for, and are not in any way committed to, the views and recommendations contained in this Manual.

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Foreword

The European Investment Bank is very pleased to present this Design Manual for Waste Stabilisation Ponds in Mediterranean Countries, which has been prepared by Lagoon Technology International Ltd. with financial support from the Mediterranean Environmental Technical Assistance Programme (METAP).

When METAP was launched in the late 1980's, one of the aims of the European Investment Bank was to help actions at both regional and country levels. Within the third METAP cycle, the Bank considered it important to include a study to analyse the economic and project preparation aspects of waste stabilisation ponds (WSP). The objective of this Manual is to encourage the development of WSP wherever this wastewater treatment technology is appropriate. It gives information about policy and institutional development as well as design and operational processes. The Manual should be used as a starting point for decisions on the convenience and desirability of using WSP whenever local circumstances are favourable for their adoption. The Bank hopes that in this way WSP technology will become more widely used throughout the Mediterranean region.

We would like to thank Professor Duncan Mara and Dr Howard Pearson for their cooperation, and also the Department of Infrastructure II of the Bank's Project Directorate whose idea this Manual was and who wished to see WSP included within the selection framework for wastewater treatment processes in the Region.

Christian Careaga
METAP Coordinator
European Investment Bank
August 1998

Preface

Waste stabilization ponds are an extremely appropriate and sustainable method of wastewater treatment in many situations in Mediterranean countries, and we hope that this Manual will serve to promote modern pond design in the Region. Of course design by itself is not enough: operation and maintenance are crucial, but fortunately with ponds this is very much simpler and requires less skilled labour than is the case with electromechanical treatment processes. Guidance is also given on pond monitoring and evaluation, and this can lead to improved design – there is no substitute for local data. Sometimes, because of more rigorous legislation or neglect, pond systems need upgrading or rehabilitation, and this is also discussed.

In several countries of the Region wastewater is generally too valuable to waste, and the reuse of pond effluents for crop irrigation or for fish culture is very important in the provision of high quality food. In semi-arid zones, the use of wastewater storage and treatment reservoirs is advantageous as it permits the whole year's wastewater to be used for irrigation, thus enabling the irrigation of a much larger area and consequently much higher crop production.

Duncan Mara and Howard Pearson

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ABBREVIATIONS

BOD	Five-day, 20ºC biochemical oxygen demand
Chl	Chlorophyll
COD	Chemical oxygen demand
DWF	Dry weather flow
FAO	Food and Agriculture Organization
FC	Faecal coliform(s)
SAR	Sodium absorption ratio
SS	Suspended solids
TWL	Top water level
WHO	World Health Organization
WSP	Waste stabilisation pond(s)
WSTR	Wastewater storage and treatment reservoir(s)

PRINCIPAL NOTATION

A	Pond area
B	BOD contribution per caput per day; pond breadth
C	Concentration
D	Pond depth
e	Net evaporation
k	First-order rate constant
L	BOD concentration; pond length
N	Number of FC
n	Number of maturation ponds
P	Population
Q	Flow
s	Seepage
T	Temperature
V	Volume
θ	Mean hydraulic retention time
λ_s	BOD surface loading rate
λ_v	BOD volumetric loading rate

Subscripts

a	Anaerobic
e	Effluent
f	Facultative
fp	Fishpond
i	Influent
m	Maturation