

**STORMWATER DRAINAGE
AND LAND RECLAMATION
FOR URBAN DEVELOPMENT**

United Nations Centre for Human Settlements (Habitat)

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CONTENTS

	<i>Page</i>
FOREWORD	
INTRODUCTION	1
A. Background	1
B. Purpose of the report	1
C. Scope of the report	1
I. URBANIZATION AND THE DEMAND FOR URBAN LAND	2
A. Current trends in urban growth	2
B. Increases in land prices and the use of marginal land	5
C. Specific problems of the urban poor	5
D. Urban health in marginal settlements	10
E. Conclusions	10
II. POTENTIAL IMPACTS OF STORMWATER DRAINAGE AND LAND RECLAMATION PROJECTS	14
A. Urban land-use planning	14
B. Urban health	14
C. Socioeconomic benefits	14
III. TECHNICAL OPTIONS FOR STORMWATER DRAINAGE AND LAND RECLAMATION	16
A. Stormwater management	16
B. Drainage system components	17
C. Storage: detention and retention	17
D. Drainage system design	22
E. Land reclamation options	24
F. Land stabilization	29
IV. MAINTENANCE	32
A. Maintenance objectives	32
B. The maintenance programme	33
C. Review of maintenance	33
D. Institutional arrangements for maintenance	34

V.	PROJECT APPRAISAL	38
	A. Technical appraisal	38
	B. Social and health impact appraisal	38
	C. Economic and financial appraisal	38
	D. Institutional appraisal	40
VI.	CONCLUSIONS AND AREAS FOR FURTHER RESEARCH	41
	BIBLIOGRAPHY	42
	<i>Annex</i>	
	STORMWATER DRAINAGE DESIGN PROCEDURES	45

FOREWORD

The potential socioeconomic benefits of urban stormwater drainage are huge: improved health and quality of life in existing low income human settlements, and the availability of additional usable urban land reclaimed by drainage projects which can be used for human settlements or industry and commerce. Properly designed and maintained stormwater drainage projects almost always increase substantially land values.

This report has been prepared in response to the increasing need for those involved in urban land use and management to develop efficient and cost-effective urban stormwater drainage programmes. It focuses specifically on the socioeconomic and engineering factors involved in such programmes, with special emphasis on appropriate strategies for proper operation and maintenance, as well as providing sound advice on planning and design. Operation and maintenance of stormwater drainage projects has all too often been neglected in the past - frequently it has been done only in response to emergency situations: this is both costly and inefficient. Detailed engineering advice is given in the annex to the report; this is basically a stormwater design manual.

The very rapid increase in urbanization that is currently occurring in developing countries is an irreversible fact of life facing urban planners and city engineers. The demand for urban land is correspondingly enormous and I am confident that this publication will be invaluable to those professionals involved in urban land management and urban stormwater drainage. These two disciplines together have the ability to regenerate vast areas of land in developing country cities, land that is currently unable to be fully utilized due to inadequate or non-existent stormwater drainage. I hope therefore that this report will serve as a useful starting point in increasing awareness of the need for appropriate strategies for urban stormwater drainage, so that the supply of usable urban land increases.

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INTRODUCTION

A. Background

The management of rainfall and the resulting stormwater flows is an essential feature of healthy cities. This is best illustrated by considering an urban area devoid of any such management practices: during times of intensive rainfall two events commonly occur - flooding of low-lying areas, and landslides on steep slopes which have been denuded of their natural protective vegetation in order to provide space for human settlements. The latter is perhaps the more dramatic: the shacks of the poor are demolished by the landslide which generally continues downhill to damage seriously the houses of richer communities. However, the health, both physical and mental, of those living in flooded low-lying areas is often much more adversely affected. vector-borne diseases (such as urban malaria, filariasis, even schistosomiasis and yellow fever) become established as the open waters provide opportunity for the vectors to breed very rapidly; and diarrhoeal diseases - together with malaria, a major killer of children - and geohelminthic infections also become endemic. Urban communities living in such settlements have a very poor health profile, and their productivity is correspondingly low. This is not only to their personal disadvantage but, on a strictly commercial basis, is detrimental to the local industries and businesses that employ them. While stormwater management is not a magic panacea, it is an essential component of urban development in general and of urban health in particular.

Land subject to regular flooding or landslides has a relatively low value. Stormwater management increases the value of land as it then becomes available either for improved - healthier - human settlements or for more economically productive uses such as industry and commerce. The increases in land values are usually, at least in properly planned and implemented schemes, quite substantial: this benefit alone is economic justification enough for stormwater management projects to proceed.

B. Purpose of the report

This publication is intended to assist those who

management. It seeks to promote the role of stormwater drainage in the production of urban land particularly for human settlements, but also for commerce and industry, through the stabilization or reclamation of land that is currently unsuitable for such use because it is subject to permanent, seasonal or freak flooding. Specifically the purposes of the report are:

(a) To create awareness amongst urban land use planners and municipal engineers in developing countries of the economic and social benefits of the provision of good urban stormwater drainage;

(b) To provide technical information on the design of urban stormwater systems and land reclamation techniques, so that currently unsuitable urban land that is low-lying and subject to inundation, or on hillsides subject to storm-induced landslides, may be converted into safe land that can be used for low-income human settlements or for industry and commerce.

C. Scope of the report

Chapter I discusses current trends in urbanization and the effects these have on land prices and the consequent necessity for the urban poor to settle on marginal land that is subject to flooding. It also discusses the major health problems faced by those living in these settlements. Chapter II identifies the potential impacts of urban stormwater drainage and consequent land stabilization and reclamation - the implications for urban land-use planning, effects on health and the resulting socioeconomic benefits. Chapter III addresses the engineering factors involved in urban stormwater drainage and land reclamation and stabilization, with emphasis not only on appropriate planning and design (details of the latter are presented in the annex) but also, in chapter IV, on operation and maintenance which is all too frequently done inadequately so that the full potential benefits of urban drainage projects are not realised. Chapter V provides guidance for the appraisal of urban stormwater drainage projects and, finally, chapter VI identifies areas for further action and research.

I. URBANIZATION AND THE DEMAND FOR URBAN LAND

A. *Current trends in urban growth*

The current position and trends in urbanization in developing countries have recently been summarized in a UNDP Strategy Paper (see box I.1). This rapid and sustained growth in the size of cities and towns creates a correspondingly huge demand for and pressure on land, principally but not exclusively for housing. In addition to land for housing, however, there is a need for land for urban infrastructure - roads, drainage and utilities - and for commercial, industrial and recreational purposes. While there is such a need for land and while in practice, as will be noted below, land is being used for urban purposes, there is in many respects a crisis in urban land-use policy in many cities around the world - a crisis that has been caused by a desperate mismatch between the official supply of land and the demand for it. The root cause of this crisis must briefly be outlined.

The root of the current crisis is that, usually with the best of intentions, governments have adopted policies which have unfortunately and far too frequently contributed to land shortages rather than land availability. These policies have emphasised control and regulation over land use and its supply, rather than enabling and facilitating its release. These policies generally stress the maintenance of inappropriate standards - standards often inherited and accepted uncritically from former colonial powers - rather than focus on the appropriateness and affordability of such standards. Government policies have also either shied away from, or attempted to impose inappropriate legal regimes on, traditional land-tenure practices which have consequently inhibited the release of land with clear titles for urban use. Finally, these policies generally place too much emphasis on public ownership, management and development of urban land, and the resulting heavy bureaucracy normally impedes the release of land. Some examples of these defective policies are given below.

Control and regulation of supply and use

There are few better examples of attempts to control the supply and price of urban land than the Urban Land (Ceiling and Regulation) Act 1976 of India. A respected commentator has this to say about the Act and its operation:

This Act was aimed at socializing all land in excess of a given quantum on payments of a nominal amount, thus making available large chunks of strategically located land for use by the common man. Exemptions can be granted from the operation of the Act. The phenomenon of granting exemptions to large property owners, bogus cooperative societies who enter into agreements to purchase land, commercial builders etc. is universal with the result that the very purpose of the Act has been defeated.

The National Commission on Urbanization has likewise concluded that the Act has failed to achieve any of its objectives. This has not, however, prevented a very rapid rise in urban land prices all over India and a concomitant shortage of affordable land for housing for the urban poor.

Nigeria may be instanced as another country where similar legislation - the Land Use Act of 1978 - has done nothing to bring more land forward for urban development, but which has created yet another layer of bureaucracy and corrupt practices which must be overcome before land can be developed.

Even where the supply of land is not controlled, its use too often is. Inappropriate metropolitan models of town and country planning legislation (some of them dating back 70 or more years with emphasis on control of development, and the obligation to seek, via official forms, permission to build a house) simply render the self-build efforts of the poor illegal and liable to demolition.

The maintenance of inappropriate standards

Two aspects of this deficiency are plot size and building regulations. Over-large plot size

Box I.1. Current urbanization trends in developing countries

The relentless growth of cities is inevitable and irreversible. Standing at 2.4 billion in 1990, the world's urban population will rise to 3.2 billion in 2000 and 5.5 billion in 2025. The developing countries' share in these totals - 63 per cent in 1990 - will rise to 71 per cent in 2000 and 80 per cent in 2025. By the end of the 1990s, Mexico City will have almost 22 million residents. Calcutta, Shanghai and Bombay will each have more than 15 million, and 13 other cities in developing countries will have more than 10 million: Seoul, Cairo, Dakar, Delhi, Lagos, Beijing, Bangkok, Manila, Jakarta, Karachi, Tianjin, Buenos Aires and Rio de Janeiro. In addition to the growth of these megacities, the growth of small and medium-sized cities will also continue.

For decades this growth was seen as inimical to human development. Cities already benefited disproportionately from national development efforts, urban development was more costly than rural development and the growth of cities merely added to unemployment - these were the prevailing views. So, government policy and international assistance gave greater attention to the countryside.

Today the growth of cities is seen increasingly as essential for human

numbers are much higher in countries with more of their people in cities. The economies of scale in large cities generate goods and services far in excess of their share of the total population. This higher productivity of urban labour means that wages are higher and unemployment opportunities greater, especially for women. Cities also give their residents the knowledge and skills to become more productive - a propitious cycle. Cities promote the modernization of agriculture, provide markets for farm goods and reduce pressure on land.

Despite the obvious efficiency advantages of cities, the negative consequences of urbanization for low-income groups are overwhelming. Simply, many city dwellers in developing countries live in crushing poverty - more than 300 million, or a quarter of all those in urban areas. That number promises to swell. By 2000 more than half the developing countries' poor will be in cities and towns: 90 per cent in Latin America, 45 per cent in Asia and 40 per cent in Africa. Their living conditions are alarming, for their numbers far outstrip the supplies of water, waste removal, transport and clinics. Nor do they and their richer neighbours help the environment using natural resources and discharging wastes in disturbing quantity, with all the predictable effects.

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