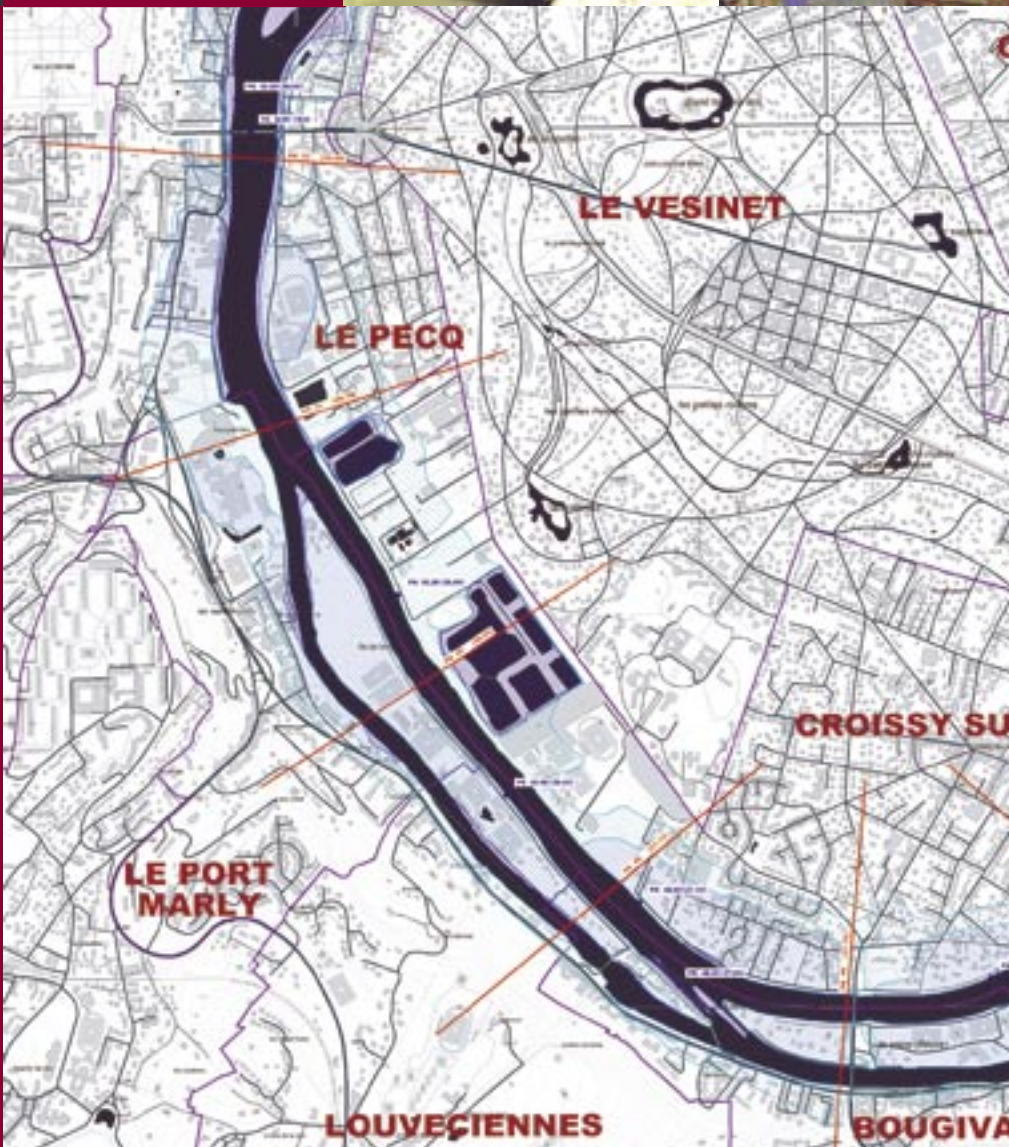


# ISTED

## Systèmes d'information géographique et gestion durable de l'eau

*Geographic information systems and sus-  
tainable water management*



Cet ouvrage, réalisé dans la perspective du III<sup>ème</sup> Forum Mondial sur l'Eau (Kyoto, 16-23 mars 2003) est le résultat d'un partenariat entre l'Institut des Sciences et Techniques de l'Équipement et de l'Environnement pour le Développement (ISTED), du Conseil National de l'Information Géographique (CNIG) et de la Direction de la Recherche et des Affaires Scientifiques et Techniques du ministère de l'Équipement, des Transports, du Logement, du Tourisme et de la Mer (DRAST/METLTM).

Sa réalisation a été menée à bien par un comité de pilotage réunissant, Gilles ANTIER, directeur des Affaires internationales de l'IAURIF, Josette LE-FOLL-PICOU, chargée de mission à la Direction des Affaires économiques et internationales (DAEI) du ministère de l'Équipement, des Transports, du Logement, du Tourisme et de la Mer, et, Patrice GEIGER, chargé de mission au Conseil national de l'information géographique (CNIG), sous la direction de Veronica RENGIFO, chargée de mission au pôle «Ville» de l'ISTED.

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*It has been drawn up by a Steering Committee consisting of the following members: Gilles ANTIER, Director of International Action, IAURIF, Josette LE-FOLL-PICOU, Task Officer, Department of Economic and International Affairs, Ministry of Public Works, Transport, Housing, Tourism and the Sea, and Patrice GEIGER, Task Officer, National Council for Geographic Information, under the direction of Veronica RENGIFO, Task Officer, «Cities Department», ISTED.*

# Editorial

The key role played by water in meeting vital elementary human needs, such as health or food, has placed it at the centre of debate. To advance development and eradicate poverty, the United Nations have set millennium goals to be achieved by 2015, which include the sustainability of ecological resources. The announcement made at the Sustainable Development Summit in Johannesburg (26 August – 4 September 2002), which aims to halve the proportion of the population without access to drinking water and sanitation, clearly demonstrates the challenge facing governments. One in five people lacks access to drinking water and nearly one in two does not have proper sanitation facilities.<sup>1</sup> Yet they are two key components of access to essential services.

The management of water resources is a responsibility that must be shared by all. The creation of a favourable environment that will enable a holistic, integrated approach to resources, the provision of adequate services to improve mankind's living conditions, the availability of fresh water, the protection of ecosystems or the management of water-related hazards such as floods or pollution, are all matters of concern to us and challenges to be tackled in the 21st century<sup>2</sup>.

The third World Water Forum to be held from 16 to 23 March 2003 in Kyoto is the opportunity to take part in a global dialogue on solutions to be adopted for more sustainable management of water resources. The considerations underlying this management are as much political, financial and institutional as technical. Geographic information is high on the agenda of technological developments able to respond to needs for data on water. It was for this reason that ISTD and CNIG<sup>3</sup>, with the help of the Directorate of Research, Science and Engineering of the Ministry of Public Works, decided to devote this volume to the role that geographic information systems can play in improving conditions of water management.

The development of information systems involves the collaboration of partners from the public sector (such as local authorities or decentralized State departments) and the private sector (consultants, contractor companies, etc.) which is necessary for the integrated management of basins. The applications are all tools for the implementation of protection, monitoring and long-range planning policies. French experience in these fields is diverse and we have chosen to present here a collection of practical achievements that can provide input for work and discussion on the use of new information and communication technologies dedicated to the environment and sustainable development.

**Jean-Pierre DUFAY**

*President of the «Cities Department»,  
ISTED*

1 The Human Development Report of the United Nations Development Programme (UNDP) announces figures for 2000 of 1.1 billion people without access to drinking water and 2.4 billion without any form of sanitary facilities.

# Introduction

## *GIS: From geographic information to sustainable development*

The mainstreaming of water into a long-term perspective requires a complex approach that takes different dimensions into account. A socio-economic dimension to optimize water management in all sectors of economic activity; a social dimension to provide equal access for all to the resource; an environmental dimension because a water policy must be integrated into a more broad-based perspective such as that of land use planning, hazard management or ecosystem protection measures; and lastly a political dimension involving all partners, beneficiaries and users in decision-making. Such a holistic vision is essential in order to take action conducive to the preservation and the most appropriate handling of this medium.

Water forms part of a complex system for which means of knowledge and information access are a vital part of good management. The use of information and communication technologies offers a vast range of possibilities for establishing new approaches to the collection and use of water data while revolutionizing information efficiency and the cost-benefit ratio of data programmes. In this respect, geographic information systems (GIS) which combine mapping and database management, offer optimized, individualized representations of this medium, where there are many actors.

Geographic information systems enable the challenge of resource knowledge to be met both from a quantitative and a qualitative point of view. For instance, access to information on hydrography and the aquatic environment of a river, superimposed on information such as existing communication systems, facilitates study of the natural environment and its response to human activity. Basin management organizations can thus be provided with input for defining technical solutions, planning and programming on a medium and long-term basis, and for information and awareness-raising actions. As a result, GIS systems, which concern both surface and subsurface water, participate in the protection and restoration of the water resource, and in the management of water quality by monitoring the status of use and by optimizing drinking water reserves in urban areas, in the interests of transparency and accessibility.

Geographic information systems and modelling tools aim to create the best possible representation of reality either by reconstructing spatial relations or by determining time trends between objects. Furthermore, the integration of the cartographic vision provides landmarks for a given problem and creates a dynamic, user-friendly tool that is not only a means of information for all but also an essential decision-aid component in cases as diverse as the management of a marine park in Honduras or irrigation schemes in Senegal.

By integrating mapping information and data on the natural, human, economic and industrial environment, geographic information systems provide a response to local management and land use planning challenges while taking into account environmental hazards. Geographic information and the generation, consultation or use of mapping data are essential to practitioners dealing with environmental hazard problems. These data are useful for the different phases of hazard management to draw up risk prevention plans, determine regulatory areas, prepare response plans, protect against and reduce impacts, mobilize response teams, make economic assessments, identify vulnerability and thereby make improvements to policies and to crisis management. These data are important, for instance, for projecting urbanization and planning scenarios onto the hydrography of a catchment basin.

It is thus possible to associate geographic, technical and economic information in order to match up the information required for the management of water supply networks, facilitate maintenance work, or make provision for the network extensions required to cope with demographic and urban growth, by monitoring consumption to predict its patterns of change. In this way, the water supply service can be optimized towards providing high output of a limited resource that is costly to produce and distribute. The use of GIS thus facilitates management able to combine the aspects of maintenance, network renewal, improvement of commercial management and optimization of investment plans for network renewal or rehabilitation.

The potential of GIS systems is used to provide historical and actual data on the quality and availability of the resource and its management in water supply networks or in hazard situations, and to optimize these data by linking them with mapping. However, the results of this tool can only be reliable if the quality of the data is verified.

The case studies presented here reflect the diversity of uses applied to water management. They address the contribution of GIS to the management of water resources both in France

to protect populations is also of vital importance. Lastly, the question of access to drinking water for all is addressed through network appraisals with a view to ensuring the quality of the water supply. These are thus the elements which demonstrate that GIS systems are tools offering rich new prospects for all water policy management and implementation processes.

**François PERDRIZET**

*Director,  
Directorate of Research,  
Science and Engineering  
of the Ministry of Public Works, Transport,  
Housing, Tourism and the Sea*

**Michel BARBIER**

*President,  
National Council  
for Geographic Information*