Sustainable Development and the Urban Water Sector Reform in Dakar, Senegal:

The Politics of Neoliberalism in a Developing Country

by

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A dissertation submitted to the Graduate Faculty in Political Science in partial fulfillment of the requirements for the degree of Doctor of Philosophy, The City University of New York

2012

This manuscript has been read and accepted for the Graduate Faculty in Political Science in satisfaction of the dissertation requirements for the degree of Doctor of Philosophy.

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Abstract

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Sophie Theven de Gueleran

Advisor: Irving Leonard Markovitz

The 1996 urban water sector reform in Senegal is not the sustainable development success claimed by its proponents. Privatization and cost-recovery management resulted in poor water and sanitation services unaffordable to many, increased access inequalities, and accelerated water resource destruction. Dependent on profitmaking and users' ability to pay, service provision did not improve the satisfaction of basic water needs for all and the protection of water resources, nor reduce poverty and waterborne diseases.

The water reform pursued the liberalization of Senegal's economy, opening new resources to the capitalist world economy and extending the inequity and destructiveness of this system to the water sector. Integrating water services into the global market, the reform served the interests of the international and Senegalese business sector, not those of the Senegalese people.

The reform process was an exemplary case of the workings of the neoliberal hegemony. Though the international financial institutions imposed the reform for continued lending, the

Senegalese government and water sector officials and professionals endorsed it, encouraged by their ideological orientations. The spread of neoliberal economic ideas had paralleled the liberalization process since the late 1970s, and by the time of the reform the idea that privatization and commercial management would improve efficiency, and therefore water services and resource preservation, was pervasive. The reform was a sustainable development endeavor good for people and good for the environment. Ideology helped justify the reform.

The United Nations played an ideological role that facilitated the adjustment of Senegal to the interests of powerful international actors. Through the elaboration of a neoliberal notion of sustainable development and water policy guidelines, the UN encouraged the adoption of neoliberal water reforms in developing countries. As the World Bank and the business sector came to dominate UN policymaking for "environmental" services, the policy discourse eliminated ecological concerns from sustainable development. From challenging the capitalist growth development model and promoting the adjustment of human activities to environmental limits, the concept reconciled economic growth with environmental preservation and social improvement. Policies to privatize and manage water services for profit became sustainable, conducive to resource protection, social equity and democratic participation.

Acknowledgements

I am indebted to numerous persons for their support and inspiration toward the achievement of this dissertation.

Ikeda Sensei, thank you so much!

Daisaku Ikeda, president of the Soka Gakkai Internaitonal, you inspired me to consider writing a PhD dissertation and have the courage to see it through. Your constant encouragements since my teen years, stressing that we all can do so much more than we think, made me dare have a bigger vision for my life and follow my aspirations to contribute to the "Century of Africa".

To all the interviewees in Senegal, France and the US, whose names I cannot mention for the sake of anonymity, thank you!
You gave substance to this work. Your generously shared your time, thoughts, and knowledge, and made me discover much more than what I was looking for. Your strength and hope in front of often-desperate situations was an invaluable lesson. Some of you became friends. I hope to continue working with some others.

Meer Amsatu, sama yaay, ag Paate Njiaay, sama mag bu goor, jerejef lu bari!
Amsatu Diagne and Pathe Njayy, I cannot imagine my stays in Dakar without your attention, care and affection—watching over me like the family you became.

Lenny, thank you so much!
Prof Irving L. Markovitz, you supervised this work from the beginning and did not give up on me, even when I almost did. You patiently read my long, overdetailed drafts, walking through the arguments, knowing sometimes better than me what I was trying to get at.

Tom, thank you!!

Prof Thomas G. Weiss, working with you for UNIHP was a great opportunity and a source of stimulation that largely contributed to this work: digging into development ideas, and meeting with UN pioneers, some of great humanity and intellect, living pages of a very interesting history. Your comments on this work supported the completion this final version.

Ofuatey, thank you!

Prof W. Ofuatey-Kodjoe, you were a major source of inspiration throughout my studies, nourishing my interests for Africa, development and international relations. You attested to the fact that meaningful intellectual work is grounded in values and social justice—the purpose of "organic intellectuals." Receiving the first W. Ofuatey-Kodjoe Award for African Policy Research the day I defended this dissertation was the best possible way for me to honor your memory.

Among all the friends who were present along the way,

Angelo, thank you!

Angelo Branford, your patient and enduring support that survived time and storms accompanied the entire dissertation process.

Maria, thank you!

Maria-Elena Pizarro, PhD Candidate in Political Science, my first audience, you let me to test on you the clarity and strength of my arguments. You were the best reader: agreeable but sharp and demanding.

Miriam, thank you my dear friend!

Prof Miriam Jimenez, thanks to you I finished this work and passed through a couple of difficult years in the best possible conditions.

Daniele, merci!

Daniele Leboul, my mother, your political involvement during my childhood was the first source of inspiration that led to this work. You exposed me to social issues (inequalities, immigration, racism) waking up in me a sense of social engagement at an early age.

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Acronyms

ACASE	Amicale des Cadres des Sociétés d'Eau Association of Water Comapanies' Executives
ACDI	Agence Canadienne de Développement International Canadian International Development Agency
ADB/BAD	African Development Bank
ADM	Agence de Développement Municipal Municipal Development Agency
AFD	Agence Française de Développement French Development Agency
AMCEN	African Ministerial Conference on the Environment
AMCOW	African Ministerial Conference on Water
ANLIB	Agence Nationale de Lutte contre les Inondations et les Bidonvilles National Agency to Fight against Floods and Shanty towns
APIX	Agence pour la Promotion des Investissements et Grands Travaux Agency for the Promotion of Investments and Major Works
ASECNA	Agence pour la Sécurité de la Navigation Aérienne en Afrique African Aerial Security Agency
BADEA	Banque Arabe de Développement Economique en Afrique Arab Bank for Economic Development in Africa
BEI	Banque Européenne d'Investissement European Investment Bank
BOAD	Banque Ouest-Africaine de Développement West African Development Bank
CFA Franc	Communauté Financière Africaine Franc African Financial Community Franc
CNTS	Confédération Nationale des Travailleurs du Sénégal Senegal National Workers Union
CONAGPI	Commission Nationale pour la Gestion Prévisionnelle des Inondations National Commission for the Forecast Management of Floods
CREPA	Centre Régional pour l'Eau Potable et l'Assainissement Regional Center for Drinking Water and Sanitation

DEEC	Direction de l'Environnement et des Etablissements Classés Direction for the Environment and Landmarks
DGPRE	Direction de la Gestion et de la Planification des Ressources en Eau Direction for the Management and Planning of Water Resources
ECA	Economic Commission for Africa
ECE	Economic Commission for Europe
ECLA	Economic Commission for Latin America
ECOSOC	Economic and Social Council
EFF	Extended Fund Facility
EPIC	Etablissement Public à caractère Industriel et Commercial Commercial and Industrial Public Company
ESAF	Extended Structural Adjustment Facility
ESAs	External Support Agencies
FAO	Food and Agriculture Organization
GIE	Groupement d'Intérêt Economique Economic Interest Grouping
GPOBA	Global Partnership for Output Based Aid
GWP	Global Water Partnership
IAEA	International Atomic Energy Agency
IAGU	Institut Africain de Gestion Urbaine African Institute for Urban Management
IBP	International Biological Programme
ICWE	International Conference on Water and the Environment
IDA	International Development Association
IFAN	Institut Fondamental d'Afrique Noire Fondamental Institute of Black Africa
IHD	International Hydrological Decade
IHP	International Hydrological Programme
IMF	International Monetary Fund

IUCN	International Union for the Conservation of Nature
IUPN	International Union for the Protection of Nature
IWRM	Integrated Water Resources Management
JICA	Japanese Cooperation Agency
KfW	Kreditanstalt für Wiederaufbau German Development Bank
LD-MPT	League Démocratique-Mouvement Pour le Travail Democratic League-Movement For Labor
MAWAC	Managing Water for African Cities
MDGs	Millennium Development Goals
NEPAD	New Partnership for Africa's Development
NIEO	New International Economic Order
OAU	Organization for African Unity
OECD-DAC	Organization for Economic Cooperation and Development- Development Assistance Committee
OMVS	Organisation pour la Mise en Valeur du Fleuve Sénégal Senegal River Basin Development Authority
ONAS	Office National de l'Assainissement du Sénégal National Sanitation Agency of Senegal
PAGIRE	Plan d'Action pour la Gestion Integrée des Ressources en Eau Action Plan for the Integrated Management of Water Resources
PAQPUD	Projet d'Assainissement des Quartiers Péri-Urbain de Dakar Sanitation Project for Dakar Peri-Urban Neighborhoods
PDS	Parti Démocratique Sénégalais Senegalese Democratic Party
PEPAM	Projet pour l'Eau Potable et l'Assainissement du Millennaire Millennium Drinking Water and Sanitation Project
PIT	Parti pour l'Indépendence et le Travail Party for Independence and Labor
PLT	Projet Eau à Long-Terme Long-Term Water Project

PNAE	Plan National d'Action pour l'Environnement National Action Plan for the Environment
PNES	Partenariat National de l'Eau du Sénégal Senegal's National Water Partnership
PRSP	Poverty Reduction Strategy Paper
PSE	Projet Sectoriel Eau Water Sector Project
SAPs	Structural Adjustment Programmes
SdE	Sénégalaise des Eaux
SONEES	Société Nationale d'Exploitation des Eaux du Sénégal National Company for the Exploitation of Senegal's Water
SONES	Société Nationale des Eaux du Sénégal National Company of Senegal's Water
SUTES	Syndicat Unique des Travailleurs des Eaux du Sénégal Senegal Water Workers' Union
UNCED	United Nations Conference on Environment and Development
UNCHS	United Nations Center for Human Settlements
UNCSD	United Nations Commission on Sustainable Development
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Education, Science and Culture Organization
UNICEF	United Nations Children's Fund
UNSAS	Union Nationale des Syndicats Autonomes du Sénégal Senegal's National Union of Autonomous Trade Unions
UNSCCUR	United Nations Scientific Conference for the Conservation and Utilization of Resources
UNSIA	United Nations System-wide Special Initiative on Africa
USAID	United States Agency for International Development

UTIS	Union des Travailleurs Indépendants du Sénégal Independent Workers' Union of Senegal
WASAI	Water and Sanitation African Initiative
WCED	World Commission on Environment and Development
WHO	World Health Organization
WSP	Water and Sanitation Program
WSSD	World Summit on Sustainable Development
WUP	Water Utility Partnership
WWF	World Wildlife Fund

Chapter 1

Introduction

In Senegal, as in many developing countries in Africa, water shortages, pollution, and distribution problems, as well as insufficient sanitation services, severely affect the lives of the vast majority of the country's poor. In Dakar, the capital city, inadequate access to drinking water, polluted water sources and lack of sanitation make people sick and hinder their activities.

By the 1980s, the urban water sector was faced with the task of providing increasing volumes of safe water to urban users in a situation characterized by inadequate water resources and infrastructures. Local water sources had become insufficient and polluted, while population increase and the development of agriculture and industry required more and more water. To remedy the situation, in 1996 the government of Senegal adopted a water sector reform, encouraged by the International Financial Institutions and ostensibly guided by the notion of "sustainable development." Sustainable development held the promise of better development, improved living conditions and economic prospects, and environmental protection.

A decade later, the reform's protagonists (World Bank, Senegalese officials) present it as a success story and use it as an example of best practices. The reform introduced a private operator, implemented the demand-driven development and cost-recovery management of water services, and allowed funds to be available for infrastructure development. Water supply and sanitation coverage increased. Measures to satisfy the needs of the poor and manage water resources were implemented. The sector reached financial equilibrium in 2003.

This dissertation will show, however, that contrary to claims of success and the promises of sustainable development, the evolution of water services and the destruction of water resources since the reform are for many Dakar residents more of a catastrophe than a success story. Access to services has grown more unequal and the needs of many are not satisfied. The poor have either no access or pay more for worse services. When distributed supply is available,

those who cannot afford it resort to polluted underground water. The price and quality of sanitation services differ greatly between urban areas. In poor suburb areas, residents handle their own excreta because services are unavailable, inadequate or unaffordable. The lack of wastewater treatment plagues these areas the most. Rainwater drainage cannot cope with the increasing severity of floods, particularly in the suburbs. With lack of sanitation and inadequate water supply, waterborne diseases are rampant, affecting children the most and killing people every year.

Since the reform, the depletion and pollution of water resources proceed at an accelerated pace. The water sector increased their exploitation and its sanitation activities contribute to their pollution. Water sources are now so polluted that they are lost, or so overexploited that they are not renewed.

This chapter introduces the research questions and main arguments of this dissertation. It presents the hypotheses being tested, defines the major concepts involved, and presents the strategy used for gathering data and evidence. The chapter then explains the relevance of this work and presents the theoretical debate in which it takes place. Finally, it outlines the major findings of each chapter.

I. Research Questions and Thesis

The discrepancy between the asserted success of the Senegalese water reform and its sustainable development promises and the actual impacts of the reform on people's lives and water resources raises question about the ability of a neoliberal economic reform to provide adequate services to all and protect water resources; and about the role of sustainable development, an internationally accepted development policy guideline, in the adoption of such reform in Senegal and its significance when applied to water service management.

"Sustainable development" became a guiding principle for development policies at the end of the 1980s. International development and business circles, national governments and civil society endorsed the notion. Sustainable development guided the elaboration of water

resource development and management principles. UN water programs and water reforms implemented in developing countries became sustainable development efforts.

These reforms included the privatization of water distribution, with multinational water companies taking over infrastructure operation and sometimes development. Sustainable development implied these policies pursued the goals of improved and more equitable access to drinking water and sanitation services and protecting water resources. One can wander, however, what was "sustainable" and new about a type of reform commonly encouraged by international and bilateral lenders in developing countries since the late 1970s.

Since the reform, who benefited from improved services and who saw their situation worsen? Who were the actors behind the adoption of the reform? What was their purpose? How did they perceive the notion of sustainable development? What was the role of the concept in the reform process? What is "sustainable development?" if the notion carries universal values, does it have different interpretations? How did one interpretation come to dominate international development circles? How was it integrated into neoliberal water policies? Are neoliberal water reforms inherently inequitable and destructive? What would be a sustainable development reform based on an alternative understanding of the notion?

This dissertation analyses and documents the impacts of the 1996 reform on access to water services in the Dakar region and on the sustainability of water resources. In the process, it seeks to determine elements for a sustainable development of water services that would ensure basic water needs for all and protect water resources. This dissertation then attempts to explain the discrepancy between the claimed success of the reform and its sustainable development expectations, and its actual consequences by analyzing the process that led to its adoption and the role of sustainable development in that process, as well as the evolution of the notion and its application to international water policies.

The main arguments of this work are the following: Neoliberal water reforms cannot provide adequate services to all, ensure the needs of the poor are satisfied, and protect water

resources. The Senegalese reform served international and local business interests, the government's development objectives and search for international funding, and high-ranking officials and civil servants benefiting from development projects. Dominant international actors (powerful states, the international business sector and financial institutions) endeavored through the United Nations system to transform sustainable development into a neoliberal economic notion, apply it to water policy guidelines, and use it to promote neoliberal water sector reforms in developing countries in the pursuit of business interests and economic growth. The Senegalese reform was no exception. Its implementation supported a development process that does not seek social progress and environmental sustainability, but profit and growth. In contrast, a conception of sustainable development concerned with environmental and social objectives has different implications for water policy. Improved access for all and water resource protection become primary goals. Water resources' sustainability requirements would determine their exploitation and regulate human activities; resource availability and the goal of satisfying basic water needs for all would help establish priorities among water uses.

II. Hypotheses and Concepts

My first hypothesis is that neoliberal water policies do not pertain to sustainable development but, sustaining a capitalist growth development process, increase inequalities in access to water services, do not satisfy the needs of the poor and destroy water resources. Accessible and equitable services and resource sustainability may be incompatible with the logic of capitalist accumulation and profitmaking. Neoliberal economic reforms promote deregulation, free trade, free competition, and the privatization of state-owned enterprises, goods and services (Martinez and Garcia, 1997). In the water sector, they privatize infrastructures' operation and sometimes development, and introduce the cost-recovery management of services. Thus, they eliminate public water services to integrate them and water resources into the global market economy.

The reform in Senegal opened the water sector to the private distribution of water supply and established the commercial management of water services. Service development had to be self-financing and management profitable. Thus, the provision of water services became dependent on effective demand whatever the human needs or the uses of water. The reform did not secure water supply and sanitation for the poor, but services improved in the city-center and residential and industrial areas. Access to water services is determined by their availability, affordability and continuity. The reform did not slow down the destruction of water resources, but their overexploitation and pollution intensified. Overexploitation occurs when intakes exceed replenishment rates, modifying the volume and quality of water sources. Water bodies are contaminated when pollutants accumulate beyond their self-purification and capacities, changing their nature and damaging the ecosystem that sustains them.

My second hypothesis is that the dominant notion of sustainable development and its application to water management is a neoliberal economic interpretation manufactured to support the above-mentioned type of reforms. This interpretation encourages a form of development that sustains itself economically, while preserving the natural environment and promoting social equity and participation (WCED, 1987). The protection of natural resources, taking into account present and future needs, had to be part of the development process. This was operationalized through cost-benefit calculations, price mechanisms and the commodification of water resources.

Powerful international actors (states, businesses, financial institutions) endorsed the concept of sustainable development for its popularity and compelling values, but progressively distorted it away from its ecological roots and counter-hegemonic potential. Made to fit the neoliberal agenda, the concept did not contribute to modify development policies, but provided them with new legitimacy. Sustainable development became little more than an ideological disguise for the pursuit of neoliberal economic policies.

The United Nations (UN) system was instrumental in this evolution. Its endorsement of the neoliberal interpretation of sustainable development as policy guideline contributed new legitimacy to neoliberal economic policies and strengthened the neoliberal consensus. Under the sponsorship of the UN, an organization assumed to promote the common good due to its (almost) universal membership, the ideological disguise of sustainable development was even more effective.

Sustainable development thus pertains to the global capitalist hegemonic system, a system in which economic and military power is sustained and enhanced by concurring institutions and ideology (Cox, 1986). An ideology corresponds to worldviews, values and theoretical constructs that condone specific objectives and behaviors, and encourage particular policy prescriptions. An ideology becomes hegemonic as dominant social actors with the resources for intellectual undertakings promote ideas supporting their parochial interests as universal values and common good. Specific values and assumptions are no longer questioned, but become common sense and are accepted as universal.

The main ideological tenets of economic neoliberalism include: economic growth and profit accumulation benefit all; consumption is happiness; competition is human nature; technology is salvation; private property makes for efficient management, fair allocation and sustainability; and wealth is the ultimate goal. These ideas are favorable to actors who benefit from the expansion of the capitalist economic system to include more people, resources, and social systems.

III. Research Method

The research strategy for gathering data for this dissertation includes documentary research, field observations, and interviews. The impacts of the reform, investment projects and management on access to water and sanitation services and on water resources were analyzed through documents, interviews and field observations. The purpose was to determine how access to services (availability, quality, affordability, distribution) evolved for the various strata

of the Dakar population, and how water resources were affected. Documents and data from public and private water institutions were consulted, as well as reports and studies on the evolution of the sector and water resources from Senegalese and international institutions (World Bank, UN agencies, NGOs). Water and sanitation infrastructures were visited.

Observations were undertaken and residents were interviewed in almost all areas of the Dakar region. In addition to water sector officials and employees, representatives from consumer associations and local NGOs, environmentalists, scientists, and water and sanitation specialists were interviewed. Questions concerned water supply systems, the evolution of water consumption and prices, alternative sources of supply, types of sanitation facilities, their price and operation, alternative treatment systems, the exploitation of water sources, their management and causes of degradation, and the health and environmental impacts of water supply, sanitation, and water pollution.

The reform process in Senegal was studied through documentary research and interviews. Relevant documents concerned legal decisions, records of parliamentary debates, regulations, policy statements, workshop reports, World Bank and other institutions' analyzes of the Senegalese water sector and reform proposals, reports and archives from Senegalese water agencies and private institutions, and press articles on the reform and urban water issues in Senegal.

The interviews targeted actors who participated in the elaboration of the reform, who were involved in the water sector before and/or after the reform, as well as knowledgeable and not knowledgeable observers. They included water sector officials (Ministries of Hydraulics and sanitation), civil servants from public water institutions (the Direction for the Management and Planning of Water Resources, the national water and sanitation authorities, legislators, politicians from the dominant party at the time (Socialist) and the opposition (Senegalese Democratic Party, Democratic League, the Independence and Labor Party), union leaders, managers and employees of the now private water company (SdE), consumer associations and

other advocacy groups, World Bank staff in charge of the reform process, representatives from funding agencies (AFD, GKW, etc.), international consultants, workers from international and local organizations with water programs in the Dakar region (WSP, WSSCC, UN-Habitat, UNICEF, Enda Tiers Monde), and a number of Dakar residents from different socio-economic backgrounds.

The questions asked concerned the process by which the reform was adopted and the ideas and interests underlying decisions: the various options available for reforming the sector and increasing water supply; who introduced them, with what objectives and resources; what were their analyses of the water sector; what was their understanding of sustainable development and its connection to the reform; and what were the awareness of and reactions to the reform of politicians, religious leaders, water sector officials, unions, and the general public.

The evolution of the notion of sustainable development and water resource policy guidelines at the international level are analyzed through primary sources: official reports, resolutions, declarations and statements from international organizations and conferences on the environment, development and water resources, including water management in Africa. These documents are considered within the international political economic context at various key moments since the establishment of the United Nations. Secondary sources analyzing these documents and the evolution of international water management policies support this analysis.

IV. The Significance of this Work

This work re-evaluates the consequences of the Senegalese water reform on people's lives and water resources, which is significant both empirically and theoretically. Empirically, documenting the impacts of the reform on access to water and sanitation services and on water resources will provide evidences of increased access inequalities, unaffordable services, and the destruction of water resources. This will illustrate the concrete significance of neoliberal sustainable development. Furthermore, based on an alternative approach to sustainable development and the provision of water services, which emphasizes environmental

sustainability and the satisfaction of basic needs, this work delineates the elements of a management of water services able to improve access to water and sanitation, reduce the burden of pollution, and protect water resources. A number of factors affecting water services and resources, which have to be integrated in order to achieve sustainability, are identified. In this respect, local initiatives promoting alternative solutions to water supply and sanitation needs are particularly interesting.

The analysis of the reform decision process and the evolution of sustainable development will show how a concept carrying specific values and objectives characterized a reform that served different purposes. This work illustrates how powerful actors manipulated ideas in support of their objectives, how Senegalese elites endorsed these ideas, which progressively became dominant in Senegal, and how these ideas facilitated the adoption of the water reform.

Theoretically, this work makes two contributions. First, informed by the work of Robert W. Cox on the international political economy, this work considers that ideas are an element of power, and that both ideas and interests underlie the development process. Concepts and their interpretations are not neutral, but support specific policies and interests. Sustainable development is an ideological construct in which economic activities and who benefit from them are at stake: a particular interpretation of the notion sustains specific development patterns, serving different purposes and interests.

Thus, this work clarifies the role of ideas in policymaking, in particular in the relation between powerful international actors and policy decisions in a developing country. It helps understand the Senegalese water reform as an “adjustment” of the less privileged to dominant interests under the cover of common interest and universal values. In Senegal, reform actors took the neoliberal interpretation of sustainable development at face value. This facilitated the adoption of a reform favorable to high water consumers, the international business sector and financial institutions.

This works also contributes a better understanding of the emergence of a neoliberal interpretation of sustainable development and its application to water service development. This will clarify the forces and processes involved in transforming and using ideas to legitimize specific policies.

The idea of sustainable development first emerged as an attempt to transform the existing development model, and reconsider economic activities so that they would be less harmful for both people and the environment. Western countries have undergone a particular process of development, i.e. industrial capitalism. If this model produces tremendous wealth, it also produces irreversible environmental destructions, social inequalities, and human sufferings that regularly spur opposition and attempts at modifying it. Threatened by the concept of sustainable development, neoliberals adopted its rhetoric, but weakened its critical content and turned the notion into a source of legitimacy for their own pursuit. This contributed to reinforce the global neoliberal economic consensus.

The second theoretical contribution of this work is an explanation of why neoliberal economic water reforms are inherently unsustainable. I suggest there are two ways of looking at sustainable development and water resource management: the "neoliberal economic" or mainstream approach (Oates, 1992; Stavins, 2005) and the "ecological economics" approach (Kapp, 1983; Geogescu-Roegen, 1971; Boulding, 1992). I propose to explore which of these conflicting interpretations provides a better explanation for the situation in Dakar, and a better theoretical lens through which to examine water reforms.

Based on neoclassical economics theory, the neoliberal interpretation of sustainable development supports the management of water resources as an economic good, applying market solutions to problems of scarcity, pollution, and mismanagement. Focusing on efficiency in the allocation of scarce resources, however, this approach sets aside allocation itself—to whom, how, under what conditions. Environmental constraints, basic needs, social issues and environmental inequalities are evacuated.

Ecological economics, on the other hand, proposes an interpretation of sustainable development geared toward the protection of environmental assets and social improvement. According to this perspective, sustainable development implies that ecology regulates economic activities so that they do not overwhelm the earth's carrying capacities. This perspective points to a definite limit to the exploitation of environmental assets and prioritize the satisfaction of basic needs within this limit. The scale of economic activities can therefore not expand indefinitely, and accelerated economic growth will not solve environmental problems and poverty. Inequalities in and redistribution of natural resources and the burden of pollution become central issues. This perspective transforms the objectives of development as ever-increasing growth into reducing poverty and fulfilling basic needs within sustainable environmental limits.

Water resources are considered from the standpoint of their ecological requirements, their various uses, the interdependence of the various forms of water (wastewater, rainwater, underground water, etc.), as well as their interactions with other ecological cycles. The availability and quality of urban water resources depend on their use and pollution by all economic sectors. They are therefore affected by the country's overall development strategy. The pursuit of economic growth through ever-increasing consumption, production, and urbanization leads inevitably to the overexploitation of local and distant water resources and to irreversible pollution damage.

V. Theoretical Debate

This work has the ambition to be a critical undertaking, seeking to confront prevailing ideas and contribute new understandings that can be the basis for change. Inspired by neo-Gramscian scholarship, in particular Robert W. Cox, this work does not approach ideas as neutral, but as contributing or challenging the dominant order. The conceptualization of the relationship between the natural environment and development or economic activities—sustainable development—and its function within the global economy are at stake. The school of

ecological-economics, following the work of Nicolas Georgescu-Roegen (1906-1994) that related ecological and thermodynamics principles to the economic process, is a major contribution in this effort.

A. Sustainable development: from counter-hegemony to neoliberal consensus.

The International Political Economy (IPE) of Robert W. Cox is inspired by the work of Antonio Gramsci (1891-1937) on the hegemonic expansion of the capitalist system. Cox views the capitalist system as a hegemonic world order based on a consensual form of power that is created through ideas (Cox, 1993b). Dominant actors rule not only through violence and coercion, but also ideologically through intellectual and moral leadership. They create a hegemonic culture that legitimizes their power by expressing their interests in terms of universal values and common good, thus reaching a coalition beyond capitalist interests and fostering consent even by those suffering from the existing power structure (Gramsci, Hoare, & Nowell-Smith, 1971, pp. 181-182).

In this process, powerful actors absorb and transform ideas challenging their interests into sources of legitimacy. Consequently, dominant policies remain unchanged, rather than promote the goals set forth by the ideas that now qualify them. Sustainable development became an ideological notion expressing the pursuit of privatization and growth in terms of environmental protection, participation and equity. In the neoliberal world order, challenging ideas are turned into concepts supporting market-oriented policies, strengthening the consensus at the basis of the capitalist system. This consensus facilitates the adoption of reforms that further the integration of developing countries into the global economy. But, if hegemony is based on ideas that manufacture consent, the political element is always ready to employ force and coercion to maintain its rule if necessary (Gramsci et al., 1971, p. 12).

The hegemonic world order is a combination of ideas, material forces, and institutions (Cox, 1987). Cox considers the ideological role of international organizations in hegemonic

domination. They reflect existing power relations and contribute to strengthening the hegemonic consensus (Cox, 1996; Cox & Jacobson, 1973). International organizations contribute to developing and spreading hegemonic ideas. They encourage collective images consistent with the existing order emphasizing shared interests and universality (Cox, 1981). They define legitimate national policy guidelines, institutions and practices that reflect orientations favorable to dominant social and economic interests (Cox, 1993a, p. 63). The United Nations system has contributed to and promoted sustainable development as market efficient management that benefits all and is the only rational approach to address economic, environmental and social issues.

International organizations provide mechanisms of ideological transmission that convey dominant ideas to subordinate actors and facilitate their adjustment to dominant interests. The notion of sustainable development made neoliberal reforms appear consistent with developing countries' interests, and thus encouraged their implementation. Through these processes, the economic principles and priorities of the advanced countries are being adopted by ruling classes in the South (Budd, 2007).

International organizations tend to absorb ideas challenging power and turn them into a source of legitimacy for dominant actors and their policies (Cox, 1996). Counter-hegemonic ideas can be powerful and widely popular which forces dominant actors to endorse them or risk losing legitimacy. Appropriating such ideas is another way to expand the consensual basis of power. This is done, however, by re-interpreting ideas and emptying them of their subversive content. Intellectual constructs are developed to demonstrate how hegemonic policies are best to realize the values and objectives carried by these ideas.

Sustainable development first emerged from concerns about the destructiveness of development activities, and promoted the goals of environmental protection, satisfying basic needs and achieving self-reliance. Intellectual undertakings within the UN system switched the focus to the need for growth, and explained that only competitive markets could achieve the

desired objectives. All development policies and programs then became "sustainable development" and were launched as new endeavors that would achieve the common good. As a result, adopting the notion only led to introducing minor corrective measures to existing strategies.

But even when made to fit the neoliberal ideology, ideas—their meaning and translation into strategies—remain open for contestation and a force of change. As Cox explains, ideas impact consciousness and the emergence of a new consciousness leads to a shift in power relations (Cox & Schechter, 2003). Sustainable development retains a potential for dissent – specifically when discrepancies between the values carried by the concept and the impacts of policies it justifies become all too obvious.

As Gramsci puts it, knowledge does not stand outside the world but pertains to social processes by developing ideas that support or challenge the established order (Nemeth, 1980, p. 15). "Critical" perspectives therefore do not aim at neutral analyses of the world, but challenge accepted knowledge, the ideological foundation of the dominant consensus that presents assumptions as a matter of course and defines the economic and social structures as given, thus establishing the limits of discourse and political debate (Best, 2006).

B. The economic process in its natural context.

Ecological economics is a critical perspective that proposes a new paradigm for an ecologically sustainable and socially equitable development. Sustainable development proceeds from understanding the relationship between nature and economic processes (Boulding, 1966, 1981; Georgescu-Roegen, 1966, 1971; Kapp, 1950, 1965, 1979).[1]

Ecological economics clarifies why neoliberal development policies pertaining to the capitalist system are inherently socially and ecologically destructive (Costanza & Jørgensen, 2002; Georgescu-Roegen, Grinevald, & Rens, 1995; Grinevald, 2008; Rifkin & Howard, 1980).

[1] This perspective is based on the convergence of the socio-institutional economy Karl William Kapp (1910-1976), Nicholas Georgescu-Roegen's bioeconomics and work on entropy and economic development, Kenneth Boulding's (1910 –1993) evolutionary economics, and global ecology, which is concerned with the Biosphere.

Neoliberal sustainable development policies lead to only marginal adjustments in the development process that do not threaten economic growth and business interests. By providing a new understanding of sustainable development, ecological economics confronts the ideological (theoretical and normative) foundation of capitalism and the existing development model. Analysing the Senegalese water reform from this standpoint will also help clarify the implications for the management of water resources, and point to the necessary elements of a sustainable management of water resources.

Ecological economics combines the sciences of nature with the social sciences to analyze the ecological dimensions of the economic process (Costanza & Daly, 1987; Gowdy & Mesner, 1998; Griethuysen, 2004a; Vivien, 1994). In this perspective, concerns about the conservation of nature joined concerns about social equity and the purpose of development. It contrasts with environmental economics, an extension of neo-classical economics theory to environmental issues that puts the logic of the market as the uncontested guide for social and economic life (Baumol, Oates, & Blackman, 1979; Harris, 2003; Oates, 1992; Panaiotov & UNEP, 1994). Mainstream economists developed this perspective in reaction to the popularization of ecology and its development as a political platform in the 1960s and 1970s. It is an attempt to theoretically reconcile environmental protection with economic growth, and constitutes the foundation of neoliberal environmental policies.

1. The economy is a sub-part of the global ecosystem.

Because of its dependence on the global ecosystem, the economy is subjected to environmental constraints. The economy is an open system constantly exchanging energy and matter with other systems, taking resources from the environment and returning waste to it. Economic processes are irreversible thermodynamic phenomena bound by the law of growing entropy (Georgescu-Roegen, 1971). [2] They convert useful, available matter-energy (low entropy)

[2] The law of increasing entropy introduced the idea of irreversibility and history in Physics.

into useless waste and dissipated matter-energy (high entropy). The entropic flow of energy and matter is the biophysical basis of economic processes.

Human activities, natural resources and ecosystems are sub-parts of the Biosphere and pertain to its processes, and are therefore inextricably linked.[3] The economy is subjected to the primacy of the whole over the parts: a system is fundamentally dependent on its environment to maintain itself, whereas the reverse is not true (descending constraint principle) (Passet, 1996). Short-term interactions are constrained by the slower interactions characterizing large, complex systems (oceans, atmosphere, soils, forests), and what is true at one level of organization may not be true at another (hierarchical organization principle) (Odum, 1992). The economic system can be sustainable only if it respects the rules of its encompassing systems – social and ecological (Passet, 1996, p. 220).

Natural resources have different characteristics, economic potentials and ecological impacts (Georgescu-Roegen, 1979). Renewable resources have limited flow rates that condition their exploitation, produce much less energy than the flow of energy-matter extracted from mineral resources. Renewable biotic resources are services produced by ecological funds (soil, ocean, atmosphere, forest, Biosphere), and their flow depends on the rhythm at which they are produced by funds, and on their reproduction requirements. These requirements related to other services provided by ecological funds, such as carbon absorption, water purification, soil fertility, or climate. The renewability of natural resources depends on the maintenance of ecological funds. Ecological funds can be altered by the overexploitation of natural resources: the natural rhythm at which services are produced is not respected and the fund is damaged to the point it can no longer provide services, or when the tolerance limits of the biogeochemical cycles that ensure the functioning of the Biosphere are exceeded.

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[3] The Biosphere is the biogeologic system that transforms solar energy and forms the living space on the surface of the earth where all lives are connected. This system penetrates the lithosphere, the hydrosphere and the atmosphere and modifies their chemical composition. The notion of Biosphere was developed by a Russian scientist, Vladimir I. Vernadsky (1863-1945), who in the 1920s established a new scientific discipline, biogeochemistry: the study of the biogeochemical cycles of the Biosphere and their anthropogenic alterations (Vernadskij, 1929; Vernadskij & McMenamin, 1998).

Non-renewable mineral resources are much more energy efficient, but are limited stocks accumulated within the lithosphere. Man can determine exploitation rates but flows end with stock sizes. Fossil fuels and mineral raw materials do not belong to the Biosphere vital cycles and their exploitation is a major source of environmental disruption by overwhelming the Biosphere assimilation capacities. As environmental disruptions are easily pervasive, cumulative and disproportionate, overall imbalances are created (Kapp, Steppacher, Zogg-Walz, & Hatzfeldt, 1977, pp. 314-315). The exploitation and pollution of environmental assets have definite limits beyond which irreversible damages occur.

These characteristics impose physical and ecological limits on economic activities and imply distributional issues. The biological origin of the economic process points to "the problem of mankind's existence with a limited store of accessible resources, unevenly located and unequally appropriated" (Georgescu-Roegen, 1977, p. 361). Differences in rates of exploitation between renewable and non-renewable resources, for example, explain differences in wealth between organic based (agrarian) and mineral based (industrial) economies and the associated asymmetrical relations between the North and the South. It also provides a physical explanation for the unavoidable declining terms of trade of primary commodities. Ecological principles are fundamental determinants of economic activities and social conditions (Steppacher & Griethuysen, 2002a).

2. ***The market creates ecological imbalances and social inequalities.***

The ecological economics perspective goes against the neo-classical portrayal of the economy as a closed and mechanical system, separate from the natural environment and assuming an infinite resource base that can provide for unlimited growth.

Environmental assets are not fungible goods that can be substituted for each another or by other goods based on their monetary value (Baumol et al., 1979; Oates, 1992; Panaiotov & UNEP, 1994). Natural resources and services cannot be produced or grown, and resource depletion is not an opportunity for substitution and capital formation (Oates, 2006; Solow,

2000). Their exploitation and management cannot be guided by economic criteria. Price mechanisms and cost-benefit calculations have nothing to do with ecological balances.

No 'right' price can ever reflect the real values of environmental assets (Oates, Panagariya, Portney, & Schwab, 1999). Complex causation, uncertainty, cumulative disruptions, and costs and benefits stretching far into the future make it impossible for individual to evaluate the full benefits of environmental improvements, or the costs of environmental disruption (Kapp et al., 1977, p. 314). Furthermore, based on individual preferences or 'willingness to pay', equilibrium market prices depend on the 'ability to pay', not on the requirements of socio-ecological balances.

The commodification and monetary valuation reduce and homogenize ecological resources and social relations to fungible exchangeable things, concealing the specificities of environmental assets and social relations (Kapp, 1950). Monetary indicators provide no information on social or ecological evolutions or the relation between economic activities and the environment.

There can be no ecologically efficient allocation (sustainable levels of exploitation and pollution) through market mechanisms (Oates, 1992; Panaiotov, 1994). Supply and demand for limited stocks, for example, do not follow relative scarcity: when prices increase, more of the stock is exploited. Rich countries' efficient allocation means reducing pressure on domestic resources by shifting the burden abroad, importing more resource intensive agricultural products, and exporting toxic industries. This was clearly expressed the illuminating 1991 memo of Lawrence Summers, Chief economist for the World Bank, that encouraged exporting toxic industries to 'under-polluted' Africa.[4]

Environmental protection and measures (regulations, taxes, liability) cannot be determined by cost-benefit calculations (Wirth, Heinz, & Stavins, 1988).[5] For example, with

[4] Available at: http://www.whirledbank.org/ourwords/summers.html (05/26/09).
[5] See the 1988 US Congress report, *Project 88: Harnessing market forces to protect the environment* (Wirth et al., 1988).

incomplete information and effects that are out of proportion to each individual cause, responsibilities cannot be causally determined and the polluter-payer principle cannot be effective.[6] Environmental protection is not a tradeoff between commodities, a matter of individual preference between scares goods based on their exchange value. There is no tradeoff between assets essential to life and goods and services (Coase, 1960; Cropper & Oates, 1992). Sustainable development is therefore not a matter of efficient allocation, production capacity and economic growth. It is not about guaranteeing a perpetually constant capacity to consume (equated to well-being) through capital formation (Solow, 2000; Stavins, 2005)

Market efficient allocation is not an objective criterion of achieving the greatest good (social well-being including environmental preservation), but increases inequalities and environmental destruction. Markets ignore inequalities and initial income distribution. Based on the 'willingness to pay', market allocation is as arbitrary as the distributional inequality it expresses. It depends on who can afford what, and purchasing power determines exclusion from a particular good. Market mechanisms transfer costs between society's members: appropriating profits from resource exploitation without bearing all its costs, some get richer at the expense of others or society. They privatize benefits and socialize costs. Ignoring (externalizing) what cannot be reduced to money.

Attempting to integrate the environment into the market as solutions to environmental destruction comes down to addressing global ecosystem level problems from the standpoint of a sub-system. Regulating the whole cannot be done from below, through a lower organization level operating upon its own principles (E. Odum, 1983; Passet, 1996). The logic of a private property economy cannot be applied to the operation of the social sphere and even less the Biosphere: capital reproduction does not ensure that of the Biosphere.

The market approach to environment issues has ethical implications that need to be acknowledged. It treats life is a commodity and fosters disregard for nature and human beings.

[6] The polluter-pays principle establishes that polluters should pay the full costs of their actions in terms of damages and cleanup.

Pollution becomes just another cost of doing business, and a right if you can pay for it (Speth, 2008). It reduces citizens to their effective demand. It denies any distinction between private behavior and public social life (Kelman, 1981, p. 36). But what we can afford individually cannot condition social or ecological decisions. Indeed, questioning whether benefits outweigh costs allows avoiding considering values, making judgments, and setting priorities (Kelman, 2000).

3. Economic growth and capitalism: destruction and inequalities.

Economic growth is inherently destructive.

The open nature of the economic system and biophysical limits make unlimited growth a physical impossibility (Gowdy & Mesner, 1998). Growth, or increase of total output, corresponds to an increasing throughput: more resources enter the economic process and more waste is released. If the limits of this increase are at first technological, they become biophysical with the depletion of stocks, the destruction of funds, and the overloading of the Biosphere's absorption capacities.

Only fossil energy and mineral resources can feed the industrial growth that is the basis of western civilization and the development model. But the exploitation of mineral resources produces large quantities of degraded energy-matter (waste) that disrupt the cycles of the Biosphere (natural matter-energy exchanges), and when renewable resources are exploited based on fossil energy, funds are destroyed (infertile lands, depleted oceans) (Steppacher & Griethuysen, 2002a). Industrial development represents an unprecedented increase in the use of non-renewable resources. Renewable energies (natural, human and animal) are replaced by thermodynamic energy found in underground fossil fuels (coal, gas, and later oil). The economic process is freed from the dependence on the fixed flow of energy from the sun (forest). Industrial processes can be accelerated as never before: more energy is available to access other raw biological and mineral materials, more machines can be produced, and the speed of industrial activities increases continuously. The qualitative change introduced by the 'thermo-industrial' revolution constitutes a fundamental break in the relations between man and nature.

Growth cannot be the solution to environmental problems, and it is not the source of wellbeing, poverty alleviation or social equity either. Increased per capita consumption (the measure of well-being) does not automatically lead to improved human wellbeing. Total production ignores distributional inequalities and does not consider what is being produced, for whom, or how. No priority is given among products (train-food, plane-clean air or water) or among needs (Stavins, 2000). Much of what is important in well-being is not analyzable from a strictly economic standpoint. As a result, development is not about growth, but about improving individual and social existence.

Capitalism: an exponential growth economy.

Environmental destruction and inequalities are intrinsic to the nature of the capitalist system (Kapp et al., 1977). Private property and credit relations, the foundations of capitalism, constitute an unavoidable pressure for ever increasing productivity and growth (Griethuysen, 2004b). Property rights represent exclusive and lasting possession rights over resources and a specific economic potential.

The "privatization" of possession rights has social, ecological and economic consequences. Non-owners are excluded from such privileges, which are enforced by law. Coercive power is a necessary element of property regimes. Property regimes create institutional rigidities that hinder adaptation to social and ecological evolution. The private ownership of natural resources limits the collective capacity to modify their access, use and management. Property rights are the basis of credit relations. They give owners the possibility to enter credit relations and expand the returns on their property. They allow the expansion of property through monetary relations.

Credit relations put the economic system under timed growth pressures, requiring that monetary profits be generated within a specific timeframe. This implies undertaking activities convertible in money and selling goods, natural resources and human labor on the market, thus the commodification of human and natural resources. Entrepreneurs constantly attempt to

reduce costs and increase benefits, lowering wages or the prices of raw materials, adopting more efficient technologies and rationalizing the production process or affecting the institutional framework (advertisement, opposition to environmental taxes).

These pressures are transferred onto natural and non-renewable energetic resources. They have induced territorial expansion in search of resources and cheap labor, the overexploitation of natural and human resources, and profitable technological innovations. With the advent of fossil energy, technology has become the privileged means to face expansion pressures. Technologies are developed in relation to economic (and military) objectives, and have become more powerful and destructive—even if they are more energy efficient, requiring less input and producing less waste (Georgescu-Roegen, 1971). Their production and use rely on finite stock of energy and matter.

The collusion of political and economic powers and materialistic values sustain this system. Corporations have become the primary institutions, seeking to maximize profit growth and shareholder value. The corporate sector wields political and economic power to restrain governments and expand markets. Liberal states are subservient to corporate interests and the growth imperative. Growth is a measure of political success, while social justice is kept on the back burner. This has generated the consumer society and the materialistic values that sustain it (Speth, 2008).

Consumer demand has to be stimulated by creating new goods and new needs. This strategy does not aim at satisfying needs, but creates the illusion that non-material needs (affective, spiritual) are satisfied through the consumption of material goods (Griethuysen, 2004b). These efforts foster the materialistic, anthropocentric and contempocentric values that sustain the system. Thus, the various components of the capitalist political economy cumulate to foster an unquestioned commitment to economic growth at all costs—social and environmental.

Modern capitalist society is therefore a model of unsustainable development, and calling "sustainable development" the attempt to reproduce it is an aberration. The model of becoming

a “modern society” through growth based on fossil energy-technological-consumerist industrialization is unrelated to the satisfaction of basic needs and ignores the impossibility of maintaining fossil fuel combustion in the long run (Steppacher & Griethuysen, 2002b). Development is oriented towards the satisfaction of the desires and wishes of rich populations with effective monetary demand, at the expense of needs with no ineffective demand (poor populations, future generations, non-human needs). Investments made with loans in developing countries are subjected to the same pressure, requiring (and justifying) the imposition of economic activities that can provide, in a limited timeframe, greater monetary benefits. Everywhere this logic has resulted in the development of activities disconnected from local basic needs and ecological requirements.

C. Sustainability: establishing new hierarchies.

Sustainability is about ensuring the reproduction of the Biosphere, and has a concrete meaning based on ecological functions. As mentioned above, the sustainability of any subsystem depends on the sustainability of the entire system. Sustainability can therefore only be achieved by adjusting economic activities to ecological and social goals and requirements. The purpose of the economy should be defined on the basis of its interactions with social and ecological contexts.

Once the open nature of economic systems and their dependence on ecological realities is recognized, the formulation of social goals and normative choices can no longer be avoided (Kapp, 1976, p. 101). Social objectives and collective decisions should aim at maintaining ecological balances and economic activities necessary to improve social and individual life. The purpose of a sustainable socio-ecological economy is therefore to fulfill the social objectives of sustaining human life and ecological functions, and economic activities should be guided by ecological, human and social needs (Steppacher & Griethuysen, 2002a). Once social goals are set, the best strategy to reach them can be determined, choosing between alternative

instruments of control and economic policies based on social minima, ecological maximum tolerance levels and socio-ecological indicators.

1. ***Ensuring the reproduction of the Biosphere.***

As environmental services depend on the processes sustaining ecological funds, a regular supply of services can be ensured only by preserving ecological funds (Gowdy & Mesner, 1998). Global preservation is a necessary condition for the continued exploitation of renewable resources and the preservation of services as such carbon absorption or water purification. We need to raise our focus for environmental management on large ecosystems' interactions (Odum, 1992), and determine the Biosphere tolerance limits and requirements related to waste assimilation.

Economic activities cannot affect the Biosphere functions beyond its natural regenerative capacities. Resources cannot be harvested and exploited beyond sustainable yields, and the quantities of dissipated energy and matter as well as non-recyclable waste cannot exceed the Biosphere assimilation capacities. This requires reducing the economic throughput; the entropic flow produced by the economic process, and in particular the use of non-renewable resources. This reduction will lead to economic decline. Since the 1970s, Georgescu-Roegen reached the unpopular conclusion that "de-growth" or decline was the unavoidable economic consequence imposed by the laws of nature (Georgescu-Roegen, 1979).

To rely less on limited stocks economic activities have to change, which can be achieved by shifting the world's economy from one based on stocks to one based on the flow of solar energy. Organic agriculture is the only type of economic system that can reproduce itself without exhausting the matter-energy flow upon which it rests. This implies a gradual decrease in population to reach a level that can be maintained by organic agriculture. Any other system resorts to finite mineral stocks for its reproduction, leading to the exhaustion of (re)constitutive elements (Georgescu-Roegen, 1977).

Georgescu-Roegon's "minimal bioeconomic program" toward a sustainable economy also includes the prohibition of arms production, increasing the use of solar energy and avoiding wasteful energy use (over-heating, cooking, speed, lighting), curing ourselves from gadgetry and fashion, and developing technologies that do not draw down stocks or impair funds (Georgescu-Roegen, Tang, Westfield, & Worley, 1976, pp. 33-34). The management non-renewable resources would need to take into account the ecological requirements related to waste assimilation, the satisfaction of human needs, and inter-generational equity.

2. ***Ensuring the satisfaction of basic needs for all.***

Concerns with human needs imply using resources to satisfy basic needs as a priority. What those needs are has to be specified based on objective criteria, and available and accessible energy and matter has to be determined. But the satisfaction of basic needs for all without economic growth requires above all a global redistribution of resources and energy consumption (Griethuysen, 2004b).

According to ecological economists, poverty and underdevelopment can be addressed but at a cost for the developed world (Georgescu-Roegen, 1977). The satisfaction of basic needs of populations in poor countries requires some growth and use of non-renewable resources. This increase can be compensated at the global level by an additional reduction of rich countries' consumption. A declining economy in some parts of the world is needed so that the poorer nations can reach a 'modest' level of development, which would ultimately become the standard for all.

These various proposals are feasible only if the complexity of natural organizations is understood and respected and if social values evolve. At the core of the bioeconomic approach is a call for a change in values: values are social and ecological, intrinsic to life and the earth—the global ecosystem to which we belong. A value system sustaining a sustainable society would recognize the finiteness of our planet, the interconnectedness of all forms of life and our dependence on this web (Gowdy & Mesner, 1998). It would encourage empathy for current and

future human beings, and recognize that consumption does not automatically lead to more wellbeing, but that our way of life could actually improve with less consumption

D. Implications for water management.

From the above discussion, it is clear that managing water resources by integrating them into the market while pursuing economic growth will not protect water resources from pollution and depletion.

Considering that effective resource allocation is impossible if water is free and if no cost is attached to its depletion and pollution, neoliberal policies treat water resources as economic goods, subject them to price mechanisms, and privatize their exploitation (Oates, 2006; Rogers & World Bank, 1992; Serageldin & Wold Bank, 1995). Demand management strategies are implemented through tariffs, service differentiation and choice of technology based on households' willingness to pay. Economic incentives (taxes, fees) and environmental standards are established based on cost-benefit calculations to reduce pollution at least cost (Hardoy, Mitlin, & Satterthwaite, 1992; McGranahan, Satterthwaite, & IIED, 2006).

Privatization and price mechanisms will improve water allocation by addressing the inefficient management of publicly owned water utilities that do not face competition and, as a result, incur high costs that impede the sector's development (Kerf & World Bank, 2000). In a competitive situation, companies are forced to implement efficient management practices and achieve cost efficient allocation. More resources can be invested in the sector's expansion, and the price of water remains low.

But price mechanisms do no ensure that levels of use and pollution are ecologically sustainable or that the water needs of the poor are satisfied (Costanza, Segura Bonilla, & Martínez Alier, 1996). Efficient allocation, measured in units of profit by cubic meter of water sold, responds to effective demand, not needs, social demand or ecological requirements. On the market, no priority among uses is considered. Any 'utility' that can be afforded is justified. In fact high prices make it more rational and profitable to pump deeper and overexploit a resource.

The logic is that of exploiting a resource as fast as possible in order to reinvest its revenue into more profitable activities. At best, water prices can deter waste by poor people, but not by those who can afford it, make a profit out of its exploitation or consider high levels of water consumption as part of a 'modern' life style (Costanza & Jørgensen, 2002).

These policies lead to unsustainable water consumption and pollution levels, unequal access to water services and an unequal burden of pollution. Subjecting water resources to the effective demand of those with greater market power leads to overconsumption and depletion. Inequalities in access to water and sufferings from pollution increase as the poor cannot afford water prices and resort to polluted non-distributed supplies. This approach maintains water access and the burden of pollution along class lines, based on consumers' place in the economic system.

The sustainable management of water requires first to recognize its nature. Water resources are not a good that can be manufactured or replaced by other goods. They are a sequence in the hydrological cycle, and as such are connected to the atmosphere, the lithosphere and the biosphere. Surface water and underground water tables are primarily recharged by rainwater, directly or through infiltration. Water bodies are often connected, and the pollution or depletion of one affects the others. Water resources finally pass through users, and what one does with it impacts the others. Water resources are therefore affected by their direct uses and by the ecological impacts of all human activities.

In urban settings, the availability and quality of water depend not only on urban water uses, but also on the uses of soils and air pollution; that is on the region's economy and development strategy. Because of their impacts on water, air and soils, development strategies promoting economic growth through industrialization and intensive agriculture, ever increasing production, consumption and urbanization will never allow for the sustainability of water resources (Mayumi, Gowdy, & Georgescu-Roegen, 1999). Urbanization, as engine of growth supporting industrialization and high consumption levels, concentrates activities and

populations to the point of depleting and polluting local water resources and affecting distant sources.

Sustainable water development strategies for urban areas need to consider the ecological environment: soil types, climate (rainfall, temperature), water bodies (assimilation capacities, replenishment rates); the urban environment: water and soil uses, waste production, pollution sources, air quality, and their impacts on the watershed (quantity and quality). Water strategies also require setting water use and pollution standards based on ecological requirements, priorities among water uses based on ecological and human needs, and adjust economic activities to these requirements and priorities. Implementing these, however, requires or would lead to a fundamental change in economic activities. Sustainable water management toward the preservation of water resources and ecological balances and the equitable access to water supply cannot be disassociated from the transformation of the capitalist economic system. Reasserting the ecological foundation of sustainable development and its economic implications constitutes a clear challenge for the existing international political economy.

VI. Dissertation Outline

This work is divided into two parts. The first part (chapters 2, 3 and 4) provides evidence of the unsustainability and inequality-creating nature of the neoliberal water reform, and identifies elements for an alternative sustainable development of water services. It analyzes, more than ten years after the reform, its impacts on access to water services and on the sustainability of water resources. It will show that the development and management of water services implemented since the reform increased access inequalities for both water supply and sanitation, did not address the needs of the poor, and that water resources are being destroyed at an increasing pace. The reform turned water supply into a lucrative private business. It made water available for profitmaking and growth-inducing activities, and integrated water services into an unsustainable development process. Based on the ecological economics approach, this analysis helps understand the situation in Dakar and the reasons why neoliberal water policies

cannot ensure the satisfaction of basic water needs for all, the equitable provision of services and the protection of water resources. This perspective also helps to identify elements to be integrated in the management of water services if these goals are to be achieved.

The second part of this dissertation (chapters 5 and 6) is concerned with ideas as an element of power, and the impact of ideology on consensus building and policymaking. It analyses the adoption of the water sector reform in Senegal, the evolution of the notion of sustainable development within the UN system, and its application to water policy guidelines. It will show how the neoliberal notion of sustainable development facilitated the implementation of the water sector reform imposed on Senegal, and how powerful international actors had transformed the notion into a concept that served their interests and reinforced the neoliberal consensus. This will demonstrate the relevance of Cox's perspective on the role of ideas in a hegemonic world order.

A. Part I: a sustainable development reform?

Chapter 2 analyses the impacts of the reform on access to drinking water. It will show that the water reform did not improve access to drinking water for the majority of Dakar residents, but making it depend on individual wealth, it increased access inequalities and made it unaffordable to the poor. Infrastructure investments and the commercial management of water distribution resulted in unequal, unaffordable and inadequate water access, and a redistribution system in which poor consumers subsidize the water consumption of wealthier ones. This differentially affected domestic users, as well as economic activities in and outside the Dakar region.

The following chapter (3) considers the evolution of sanitation services since 1996, including wastewater collection and treatment, and rainwater drainage. Findings will show that the cost-recovery management and demand-driven development of sanitation services ensured that they would not compromise the profitability of drinking water distribution, and eliminated their provision as a public service. The sector's development strategy and lack of an integrated

management resulted in inadequate collective and individual systems that function poorly and do not satisfy sanitation needs, and increased inequalities in access to services and the burden of pollution. These have devastating consequences for people's lives: horrific living conditions, worsening floods, diseases, and increased poverty.

Chapter 4 assesses the impacts of the reform on water resources. It will show that rather than contributing to resources' sustainability, infrastructure investments and the commercial management of water supply accelerated the destruction of water resources. The reform aimed at supplying the growing demand in the Dakar region and ensuring the sector's financial sustainability with little concern for the consequences on water resources. The sector increased the exploitation of surface and underground resources, but adopted no effective measures for their protection. This chapter will show that the sector's activities are not integrated and are destroying water resources, and that integration beyond the water sector is required to secure water resources' sustainability. But without political will to preserve these resources, their commercialization for profit is unregulated, and sustains a growth-oriented development process that requires increasing volumes of water, irremediably causing the destruction of local and distant resources.

B. Part II: ideas, interests and policymaking.

Chapter 5 analyzes the process that led to the adoption of the 1996 urban water sector reform in Senegal within the context that country's evolving political economy and ideological climate. The chapter identifies the different stages of the reform, the actors involved, their objectives, resources and prevailing ideas, and considers how material conditions and ideas influenced the sector's reform and investment decisions.

This chapter will show that the water reform was meant to speed up an ongoing economic liberalization process imposed on Senegal by the International Financial Institutions. A policy discourse, promoted by both the IFIs and the Senegalese government, supported this process, spreading neoliberal economic ideas and encouraging the commercialization of basic

services. By the time of the reform, the ideological climate had changed, circumscribing opposition and facilitating the acceptance of the reform.

The reform contained the ingredients for a successful sustainable development reform. The reform process was participatory, and social and environmental impact studies were undertaken. But rather than fostering a democratic polity, the reform process nurtured political maneuvering, corruption and clientelism. Consensus-building efforts advertised the benefits of the reform, involved unavoidable stakeholders, and validated decisions that had already been made. Coercion remained latent. While the World Bank accommodated some of the government's demands for the sake of privatization and the country's stability, opposition could influence the reform only so far as it had no consequences for involving the private sector and reaching the water sector financial sustainability. Finally, reform actors ignored the consequences of institutional and investment decisions on water resources, and equally disregarded the socioeconomic impacts they would have on the majority of the urban population. But the ingredients of a successful neoliberal sustainable development reform were present.

The next chapter (6) argues that the dominant notion of sustainable development was transformed away from its ecological roots into a neoliberal economic concept supporting economic growth and profitmaking activities. This interpretation gave new legitimacy to neoliberal economic policies and the expansion of the capitalist system, presenting them as promoting environmental protection, social equity and democracy. In the water sector, sustainable development nurtured the belief that the privatization and commercial management of water services would achieve better and more equitable access to these services and ensure resource sustainability.

This chapter will show that by the early 1980s, an economic, rather than ecological, perspective on environmental management had become predominant within the UN. This evolution reflected the increasing domination of neoliberal economic interests in the global

political economy, and on the UN's environmental agenda and policies. The policy discourse elaborated during this period couched neoliberal policies in terms of universal values and common good. The transformation of sustainable development was critical in this elaboration, as the concept embraced the commercial management of basic or "environmental" services and economic growth as all-purpose solutions. The UN endorsed this ideology and concurrent water management guidelines, and encouraged the adoption of neoliberal water reforms in developing countries.

Part I

A Sustainable Development Reform?

Chapter 2

The Water Sector Reform and Access to Drinking Water

This chapter analyzes the evolution of access to drinking water in the Dakar area since the 1996 water sector reform. It contends that despite official claims to the contrary, the neoliberal sustainable development reform did not improve access to drinking water for the majority of Dakar residents. Rather, making access to water supply depend on individual wealth, the reform increased access inequalities and made it unaffordable to the poor.

According to World Bank estimates, the urban population with access to drinking water increased from 79% in 1996 to 91% (with 70% domestic connections and 21% collective standposts) in 2006 at the end of the second investment project (World Bank, 2004, 2010). Today, water sector officials are pleased with this evolution. A high-ranking civil servant from the Ministry of Hydraulics who is in charge of water supply projects explains:

> "With the great results of the investment projects, Dakar water demand will be satisfied until 2015. Production, transportation and distribution increased. Water losses declined from 30 to 20% of production. But water access is the most remarkable result. There have been numerous new connections to the network, including social connections for the poor. This contributed to reduce poverty and improve health conditions" (official, Ministry of Hydraulics; Dakar, June 16, 2006).

These overall improvements, however, hide serious inequalities and worsening access for many. The reform contributed to widen the gap between rich and poor and supported a development process that benefits only a few. Infrastructure investments and the commercial management of water supply implemented since 1996 increased access inequalities, reduced access for the poor, and created a very inequitable redistribution system among water consumers, thus differentially affecting domestic users and economic activities.

To give the reader a more concrete picture of what is at stake in water distribution in the Dakar region, the first section of this chapter briefly presents the region, with its different areas,

economic activities, and main water infrastructures. The second section considers infrastructure investments that increased water production and distribution since 1996. It will show that due to their nature and locations, these investments did not target the poor, but increased access inequalities. Furthermore, the impact of these investments on water resources outside the Dakar region differentially affected the water supply of populations and economic activities outside the urban area. Large plantations producing for export can afford distributed water for irrigation, while small growers and villagers saw their water supply sources disappear.

The third section analyzes the consequences of measures meant to improve water access for the poor. The program of social connections to the distribution network subsidized by the government and the social price of water subsidized by large consumers did not benefit the poor. On the contrary, these measures induced an inequitable redistribution among consumers in which the poor end up subsidizing the water consumption of wealthier households. Addressing the commercial management of water supply, the following section will show how price increases, the disconnection policy for nonpayment, and supply directed toward high effective demand resulted in unaffordable access, poor households reverting to collective supply (street fountains, collective building taps), and low water quality and insufficient supply in poor neighborhoods.

The last section looks at the implications of access difficulties and inequalities on people's lives and economic activities. The small minority of well-off households living in the city center and residential areas, industries, and large plantations producing for export benefited from improved water access. Meanwhile, the poorest resort to polluted underground water for domestic uses and informal economic activities. Urban gardeners unable to afford distributed water or to use polluted underground water for irrigation resort to raw sewer wastewater. The use of these alternative sources of supply has serious health consequences. Rather than receding, waterborne diseases are rampant and kill people every year. Poor areas of the suburbs and children are affected the most.

I. Presentation

This study focuses on the Dakar urban area, but the Niayes region stretching along the Atlantic coast from Dakar to Saint Louis in the northeast is considered as the region's underground and surface waters are exploited for Dakar supply. An adduction pipe crossing the Niayes brings water from the Lake of Guiers (250km away) to Dakar, and boreholes scattered in the region draw into underground sources, including extremely polluted tables in the Dakar area.

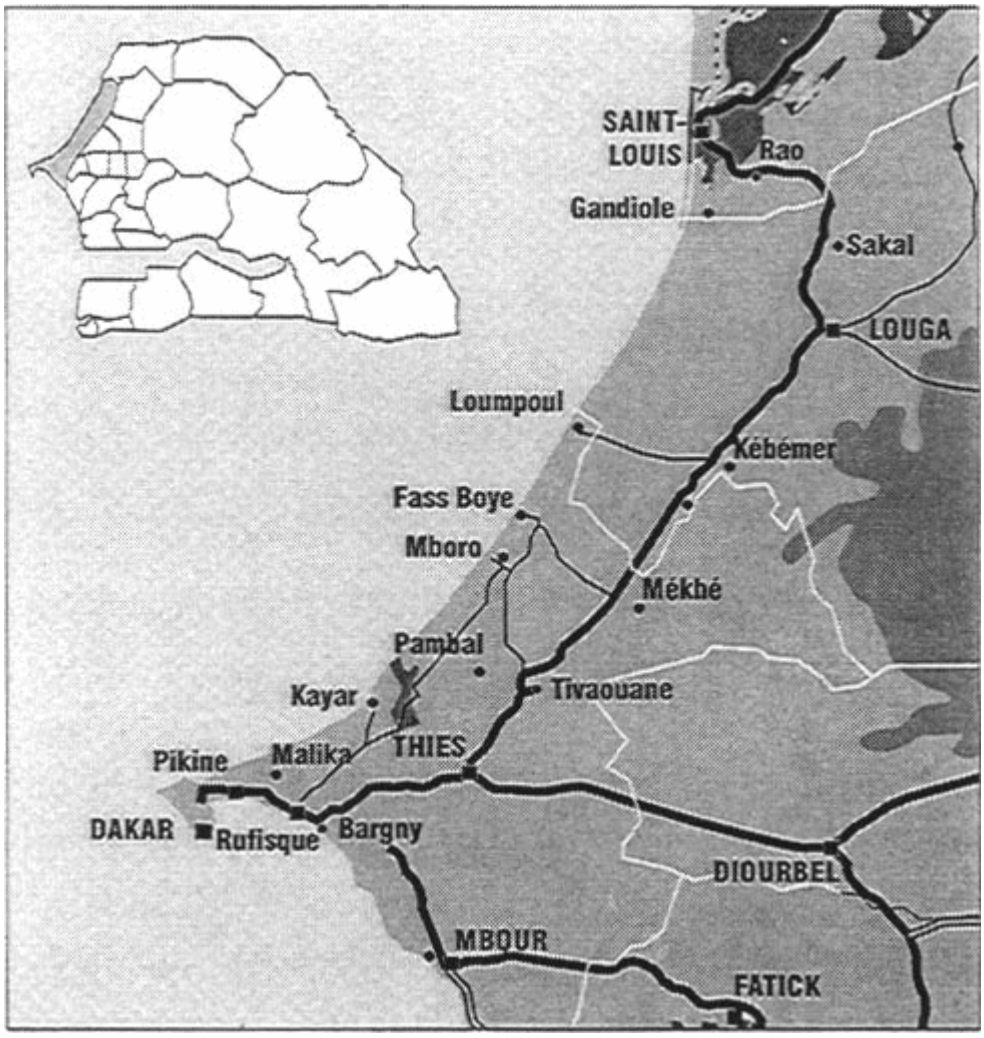

Figure 1: Map of the Niayes region
(Toure Fall S. & Fall, 2001, p. 5)

The Dakar urban area is located on the Cape Verde peninsula at the south end of the Niayes. According to official estimates, the city of Dakar proper (head of the peninsula) has a population of 1 million, whereas the population of the metropolitan area (including the peninsula's neck) is 2.45 million people (Rep du Senegal, 2005, p. 163). These numbers are, however, more than likely largely underestimated.

Two wealthy residential areas, Almadies and Fann Residence, are located on the head of the peninsula. The city center on The Plateau concentrates administrative, commercial and touristic activities. It is a privileged area, but pockets of poverty exist (Niaye Thioker). The urban area integrated a number of traditional villages (Ouakam, Ngor, Yoff, etc.), which grew through mostly unplanned housing extensions. Irregular, spontaneous, or "floating," neighborhoods, which represent about 50% of land occupancy, are extremely poor and often located on unsuitable grounds.

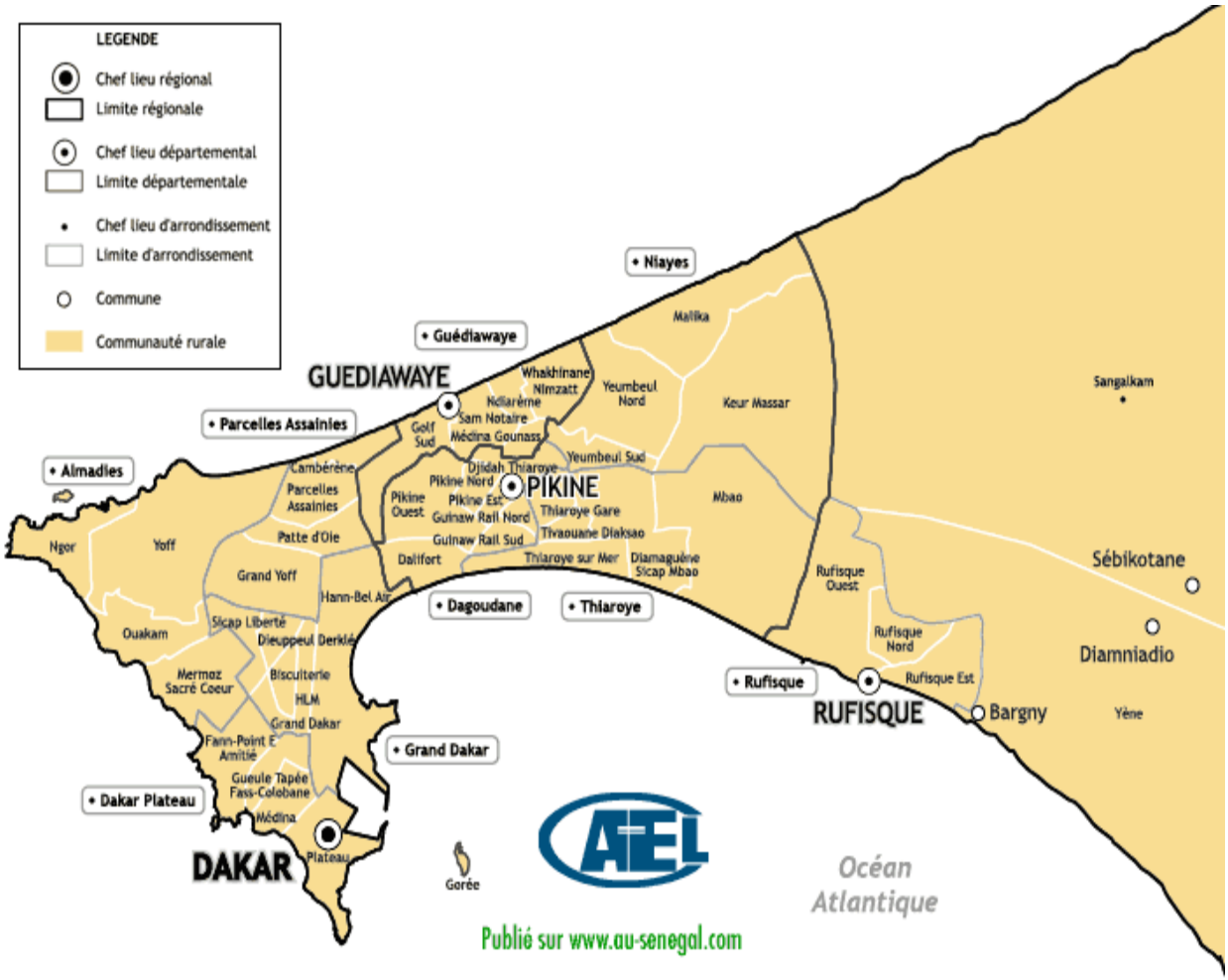

Figure 2: Administrative divisions of Dakar, Senegal

Income groups are not uniformly concentrated in geographic areas, calling for a nuanced approach when assessing the impacts of the water reform on urban residents. A minority of white-collar workers and professionals are scattered in old or planned housing districts alongside much poorer households. Even in very poor areas of Pikine, there are unexpectedly wealthy households. Outside the city center and residential areas only main roads are paved.

Ninety-five percent of Senegal's industries are concentrated in the Dakar region (food processing, textile, chemicals, timber, paper, slaughterhouses, tanning, fisheries, tobacco, soft drinks, oil refining). Industrial areas are located amidst inhabited neighborhoods around the

Baie de Hann: in the harbor and Hann Bel Air in the east, and Mbao in the west. Informal economic activities occupy most of the urban population and are related to the satisfaction of daily needs. Urban agriculture is an important, mostly informal, activity bringing a degree of food self-sufficiency and income to local populations.

The presence of "niayes," ponds of surfacing underground water, in the north (Patte d'Oie) and on the neck (Pikine) of the peninsula is an important characteristic with environmental, social, and economic significance. The niayes provided free water supply for domestic needs and agriculture and other economic activities. Underground water pollution reduced, but did not eliminate, their use.

Outside the urban area, agriculture is the primary economic activity. A plantation system for export developed with large planters subcontracting smaller ones to fulfill their own contracts with foreign importers. Natural conditions and the proximity to urban markets and export opportunities made the Niayes the country's leading region for agriculture production, with 70% of vegetable cultivated areas and more than 80% of vegetable production (Toure & Seck, 2005).

II. Infrastructure Development and Access to Water Supply

Investments realized by the water sector since the 1996 reform increased the overall availability of drinking water in the Dakar region. But these investments also increased the gap between areas with and without supply network, and between those served by domestic home connections and those served by collective water points (standposts). Outside the urban areas, water infrastructures increased water supply difficulties for populations living near new water boreholes and around the Lake of Guiers.

A. Increasing the volume of drinking water.

Infrastructures that increased the exploitation of surface and underground water for Dakar supply negatively affected the water access and livelihood of populations in the Niayes region.

1. infrastructure development.

Between 1996 and 2008, total water production increased by some 220,000 cubic meters per day (m^3/d).[7] The first investment project, the Water Sector Project (PSE, 1996-2000), increased water production (+60,000m^3/d) by increasing the capacity of the Ngnith water treatment plant on the Lake of Guiers (+24,000m^3/d) and by drilling 11 new boreholes in the groundwater tables of the Littoral Nord between Gueoul and Kelle (+35,000m^3/d) (World Bank, 1995, 2004). After 2000, the Long Term Project (PLT, 2001-2006) financed the construction of a second treatment plant on the Lake of Guiers (Keur Momar Sarr, KMS; +65,000m^3/d). In 2008, the plant's capacity was doubled (reaching 135,000m^3/d).

To transport the additional volume of water from the lake and the Littoral Nord tables, the PSE laid a new water conduit between Gueoul and Dakar (155km) in 1997 (World Bank, 2004). The PLT installed an adduction pipe (70km) connecting the new KMS plant to this conduit. The project also financed a pressure booster at Mekhe (50km north of Thies) to increase water flow toward Dakar.

[7] Total production rose from 264,000m^3/d in 1996 to about 480,000m^3/d in 2008. Exploitation of the lake water rose from 39,000m^3/d to almost 200,000m^3/d, and exploitation of the Littoral Nord groundwater from 27,000 to 62,000 m^3/d.

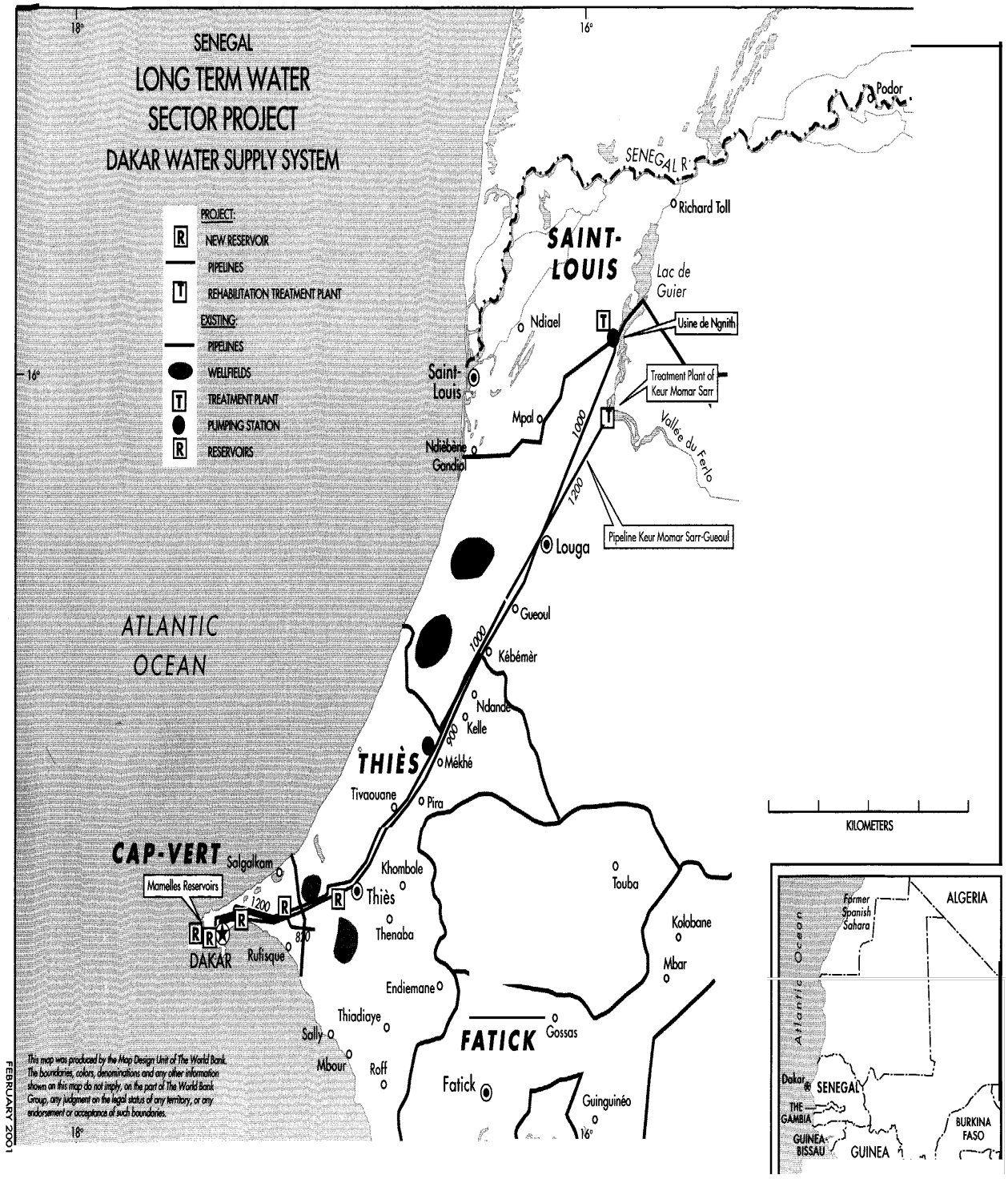

Figure 3: Dakar water supply system
(World Bank, 2001)

2. *Impact on local populations.*

Around the Lake of Guiers, very large rice cultivation, sugar plantations and refineries used the lake's water for irrigation, salt drainage from the ground and the underground table, and for industrial processing. Populations living around the lake, who had no access to distributed water, used the lake and underground water for all their needs.

The water sector's new infrastructures to increase the exploitation of the lake's water blocked these populations' access to the lake (DEEC, 2008). The management of the lake's water levels to ensure the operation of these infrastructures destroyed flood recession agriculture that sustained the lives of many around the lake. This management also induced the proliferation of aquatic plants, which further hinder access to the lake and increase the prevalence of waterborne diseases (malaria and schistosomiasis vectors).

Eight years after the reform, an Action Plan for the Lake (2004) finally addressed the lack of drinking water of riparian populations whose access to the lake was reduced for improved supply in Dakar (DEEC, 2008). The Action Plan included a drinking water project with a distribution system and a treatment plant to supply 20,000 people in 30 villages. Works were completed in 2010, but the price of water may undermine the benefit of the project for local populations:

> "The water price has to be attractive enough to offer the populations a service equivalent to what they have today or the water project may not be viable" ((DEEC, 2008, p. 127).

The Lake Environment and Social Plan (2008) suggested the establishment of a tax levied on consumers outside the lake watershed in order to help finance water supply for local populations: a solidarity tax. The Plan concluded that if the water price was still too high with this tax, the water supply project may not be viable.

Furthermore, some considers this compensation is insufficient. A hydrologist involved in the lake's water management plan explains that:

"The populations around the lake don't benefit from agriculture or other activities that

> use the lake's water. We take water from the lake for Dakar, when these people have no drinking water. Transferring water should be compensated: not only should they get drinking water, but also something more. They are asking for a percentage of the value made from this water. Like with phosphates, when we exploit phosphates, a percentage of the profit is paid to local populations" (hydrologist, independent consultant; Dakar, May 10, 2006).

The sinking of new boreholes in the Littoral Nord water tables affected the water supply of nearby populations and growers. As water table levels lowered, village and shallow agriculture wells dried up. The PSE impact study recommended compensatory measures for deepening village wells or connecting inhabitants to the water distribution system (Setude, 1995). A few villages were connected to the lake adduction conduit, but the price of water hinders access to this source of supply.

But nothing was done for small producers (2ha) unable to deepen their wells and afford motor-pumps. Agricultural sites without access to drinking water are closely dependent on the quality and level of underground tables. The numerous small growers (less than 2ha) in the Niayes region, who cultivate extensively for local consumption using wells not always equipped with motor-pumps, were most affected by tables' lowering levels (DGPRE, 2009b).

Large plantations, on the other hand, are connected to the lake's adduction pipe and use drinking water for irrigation. Large agriculture enterprises (above 80ha) also have private boreholes into the underground table and generator-run pumps (DGPRE, 2009a).[8] Away from the urban area, these plantations face a lesser degree of underground water pollution. These producers who cultivate fruits and vegetables for export consume large quantities of drinking water (irrigation and processing).[9] Furthermore, the majority of these plantations (64%) irrigate with automated sprinklers, which waste a lot of water. Thus, with deep wells, boreholes and drinking water supply, the water access of these enterprises was little affected by lowering water

[8] Thirty one percent of large producers use boreholes, and 68% wells 25-30m deep (DGPRE, 2009a).
[9] Seven plantations cover 20ha, 5 cover 80ha, and 5 others 150ha (DGPRE, 2009a).

tables, and remains cheap as their drinking water consumption is subsidized and the tax on private draw-offs in water tables is not consistently collected.

Few medium-size producers (5-10ha) have boreholes or wells equipped with motor-pumps and have access to drinking water through the large plantations they cultivate for.[10] Before 1996, medium-size cultivators near Bayakh were supplied by the SONEES, which exploited boreholes at Beer Thialane for agricultural needs. These infrastructures were transferred to cultivators who became responsible for their management through a users' committee. This anticipated the future law on public water services, which entrusted service provision to users' committees in rural areas—a form of privatization (Law 2008-59 of 24 Sept 2008). This system, however, raises the problem of affordability. A manager from the Direction for Water Resources Management and Planning explains that after the reform:

> "At Beer Thialane, the management committee could not pay electricity bills and unpaid agricultural loans accumulated. In 1999, the infrastructures were shut down. A few producers got connected to the SdE network. But they have problems with water prices." (DGPRE manager; Dakar, April 9, 2006).

B. Improving water distribution.

The reform's investments improved water distribution in the Dakar region, extending the supply network, increasing the number of household (domestic) connections to the network, and installing collective standposts. This section will show, however, that because of the nature and location of network extensions, and because of the emphasis on domestic connections over collective standposts, these new infrastructures did not improve water access in the poorest areas and increased inequalities between neighborhoods with and without supply network, and between neighborhoods with domestic connections versus those with collective standposts.

[10] Large cultivators pre-finance small ones for water, seeds and chemical inputs, and determine the price per kilo and the quantity to be produced.

1. Network extensions.

The PSE financed the extension of four hundred kilometers of network (World Bank, 1995). Extensions consisted in either densifying the network in areas where it already existed, improving water distribution in neighborhoods already supplied, or the network was extended to new districts of planned housing development, which are far from being the poorest. Poor neighborhoods did not benefit from improved distribution, and areas without or with only embryonic network remain numerous within the urban fabric.

The supply network does not reach irregular "floating" neighborhoods, which are the poorest areas. These settlements developed in the suburbs, progressively joining Pikine regular to the traditional villages of Thiaroye and Yeumbeul. The informal status of floating neighborhoods (irregular tenants and land occupancy), their settlement patterns (anarchic dwellings, narrow tortuous paths, dead-ends or no definite streets), perpetual changes with new constructions constantly appearing (i.e. the term "floating"), and the lack of resources make it difficult to install full-fledged water supply infrastructures. This resulted in a spatial dichotomy in districts such as Yeumbeul, Malika or Thiaroye between supply sources. Standposts and connections to the network are concentrated in a few areas corresponding to regular settlements, leaving floating neighborhoods with no access to distributed water.

In Yeumbeul Nord (20km from the city center), irregular housing sprawls developed without infrastructures since the 1980s. The area now regroups about 150,000 people (70% of the district's population), and remains with almost no service. A worker from a local NGO involved in water supply projects explains:

> "Some network extensions took place in certain areas, but after much effort on the part of residents and after a study done by the University of Dakar showed that the high concentration of nitrates in well water endangered people's health. Because when people don't have distributed water, they use well water" (NGO workers; Pikine, June 16, 2006).

2. Collective standposts versus domestic connections.

When the supply network reaches poor neighborhoods, it is insufficiently developed to allow for household connections. Distributed water is provided by an insufficient number of collective standposts.[11] During the 1996-2003 period, the number of collective standposts rose from 940 to 1,424 (+484) (World Bank, 2004). According to some estimates, the average number of users per standpost would be 2,800, and much lower in certain areas (Champetier et al., 2003). In Hann Dalifort, for example, five standposts served 8,000 people in 1999 (Merklen, 2000). In Yeumbeul, about 30 standposts are concentrated in a few areas.

Local actors encourage the installation of standposts in irregular neighborhoods. Local populations, NGOs and international organizations are often taking the initiative for installing standposts. The NGO Enda Tiers-Monde has been actively involved in such projects in the suburbs of Dakar. Where network extensions are possible, the NGO elaborates a project with the population, seeks funding, and ensures users' financial (min 25% of CFAF 250,000 cost) and physical participation. Between 1994 and 2000, 130 standposts were realized with Enda's funds in some of the poorest areas of Pikine, reducing the average distance between houses and supply points by half (from 600 to 300 meters) (Enda-Rup, 1996; Merklen, 2000). The situation improved somewhat after 1999 with a number of water supply projects, but fountains remain insufficient.

Though it secures SdE's concern for equipment profitability, installing standposts in poor neighborhoods was a marginal undertaking after the reform. The PSE and the 1995 Water Sector Policy Letter emphasized the development of private domestic connections to the network as opposed to collective standposts. The objective was to increase water consumption by increasing the number of private connections rather than standposts where consumption per person is lower. While individual consumption at standpost was expected to remain constant

[11] An estimated 282,000 people resorted to standposts for water supply in 1995; this rose to 320,000 in 1998 (Champetier, Collignon, Ly, & Toure, 2003).

(20 lpd), consumption through private connections was projected to increase from 80 lpd in 1994 to 110 lpd in 2000, and 120 lpd in 2020 (Provost, 1994).

The number of private domestic connections to the supply network increased by about 166,000 between 1996 and 2005.[12] The price of an individual connection, however, represents the entire month salary of a low-level civil servant (ranging from CFAF 100,000 to 200,000, US$200-400, depending on distance from the network). The increase in domestic connections resulted primarily from a social connection program through which the government subsidizes network connections for people in poor neighborhoods. About 105,000 social connections were realized over the ten-year period following the reform. Social private connections, however, are possible only in areas where the supply network exists, and eligibility requirements restricted the application of the program to the poorest.

Focusing on domestic connections as opposed to standposts reduced the number of people affected by water supply improvements. One standpost is used by many households, while a private connection benefits only one. Thus, the water consumption growth strategy of the water sector widened the gap between households with a private connection and those without, but worse, it did not improve the situation of those with no access of any kind.

This section showed how overall increased water production and distribution since 1996 did not benefit the poorest. Investments did not target the poor and they increased water access inequalities. Water exploitation infrastructures on the Lake of Guiers reduced riparian populations' access to the lake, which remains their primary source of water supply. Lowering water tables induced by new boreholes in the Niayes region affects villages and small cultivators. The provision of drinking water as a compensatory measure for these negative impacts is inadequate because of the price of distributed water.

In the Dakar region, the poorest have benefited little from increased average access rates. If about 90% of households have access to drinking water, in peripheral areas only 50% of

[12] According to the World Bank, the number of connections rose from 241,671 in 1996 to 327,501 in 2001, and 408,000 at the end of 2005, an additional 166,000 total (World Bank, 2004).

residents access water from distributed sources (Boccanfuso, Estache, & Savard, 2006). Investment decisions were based on an increased water consumption strategy, not on the goal of improving access to drinking water in the worst served areas. Extending the network to new planned housing districts and densifying it where it already existed left the poorest areas with no access to drinking water. Focusing investments on private connections rather than collective standposts improved access in neighborhoods already served while standposts remain largely insufficient in areas where private connections are not an option.

III. Targeting the Poor

In accord with international water development strategies, targeting the poor for improved water access was an objective of the Senegalese water sector reform. Measures to reach this objective included a program of subsidized or "social" connections to the distribution network and a cross-subsidized social price for low water consumptions. The social connection program was the only governmental subsidy to the water sector that survived the reform. The program improved access for eligible residents in supplied neighborhoods, while the social price of water benefits households with low water consumption, but cannot ensure the satisfaction of the poor's basic water needs. The tariff system made water unaffordable for many and resulted in the poor subsidizing the water consumption of wealthier households.

A. "Social" connection programs.

Social connection programs are part of the efforts to densify the supply network to make it more cost-effective, while officially targeting the poor. The absence of network in the poorest neighborhoods and the program's requirements makes it useless to provide access to the most destitute. A representative from the public service consumer association (ADEETelS) notes that:

> "This is more a 'connection' program than a 'social' program. It requires dealing with structured and stable communities, credible and reliable enough for the SONES and the SdE. The program does not target the poorest and most precarious strata of the population. Only less poor and more stable populations can benefit from it" (association

representative, dentist; Dakar, May 15, 2006). [13]

Initially, the program required home ownership backed by an ownership title, which residents in poor neighborhoods or customary owners could not provide. A reference letter from the neighborhood chief was then requested, which is also difficult to obtain in poor neighborhoods. Furthermore, to be eligible, a house must be less than 20 meters away from a main water conduit—an unrealistic condition in many areas where no extensions were realized. To help reduce this obstacle the SONES encouraged collective requests so that the average pipe length needed for each house would not exceed 20 meters.

Finally, households must pay a CFAF 13,000 registration fee for a social connection. This amount seems irrational when a bi-monthly social consumption of 20 cubic meters amounted to CFAF 3,134 before 2003 and 3,826 after. If one considers that poor people can pay CFAF 3,826 every two months for their "vital" water consumption, it is quite incoherent to ask them CFAF 13,000 up front to obtain a subsidized connection. Unable to pay this fee, many households cannot benefit from a social connection. But wealthier families living in target areas can obtain a social connection to the network.

Under the PSE, only 3,600 social connections (out of 34,000 total) were installed in poor suburbs neighborhoods (World Bank, 1995). Between 1996 and 2000, only 20,460 connections were realized in total (World Bank, 2001). Among these, 50 were installed in Yeumbeul, where in 1999 domestic connections numbered 6,100. The number of social connections picked up after 1999 with the PLT. In Hann Bel Air, where 45,000 people accessed distributed water through standposts concentrated in two areas (Hann Pecheurs and Hann Village), residents obtained social connections after the SONES undertook some network extensions (Enda-Rup, 1996).

Furthermore, social connection programs are irregularly implemented based on

[13] ADEETelS: Association de défense des usagers de l'eau, de l'électricité, des télécommunications et des services; Association for the protection of water, electricity, telecommunication and service consumers.

uncertain criteria. The government defines priority zones for these programs, but political convenience rather than needs determine priority. Early 2010, for example, the government decided to implement a "special social connection operation" in Tivaouane. This was right before the yearly pilgrimage of the Tijan brotherhood to this location and looked very much like a political move to compensate for the religious faux-pas of President Wade, and the ongoing governmental favors to the Murid brotherhood, whose religious town, Touba, benefits from free water supply.[14]

B. "Social" water tariff and cross-subsidization.

Being connected to the network is only the first step for accessing drinking water. The price of water determines real accessibility. Because of the structure of water prices and price levels, many households who obtained a social connection get disconnected from the network because they cannot pay their bills.

1. Domestic water prices.

Water consumers are charged different prices based on their consumption and use of water (agriculture, commercial, domestic). Differentiated prices through cross-subsidization constitute a redistribution system between domestic consumers and between categories of consumers (growers, commercial-administrative, domestic), with some paying more to subsidize the consumption of others.[15] Thus, domestic consumers benefit from transfers from non-domestic consumers, and among domestic consumers the social tariff applied to small consumption benefits from transfers from other domestic billing. Reformers considered this system strongly redistributive as the social tariff benefits from transfers of about 20% of water sales (Blanc & Ghesquieres, 2006).

For domestic consumption, the price per cubic meter of water increases with the volume consumed. Three volume blocks were determined for a two-month period: the social or "vital"

[14] Early 2010, President Wade had a political opponent arrested at his church during a Sunday mass.
[15] Water is billed an average of CFAF 268/m3 to growers, 372 to domestic households, and 639 to non-domestic consumers.

consumption block (up to 20m^3 bimonthly) is charged at a lower "social" price, the medium block (between 21 and 100m^3 until 2003 and 40m^3 after) is charged the "full" price, and an upper block of "unnecessary" consumption (beyond 100 and then 40m^3) is charged the "dissuasive" price.

But water prices are indifferently applied to all neighborhoods and all households, and consumption is measured by the water meter installed at each connection whatever the number of persons supplied by that connection. This system assumes all households have more or less the same size and that water consumption increases with wealth. If this system seems logical for small Western-type households, its application to the Senegalese context is problematic. It is oblivious to the sociological realities of the Dakar urban area, the prevalent way of life, and the situation of the poor.

The social tariff applies to consumptions up to 20 cubic meters every two months. This is an acceptable consumption level in a 5 or even 10-person household—the basis on which water managers calculated the thresholds between blocks. But in a 15-person household, this is equivalent to a consumption of 22 liters per person per day to cover cooking, cleaning, drinking, bathing and washing. Knowing the World Health Organization recommendation of 35 liters per person per day, and UNDP's minimum water for survival of 20 liters per person per day (representing a couple of flushes of the toilet), the "social consumption" established by the price structure does not ensure the satisfaction of basic needs.

In Dakar, rather than serving nuclear family units, private connections are often collectively used, specifically in poor neighborhoods. Concessions are inhabited by a few families that include the "narrow" family of 10 to 15 persons plus members of the extended family, resulting in households of 20 to 25 persons. A concession may have backyard rentals or room tenants, and a private tap serves as a supply point for neighboring families without running water. Each concession and many rental buildings, however, are equipped with only one water meter. Consumption per meter therefore easily exceeds the threshold of the socially priced

volume, while the volume consumed per person remains very low. In all these cases, consumers are charged the full or dissuasive price. When considering supplying populations around the Lake of Guiers with drinking water, the Lake Environmental and Social Plan (ESP) noted that SdE prices were not adapted to households' sizes which would lead to water consumptions above the 20m³ social bloc (DEEC, 2008, p. 127). But his realization never occurred concerning Dakar residents.

In rental buildings with only one water meter, tenants refused paying for bills they considered overestimated in relation to their personal consumption. Disputes over water bills nobody could afford were frequent, and conflicts erupted between building owners and tenants. As a result, building owners closed all individual and floor taps, keeping only one tap in the courtyard where they sell water by the bucket to tenants at a price even higher than the dissuasive price. As a result, overall hygiene deteriorated and diseases spread as tenants stopped buying expensive water to clean common areas. A survey in the Parcelles Assainies showed higher rates of diarrheic illnesses, specifically for children, in rental houses and buildings where sanitary conditions had deteriorated due to water price.[16] Installing additional meters in concessions or buildings not only would cost the owner, but does not always make sense as one person may be in charge of paying the entire water bill. The owner would also have to declare rentals and be liable for paying taxes on rent money that does not always exist.

These are cases where no more than the social price for water should be charged. The situation is worse for poorer families that are the most crowded, with incoming relatives from the interior or the sub-region and with little or no resources. Meanwhile, westernized middle- and upper class families, with better and regular income, fewer children and no relatives under their roof, have low water consumptions and benefit from the social tariff of water that was meant to target the poor.

The tariff grid adopted in 2003 only made things worse by reducing the volume charged

[16] Survey conducted in 2005 by a student from the University of Dakar for a doctoral dissertation—unpublished.

the "full" tariff from 100m³ to 40m³ bimonthly (40m³ is equivalent to 33lpd in a 20 person household). This reduction entails that an increased portion of the consumption of many more households reached the dissuasive tariff for a volume per person that is far from waste or luxury consumption.

Between 1996 and 2003, the increase between the social and full tariffs is tremendous: 241% in 1998 and 229% after 2003. Under the new grid, a household consuming 45m³ bimonthly will pay as much for 5m³ beyond 40 as for the 20m³ charged the social tariff. Though the price increase was lower between the full and the dissuasive blocks (+14.9% in 1998 and +25% in 2003), this constitutes a very expensive supply and led households to reduce their water consumption.

2. Standpost price.

The price of water at standposts is another inequality embedded in the tariff system, compounding access difficulties in poor neighborhoods. Even though urban dwellers using standposts as supply sources are poorer and experience harsher living conditions than those connected to the network, the price they pay for water is higher than the "social price" paid by consumers with a home connection. Since 2003, the social price of water is CFAF 0.19 per liter, while the price charged by the SdE at standposts is CFAF 0.32/l. According to Blanc and Guesquieres, standpost consumption benefits from transfers of only 2% of total sales earnings (Blanc & Ghesquieres, 2006).

Standposts consumers are charged between CFAF 15 and 40 for a 30-liter bucket, or CFAF 0.5 to 1.3 per liter depending on location. They therefore pay up to six times more for water than small domestic consumers, when they consume far less than any connected household, have to walk to water points, wait on line, and carry buckets back home. A manager from the SONES explains the high price at standposts:

> "It's because of the cross-subsidization system. And also the salary of standpost managers, and losses, etc." (SONES manager; Dakar, May 27, 2006).

In addition to paying more for water, standpost consumers contribute financially and in kind to network extensions and standpost installation in their neighborhoods. Even though water is more expensive at standposts, however, poor households favor this source of supply, which allows them to spend less at a time and keep control over water expenses.

3. Non-domestic prices.

Commercial-administrative prices.

Among categories of consumers, the price of water applied to the commercial-administrative category particularly affects small institutions providing basic services such health and education in poor neighborhoods. The "non-domestic" consumer category applies indistinctively to communal, administrative, and commercial buildings, whatever their kinds, needs and means. Before 2003, these consumers were charged either the full and dissuasive rates (CFAF 519.93 and 597.14/m^3) depending on their consumption. They are now charged the dissuasive price (CFAF 788.67/m^3) whatever the volume of water consumed. This makes water even less affordable to small communal institutions, which ought to have running water as a matter of safety and public health. This got even worse when in 2009, the government agreed to increase water tariff charged public administrations as a form a temporary subsidy to balance the water sector's finances.

Agriculture water prices.

The evolution of agriculture water prices since the reform exacerbated inequalities among growers in the Niayes region, affecting small cultivators the most. Increased tariffs forced smaller cultivators to sell off their land to large owners, reinforcing the concentration of land into a few hands. If some could afford sinking wells into the water table, this was made more difficult as tables lowered due to increased SdE pumping. Large plantations, which obtained water quotas adequate to their needs, on the other hand, are now charged lower prices than smaller growers with insufficient quotas.

Water prices for agriculture consumption are cross-subsidized among growers and by other non-domestic consumers. Before the reform, growers were charged for water based on their consumption, following a three-block tariff system.[17] A differential tariff system based on consumption levels is more adequate for agriculture than for domestic use: beyond climatic conditions, irrigation needs depend on plot size, crops, and cultivation methods. Water consumption is therefore likely to increase with wealth.

Since 2003, agriculture water prices have increased but are no longer applied based on consumption levels per se. Growers are charged depending on whether they respect or exceed their allotted water quotas.[18] With this system, prices depend on the volume of water consumed in relation to allocated quotas. Quotas are based on land size, but criteria for their allocation are unclear. Furthermore, as their total added volume is capped in order to reduce drinking water use in agriculture, quotas are not always obtained. As a result, large plantations consuming important volumes but respecting their quotas are charged less than smaller growers consuming less but exceeding their quotas. In this case, just as for domestic consumers, smaller growers end up subsidizing the water consumption of larger ones.

Medium-size producers are under productivity pressures to meet contracts' quantities and deadlines, but to avoid exceeding their quotas, they tend to water less often and less generously. These growers complain about high tariffs as a main impediment to their activities. The new monthly billing system added further difficulties by creating cash flow problems during growing seasons, while the credit system takes no account of cultivators' need to finance water supply.

This section showed that measures in the reform package to improve water access for the poor did not benefit those officially targeted. Rather, these measures contributed to increase water access inequalities, making water unaffordable and forcing many households to reduce

[17] The agriculture water price was CFAF 66.86/m^3 up to 3,000m^3/bimonthly; CFAF 94.08 between 3,001 and 20,000m^3 (+41%); and CFAF 516.68 beyond 20,000m^3 (+449.2%).
[18] Within allotted quotas, cultivators are charged CFAF 113.37/m^3; between one and two quotas, they are charged CFAF 507.84/m^3; and CFAF 714 beyond (SdE, 2010).

their consumption. Reducing consumption is a form of self-disconnection due to poverty that threatens public health.

Social connection programs are “connection” rather than “social” programs. They are geographically restricted and their eligibility requirements make them irrelevant for improving water supply for the poorest. But they benefit wealthier households. Furthermore, their implementation is irregular and based on political convenience rather than poverty and needs. As a result, the share of private tap provision increased for all but the poorest, with the upper middle class gaining the most from private tap installations (Boccanfuso et al., 2006, pp. 11, 27).

Water access inequalities are embedded in the cross-subsidized differential tariff system. The social price of water benefits only those with a domestic connection who have limited water consumptions, but it does not ensure the satisfaction of the basic water needs of the poor. The social price applies to consumption levels that are too low to benefit poor and larger households, but that are adequate for smaller, wealthier ones. As a result, poor households whose consumption reaches higher tariff blocks subsidize the social price paid by wealthier households consuming less. Modifying the relation between volume consumed and prices, the 2003 tariff structure made this situation worse.

The price of water at standposts is higher than the social price paid when enjoying a home connection, increasing inequalities in favor of those with better access. Price differentials among domestic consumers and among categories of consumers compound unfairness. The higher commercial price indistinctly applied to institutions affects the provision of basic services in poor neighborhoods. Agriculture water prices charged large plantations are lower than the social domestic price. Agriculture price increase and the tariff system based on quotas forced a number of medium-size cultivators to sell their land, and established inequalities with smaller growers subsidizing large ones. The overall water price structure makes for a “reverse” redistribution from the poor towards the wealthier. Perverse distributional effects increased with water prices as the water sector moved toward financial equilibrium.

IV. Water Supply Management

The commercial management of water distribution implemented by the private operator, the SdE, since the reform compounded increased water access inequalities resulting from infrastructure development and measures targeting the poor. Reaching the water sector's financial equilibrium—self-sustaining financing with private profit—required regular price increases and the implementation of a disconnection policy in case on nonpayment. These measures were disproportionately unfavorable to the poor and made prolonged disconnections from the network common. Furthermore, the private management of water distribution implies directing supply to areas with high effective demands, which resulted in unequal supply availability and water quality. Due to access difficulties, high prices, low availability and quality, many of the poor reduced their water consumption of drinking water and continue using the extremely polluted underground water.

A. Water prices.

Water price levels are a problem for most Dakar residents. A social scientist explains:

> "The price of water in Senegal was first determined by the French water company, Générale des Eaux. It then evolved to solve financial questions and contractual relations with the private operator. As a result, water prices are too high relative to people's income" (hydro-geographer, professor, UCAD; Dakar, May 25, 2006).

It is not really appropriate in a country like Senegal to talk about average monthly income as so many people don't have any income, or very irregular small amounts of money from a lucky day job, or one person with a regular salary supports twenty others. But to put the matter into perspective, in 1998 a maid earned about CFAF 30,000 per month and supported an entire family in the suburb. If the household consumed 20m^3 of water over two months (16-22lpd), the cost of that social consumption was equivalent to 5.1% of the maid's income (Collignon & Vezina, 2000). If the household consumed 45m^3 (37-49lpd), the water bill took 26.7% of her income—a proportion that is not affordable for survival level incomes. In the US in contrast, the median household spends about 1.1% of much bigger income on water for a

consumption that is without comparison (500-700lpd).

Water price increases have been disproportionately unfavorable to the poor. Water prices were raised during mid-1992, and then increased by 30% in January 1994, following the 50% devaluation of the CFA Franc. Since the reform, water prices were to rise 3% per annum until financial equilibrium was reached in 2003 and then stabilize. The first 3% increase was applied in July 1995. The yearly increase of the average water price officially remained slightly above 3% and was 3.9% in 2000. But the evolution of prices across consumer types and consumption levels did not follow 3%. The annual percentage increase was applied differentially to various tariff categories.

In 2003 when prices were to stabilize, the new tariff grid increased tariffs and reduced the volume charged the full price. The new grid has affected the poor even more, though its official aim was:

> "… to better serve the poor while ensuring sustainable sector development… [with] a social price which, at a minimum, would cover operating costs" (World Bank, 2001, p. 8).

Between 1995 and 2003, the social price of water rose by 22.1% (from CFAF 152.19 to 191.32/m^3). The full price rose 18% for consumption between 20 and 40m^3 (from CFAF 519.93 to CFAF 629.88/m^3). But for consumptions between 41 and 100m^3, now charged the dissuasive price (CFAF 788.67/m^3), the increase was 51.69%. Beyond 100m^3, the dissuasive price rose by 32.07% (from CFAF 597.14 to CFAF 788.67/m^3). Thus, price increases for all categories of domestic consumers were higher than 3% annually over a seven-year period; the social tariff rose more than the full block price; and the reduced volume charged the full price constituted a huge hidden price increase. Standposts' water price rose by 45.1% between 1995 and 2003 (from CFAF 221.98 to 322/m^3), twice as much as the social price increase.

Price increases impacted the consumption of low-income households more than that of middle and high-income consumers. Water consumption is much more price elastic for low-income consumers than for richer ones. According to Boccanfuso & al., the bottom 20% of the

population appears worse off with the evolution of prices as this fraction of the population suffered the stronger decreases in private tap supply and stronger increases in water share expenditure increased (Boccanfuso et al., 2006, p. 11).

The price of water constitutes an obstacle to water access and affects the consumption of people who already consumed very little. At the time of the reform, water consumption in Dakar was expected to grow 30% in the 2000s and triple over the next 30 years (World Bank, 2001, p. 4). By 2004, however, it was clear that consumption was lower than anticipated, even though more people were served than initially intended (World Bank, 2004, 2009).

B. Disconnection policy.

A disconnection policy for nonpayment and other service management rules accompanied high water prices, leading numerous households to be disconnected from the supply network for long periods of time. Small institutions are frequently disconnected, impeding the provision and quality of basic services in poor areas. The disconnection policy further affected low-income neighborhoods by inducing the disappearance of what was left of free public water supply.

Bill collection is a performance target the SdE must contractually reach. This encourages the strict application of water shutdown in case of nonpayment**.** No late payment is tolerated even for those clients paying regularly. The SdE prides itself on its "democratic" management, disconnecting all clients, whoever they are, if bills are not paid. A manager explains:

> "The company considers all clients equally and uniformly applies water cuts for nonpayment, whatever their status or activities. If a Minister does not pay his bill, water is turned off" (SdE manager; Dakar, May 19, 2006).

For a meter to be reopened, the client needs not only to pay the bill but also an expensive CFAF 7,500 reconnection fee. Thus, someone unable to pay a CFAF 3,000 water bill has to pay three times that amount for the meter to be reopened, making reconnection difficult. In 2002, it was reported that 12% of existing connections were not in service in Dakar (Trémolet, 2005).

But this represents monthly disconnections, not their accumulation. In some areas, like Hann Bel Air, where many social connections were installed, numerous households have their water meter shut down. Disconnected households resort to more expensive standpost water when available, to neighbors or relatives' taps, or to polluted underground water from wells and hand-pumps.

To make things worse, as the representative from the service consumer association ADEETelS explains:

> "After the reform, people received extraordinary 'regularization' bills with five to ten years adjustment arrears. On what basis? Nobody knows. Or bills included the costs of some technical improvements under the operator's responsibility. These costs are not supposed to be transferred onto consumers. People have little possibility to contest bills. Even when contesting a bill on the basis of a malfunctioning meter, the client has to pay a CFAF 15,000 fee for the meter to be checked. When a meter is shut down for whatever reason, the client has to pay for its reopening even if the SdE is responsible for the problem. Lower prices, better client services and fair billing were some of the demands expressed during a demonstration in 2003" (association representative, dentist; Dakar, May 15, 2006).

With the uniform application of the disconnection policy, health dispensaries, schools or others small institutions providing basic social services are regularly deprived of water. Their disconnection affects the provision of services and public health in destitute areas.

The disconnection policy led to the disappearance of what remained of free water supply. With the reform, the Senegalese government committed to the payment of public water bills and to reduce nonpayment arrears. This forced all public institutions to reduce their water consumption. From 1996, the SdE began treating municipalities as regular costumers and subjected them to its cut-off policy to "curb wastage and rationalize consumption." Despite the earlier privatization of standpipes, local districts still ran high water bills and important arrears. They were in charge of the water bills of a few public taps where free water was still available: in markets, mosques, public toilets, schools, health dispensaries, youth centers or other public

places where water is a matter of safety, public health and human dignity.

As it had been assumed for standpost supply, water sector managers consider that free water from public taps was wasted:

> "There was no management. People were careless. Water was running uselessly. People fetched water for domestic or professional use, or showered at mosques" (SONES manager; Dakar, May 19, 2006).

But no study was done to determine how water was actually used, or the impact of no longer providing this free supply.

Municipalities were encouraged to privatize all water supply points and closed down most if not all public taps. Institutions that had benefited from public taps established management committees responsible for selling water to users and for paying water bills to the SONES. An SdE manager explains the positive results:

> "Two years after the reform, municipalities' water consumption decreased by 50%. They still bear unpaid bills, but their debts are much lower. Privatization reduced waste and rationalized water use. The outcome is a more efficient use of water" (SdE manager; Dakar, October 10, 2006).

Impacting public agencies, the reduction of public water consumption negatively affected the life of the poor. Because of the level of poverty, many communal institutions have since the reform no or irregular water supply. Some mosques have water because a neighborhood chief pays the bill. People have to pay to use collective toilets and showers. A youth center in Guediawaye has been without water since the town hall stopped paying the bills. Even though health dispensaries' water bills may be low, Health Committees often have to borrow to pay them as patients' fees do not cover all costs.

Children's lives suffer. In schools:

> "Parents' yearly contributions don't cover the costs of water, repairs, maintenance and electricity. Water bills may also be high because neighbors without water or mechanics and nearby craftsmen use their taps" (Youth Center director, Guediawaye, April 14, 2006).

Unable to afford water bills, schools in peri-urban areas have no running water or only one tap for the entire school and no water in the bathrooms, because they cannot afford water bills. In Yarax (Hann Bel Air):

> "The four schools have water when it is not shut down. It's the same for the health center" (civil servant; Bel Air, Nov. 21, 2006).

In Pikine Est, two schools out of six did not have water early 2010. In Pikine Nord, a primary school with 1,200 students has one tap in the yard. One of the schoolteacher explains:

> "Water is not always running. The toilets have no water. The kids go out on the street when they need to. This deters girls from attending school" (elementary school teacher, local health committee president; Pikine, May 12, 2006).

Water is shut down and the high fee to reopen connections leads to long periods without running water. These are neighborhoods where cholera kills people every year.

C. Supply regularity.

Since the reform, supply regularity did not improve for everyone despite infrastructure investments to increase the volume of water feeding the network and network pressure. Commercial management requires directing supply to high effective demands. As a result distribution is interrupted in poor areas to ensure supply in priority zones, and when water is running, low pressure seriously reduces availability. Without means to compensate for limited supply, poor households resort to polluted underground water.

Before the reform, water shortages did not allow continuous supply to all neighborhoods. The SONEES regularly interrupted supply in poor neighborhoods to ensure continuous supply to rich ones. In 1995, the average number of hours of service per day was 15-16, with 24 hours in some areas and only a few during the night in others. With the sector's investments, fringe areas were to enjoy the same quality of service in term of pressure and availability as did well off areas. Since 2000, the overall population officially benefits from a 24 hour water supply (World

Bank, 2001, p. 13).[19]

According to water sector managers:

> "The autonomy gained from privatization allowed the SdE to implement a 'democratic management' of services by rotating distribution. Rich neighborhoods had no longer 24h supply so that water could be distributed in poor areas. Thus, we achieved a balanced distribution with all neighborhoods equally affected. This 'shortage sharing' practice improved the situation of the poor" (SdE manager; Dakar, Oct. 10, 2006).

Despite these claims, poor areas have very irregular supply. In reality, the SdE implements a "distribution priority" strategy, which divides the Dakar region into four zones of priority supply levels. Depending on availability and demand at a particular time, water is supplied in priority to the city center and Fann, wealthy and residential neighborhoods where the presidency, ministries, embassies, main hospitals and the residence of high-ranking officials are located. Other neighborhoods and the suburbs are lower priority zones. Close to the city center in neighborhoods such as Medina, and even more so in areas of Pikine, tap water is interrupted for hours and sometimes for days.

Frequent and long supply interruptions force residents to resort to polluted underground water. In 2006 in Guediawaye (HLM Paris, Sahm Notaire) where water cuts lasted for three to four days in a row, women fetched water or used neighborhood hand pumps plunging in the underground table.

Individual or collective water storage is necessary to compensate for insufficient supply, but poor households and communities cannot afford adequate storage facilities. Stored water is therefore insufficient and unsafe as poor storage is a source of contamination. Women store water in buckets and basins, but also in whatever recipients they may find, including some that previously contained dangerous chemicals. Some medium size buildings have rooftop cisterns, which are filled at night when pressure is sufficient. But water is contaminated in decayed and ill-maintained tanks and after sitting there for long periods of time. The chlorine the SdE injects

[19] According to other sources, the average number of hours of service per day increased to 19 in 1998 and 22 in 2005.

in the network guarantees water potability for 24 hours. But bacteria develop rapidly in tanks on heated rooftops.

Problems of pressure in the distribution network add to supply irregularity and inequality. Pressure follows water quantities and low pressure disproportionately affects poor neighborhoods. The SdE is responsible for distributing water at 1 bar to all its customers, i.e. water should reach up to the second and third floors of houses and buildings. Pressure is, however, insufficient in Dakar's lower income and suburban neighborhoods. In these areas, only a thin flow comes out of taps, and if someone uses water on the ground level, no water reaches the second floor, let alone the third or fourth floors. This occurs intermittently or throughout the day.

Reasons for low water pressure are diverse and cumulative. They are related to hydraulic problems, network configuration and urban development. A water specialist explains that:

> "When it was first built, the water network was dimensioned to satisfy a demand based on a particular urban development. It corresponded to urban plans that foresaw the construction of single story houses. Urban population growth, however, turned out to be much faster and more important than anticipated, and resulted in housing development and water demand way beyond the network capacity. On 150m2 lots meant for single story houses, owners build two, three or four story constructions in which they multiply separate individual rooms. Instead of ten to twenty people, fifty, sometimes one hundred, people occupy these lots. Of course, water supply faces height and flow rate problems" (hydrologist, professor; Dakar, October 5, 2006).

Pressure, however, follows water quantities, and quantities are unequally distributed in the network. Supplying priority zones first leaves little water and pressure for other areas. Distribution management based on priority supply zones directs water to large consumers first, reducing availability and pressure for the others. The industrial areas of the region (Hann Bel Air/harbor, SODIDA and Mbao) consume important volumes of drinking water and do not suffer from low water pressure. According to a scientist from Dakar University, industries would be partly responsible:

> "As the distribution network provides for both industrial and domestic water needs, industrial intake leaves little pressure in the network. Food processing, plastic and chemical industries consume important amounts of water. During the day, when industries are in operation, water does not reach many taps" (hydro-geographer, professor; Dakar, May 27, 2006).

Thus, water cuts and low pressure affect poor customers, making for inadequate supply and uncertain quality. In the city center, residential (Almadies, Fann Residence) and industrial areas, water cuts and pressure drops are rare. These areas and fancy sport complexes, casinos or hotels along the Corniche enjoy swimming pools, green lawns and golf courses. Hotels and high standing buildings have water reservoirs and pressure boosters, as well as generators against erratic electricity cuts, to ensure continuous water supply.

D. Water quality.

The overall quality of distributed water improved since the reform, but all areas did not equally benefit. Despite official information about the SdE exceeding its water quality targets and conforming to WHO recommendations, the quality of distributed water is uneven. The quality of distributed water depends on its origin, on the condition of the network in different neighborhoods, and on distribution management.

Since the reform's investments, an increased volume of good quality water from the Lake of Guiers feeds the distribution network. Some network renovations and the construction of a belt conduit around the suburbs contributed to improve water quality. But the network remains largely decrepit and as a result of distribution management some neighborhoods are supplied with very poor quality water. In many areas, distributed water is often red, brown and muddy, but pollution can also be invisible (Trémolet, 2005).

Near the city center (Gueule Tapée, Medina, Gibraltar, etc.), drinking water is often brown. Areas of Pikine, Guediawaye, Hann Maristes, Thiaroye, Yeumbeul, or Dalifort, receive red muddy water sometimes for days. Residents let it sit for hours for the muddy elements to settle and use water that is somewhat clear.

Except for a few renovated sections and extensions, the distribution network dates back from colonial time, and its decay is a problem for water quality. [20] In the suburbs, an old transmission pipe, the BONNA, built in 1958, brings water. The decay of this conduit and its numerous leaks contribute to water contamination. In 2008, the BONNA was partly renovated, but brown muddy water did not disappear. Intermittent supply and pressure variations in decayed piping affect water quality, as resuming flow scrapes off debris and deposits. With low network pressure, outside contaminants are sucked into the system. Illegal landfills sitting on top of pipes cause contaminants to percolate and penetrate the network. Leaks, breaks and land subsidence are additional contamination points, while water pipes are sometimes lying bare on the ground, subject to all sorts of abuses affecting water quality.

The provenance of distributed water is basic to its quality. The SdE exploits a number of underground water tables, some of which are extremely polluted, and supplies different areas with water from different sources. The suburbs receive lower quality water. Water comes from underground tables (Pout and Sebikotane) containing iron deposits and whose water is reddish.[21] According to the water company, this does not affect potability as iron presents no danger to human health. People, however, refuse to drink this water. In 2005, a "belt" conduit bringing water from the Lake of Guiers was built around the suburb to improve water quality.[22] In 2011, the SONES achieved the construction of a de-ironing plant. This investment is important for the SdE as the appearance of water impacts consumers' behavior. But other invisible sources of pollution are more dangerous.

A number of exploited tables are contaminated with nitrates and other chemicals (including Persistent Organic Pollutants) from agriculture and industrial activities, and lack of sanitation (I. Cisse, 2006; Tandia, 2002). Water tables in Thiaroye and Sebikotane contain very

[20] By 2010, 450km of had been renovated by the private operator (SdE), and 800km by the public asset-holding company (PSE-PLT combined).
[21] At certain boreholes, concentrations reach up to 3.3mg per liter (mg/l). SdE analyses show an average of 0.6mg/l in distributed water, while the WHO recommends 0.2mg/l (SdE documents).
[22] The belt is connected to the Guiers transmission line at Rufisque and surrounds the suburb via the north until the stadium and serves areas of Keur Massar, Guediawaye and Parcelles Assainies.

high levels of nitrates concentration (up to 500mg/l), way beyond WHO recommendation (50mg/l). Since production capacity increased at the Lake of Guiers, additional good quality water arrives in Dakar, and a few boreholes pumping in polluted tables were closed. But many are still in operation and feed the distribution network.

Water from contaminated sources is officially diluted in conduits and reservoirs with better quality water. At the Thiaroye plant, for example, water from the Thiaroye and Sebikotane tables is diluted with water from the Lake of Guiers and from other tables (Pout). Though SdE managers assert that:

> "Adequate dilution is automatically done in reservoirs where water from different sources arrives" (SdE manager; Dakar, May 19, 2006).

There is no control of proportions. Furthermore, because satisfying demand and ensuring network pressure are the water company's priorities, at peak hours no dilution takes place. Water from polluted boreholes is directly diverted into the network without transiting through a reservoir. Neighborhoods receiving this undiluted water are those closer to the boreholes, i.e. poor peri-urban neighborhoods.

Despite these facts, the SdE meets its contractual target for water quality: 96% for bacteriological and physic-chemical potability (Performance contract). Boreholes, as well as water plants on the Lake of Guiers and chlorination units along the transmission pipe to Dakar treat water with chlorine to ensure bacteriological potability. In the Dakar region, water plants perform basic treatment (filtration, chlorination) before dispatching water into the system, but do nothing about chemical contaminations. But an SdE manager shows that the targets for chemical potability are reached:

> "Sample analyses for physico-chemical quality (color, temperature, nitrates, iron, fluor, etc.) were 97.2% conform in 1998" (SdE manager; Dakar, Oct. 10, 2006).[23]

Targets are reached because the SdE requested and obtained exemptions from meeting

[23] SdE data show the presence 30mg of nitrates per liter in distributed water after dilution, and only 79mg/l before (SdE, 2009). This may be the case at specific points and times, but knowing the network's operation and the high concentration levels at certain boreholes, cannot be a constant throughout the network.

quality standards for various chemicals at certain boreholes. Exemptions were obtained on the ground that the SdE cannot mitigate poor quality because the SONES did not realize needed investments. An SdE manager explains:

> "An agreement was passed with the SONES for boreholes with elements in excess for as long as investments that can mitigate them or provide alternative sources of water are not realized. These exemptions include wells with excess chloride, iron, or nitrates. But even with these exemptions, we continue to perform water quality controls and dilution" (SdE manager, *ibid*).

a water specialists contends, however, that:

> "We have no idea of the real quality of water at taps. Not only controls at treatment plants and along the network do not ensure quality at taps, but control through sampling is insufficient; we need to establish a monitoring system. And testing for residual chlorine does not ensure potability either. Inhibiting factors can interfere. The SONES, as regulator, is responsible for controlling water quality and subcontracts analyses to outside labs, to us [the university] or to the Institut Pasteur. But, this is pretty rare, once a year maybe and only for a few elements" (biologist, professor; Dakar, Nov. 3, 2006).

Thus, the quality of distributed water is uncertain and not independently tested. If bacteriological pollution seems under control, the decrepit condition of the network in the chaotic environment of the suburbs provokes frequent contaminations. As for chemical contamination it is more than likely as distribution management is more concerned with cost-recovery and profitmaking than with securing people's health.

This section showed that since the reform the requirements of commercial management and financial equilibrium included high water prices and increases, disconnections for nonpayment coupled with high reconnection fees, and directing supply and good quality water to high consuming areas. These measures left the poor with unaffordable, insufficient and low quality supply, while wealthy residential, commercial and industrial areas benefit from sufficient and regular supply of better quality water.

Price levels and increases forced many urban residents to reduce their water consumption and deal with prolonged disconnections from the supply network. A pricing policy leading to supply cutoffs raises concerns about affordability, and thus accessibility. The disconnection policy resulted in the disappearance of free public water and hinders the provision of basic services in poor neighborhoods, further affecting the lives of the most destitute. Distributing water in priority to zones with high effective demand at the expense of poor areas, leaves the latter with irregular supply and low water pressure. These areas also receive water from polluted underground tables that decayed networks further contaminate. Poor areas are thus suffering from supply interruptions, low network pressure and poor water quality. Availability problems are exacerbated, as low-income households cannot compensate for poor supply with adequate storage and filtration devices. But the worst water management effect since the reform is to encourage the use of polluted underground water.

V. Impacts on People's Lives

Despite overall improvements in water coverage and official claims that the reform contributed to poverty reduction, inadequate and unaffordable water supply affects water consumption and has a negative impact on poverty. Calculating the benefits of water sector's investments in the consumer value of the additional volume of water and health improvements that would have otherwise remained unmet, reform documents saw the improvement of water services as a major source of increased revenues (World Bank, 2001, p. 42). An independent study on the impact of the reform on water consumption, access distribution and poverty, on the other hand, showed that the reform contributed to increased poverty by impacting the poor through its effects on other markets (Boccanfuso et al., 2006). The reform's negative effect on non-SdE consumers implied a greater increase in poverty for those unable to rely on SdE water. Thus, by its impact on those not supplied by the private operator, the reform made the poorest poorer (Boccanfuso et al., 2006, pp. 24-25).

The distributed water consumption of poor Dakar residents declined since the reform,

compensated by their increased use of dangerously polluted underground water for all needs. According to Boccanfuso et al., the share of informal provision significantly increased for the poorest, while it declined across all other income groups (Boccanfuso et al., 2006, p. 10). The extent of underground water pollution is not widely known and the health consequences for local populations are not systematically documented. But they are serious.

A. Domestic supply.

The unequal accessibility of drinking water implies an unequal burden of pollution from underground water. The little deep underground table in the Dakar region was a resource easily accessible and available to all before its degradation forced people to depend on distributed water. But those who do not have that option or cannot afford this dependence suffer serious consequences. Water pollution heavily affects the lives of suburban residents, hindering their activities and affecting their health and well-being.

In neighborhoods with no or few connections to the network and insufficient standposts (Yeumbeul for example), women walk to distant standposts or shared private taps in adjacent neighborhoods to fetch distributed water. But with the prices, irregularity, and poor quality of distributed water, polluted underground water is a common source of supply, fetched at traditional watering points or “céanes”, street or yard wells, hand-pumps or directly in the niayes (surfacing groundwater ponds). During the rainy season, rainwater is also used as a source of supply, accounting for 20% of total water consumption (Enda-Rup, 1996).

In the Dakar region, underground water tables are polluted by domestic, industrial and agricultural activities. Untreated industrial effluents and illegal pesticides used in urban agriculture are sources of water contamination. Dangerous chemicals (heavy metals, Persistent Organic Pollutants, acids, etc.) accumulate in soils and underground water (Gueye-Girardet, 2010; Toure & Seck, 2005). Areas with no or insufficient distributed water are also areas without proper sanitation and where growers use raw wastewater for irrigation. As a result, céane and well water contains pathogenic bacteria, including fecal coliforms (FC) in

concentrations (17,000 FC/100ml) beyond WHO norms for unrestricted use (1,000 FC/100ml) (Tandia, 2002). Céane water is also infested with parasites (ascaris lumbricoides). A sanitation specialist from the University explains:

> "In these areas [Guediawaye or Yeumbeul] there is no sanitation facilities or what they have plunges directly into the water table. These areas are so destitute that people use wells or Diambar pumps [hand-pump] to drink: they drink their excreta, and they think that water from the underground table is cleaner than distributed water" (biologist, researcher; Dakar, Nov. 19, 2006).

In Mbeubeus, more than half the population has no access to distributed water and resort to underground water for domestic and agriculture needs (O. Cisse, 2008). The area is located near the enormous landfill that receives domestic trash as well as industrial, chemical, and hospital wastes from the entire region. The landfill grew on a partially dried lake resurging from the water table, which is therefore in direct contact with the landfill. Persistent Organic Pollutants contaminate the entire area, and half the underground water points used for drinking are contaminated with lead and pathogenic organisms, including salmonella (Niang, Sarr, Pfeifer, Gueye-Girardet, & Gaye, 2008).

Many neighborhoods in Pikine are equipped with hand-pumps sinking into the underground table. In Pikine Est, hand pumps were installed in almost every street, purchased by well-intentioned foreign benefactors or local notables.[24] Residents tend to trust this source of supply thinking that hand-pumps filter water and sink deep enough (19m) in the table to provide safe water. But these pumps only filter sand and large particles. They do not filter out any bacteria or chemicals, while the entire table is contaminated, not only its surface. Women fetch water at these pumps every day for all domestic uses, except—hopefully—drinking and cooking. A housewife in Pikine Est explains that:

> "This water is clear. It is cleaner than tap water, which is dark and muddy, and it is free. I use it to clean, to wash clothes… I add chlorine to it. But when I add chlorine to water

[24] Diambar pumps cost between CFAF 250,000 and 300,000 (US$500-600) including installation.

> from the pump near the town hall, it turns black. Do you know why?" (housewife; Pikine Est, Nov 13, 2006).

These are areas where water consumption per person averages 15 liters daily and where intoxications and diarrheal diseases are rampant (Balde, Kare, & Toupane, 2006; Legros, 2002; Merklen, 2000).

Reform officials claimed that the improvement of health derived from water-related investments would be a major benefit of the reform. Morbidity and mortality rates related to waterborne diseases such as malaria and diarrheal diseases were to decline (World Bank, 2001).[25]

In the suburbs, however, waterborne diseases are rampant. According to a doctor consulting at a health center in Guediawaye:

> "Water related health problems are not receding. Consultations for diarrheal diseases (stomach flu, parasite infestation) and diseases caused by bacteria such as E. Coli and streptococcus have increased. E. Coli bacteria can cause serious illnesses (nephropathy, cardiopathy, rheumatisms), and cholera kills people every year" (doctor; Guediawaye, April 14, 2006).

In 2005, among the 11 regions of Senegal, greater Dakar had the second highest incidence of diarrhea in children under five (27.9%); an estimated 1.5 million children under five were affected and 646 died of diarrheal diseases (Balde et al., 2006).

> Underground water pollution has a wide range of negative health impacts:
>
> "Nitrates intoxications cause abdominal pains, diarrheas, and kidney diseases. Poisoning from organo-chlorine chemicals provokes respiratory, digestive and dermatologic problems. The relation between the increasing number of cancers and water, vegetables, fruits or fish contaminated by heavy metals and pesticides cannot be excluded" (doctor, *ibid*).

[25] PLT documents envisioned a 20% reduction in malaria incidents as a consequence of the project's implementation, and a reduction of 35 to 50% of diarrheal morbidity (World Bank, 2001, pp. 43-44).

B. Economic activities.

Domestic supply inequalities are replicated in professional water uses between formal and informal activities, and between large and small enterprises. As seen above, the reform benefited agriculture and industrial enterprises whose activities are "economically relevant" to justify drinking water use even if they do not require such high quality water.

Water access difficulties affect informal activities. Throughout the urban area, small crafts and businesses cannot afford distributed water. In low income neighborhoods near the city center, where most buildings are connected to the supply network (Reubeuss, Medina, Colobane), people make very parsimonious use of drinking water and do not use it for professional activities. They use contaminated underground water from courtyard wells. In the suburb, craftsmen (tanners, fabric dyers) or contractors use groundwater from wells, hand-pumps or the niayes. In certain areas, vendors use groundwater to wash cooking and eating recipients and prepare meals and drinks.

For most craftsmen, working conditions without running water are extremely difficult. Production sites and markets have no running water or only one standpost. Buckets are filled at distant standposts or underground water points. In addition to limited and polluted groundwater, these workers suffer from an unimaginable amount of dirt and dust accumulating in work sites that cannot be cleaned due to lack of water. These workers' access to water constrains their activities and endangers their health and, depending on their trade, that of their customers.

Urban agriculture and related activities in Dakar and its suburbs are mostly informal, with small individual or family plots growing fruits and vegetables for local consumption. Urban agriculture is an important activity, providing food and income for many (70% of local consumption and 30% of urban employment) (Moustier, Mbaye, De Bon, Guerin H., & J., 1999). Urban agriculture allows the integration of in-coming poor rural populations, and is a source of income for women, accounting for 45% of traders in Dakar markets (Toure Fall S. & Fall,

2001).[26] This activity faces, however, extreme difficulties, including access to water, inputs, poor and polluted soils requiring considerable quantities of fertilizers, limited equipment, land insecurity and competition from larger producers and imported produce.

Urban gardeners used to rely on underground water for irrigation. But its progressive salinization made its use improper for cultivation. In the principle cultivation site of the region, the Pikine-Cambérène-Patte d'Oie area (650ha), many ponds and wells were abandoned due to high levels of salt concentrations (Tandia, 2002).

Underground water contaminated by chemical pollution from domestic, hospital and industrial waste affects gardening activities and produce. Many gardening plots are located near pollution sources and receive contaminated drainage water (Pikine, Mbeubeuss, Patte d'Oie, industrial areas). On the Mbao agriculture site, a few meters away from the Senegal Chemical Industries (ICS), hundreds of households survive from their garden products. Irrigation is exclusively done with groundwater, which, contaminated by untreated industrial effluents discharged in the environment, prevents crop development. The Mbeubeuss agriculture site at the bottom of the landfill is highly polluted: 87% of production plots use water not respecting WHO norms for unrestricted irrigation.

Affected by polluted underground water and unable to afford distributed water, urban growers began resorting to wastewater from the city's sewers. Eighty percent of gardeners say they have insufficient water to irrigate (Niang & Gueye, 2002). Only those using wastewater seem satisfied. Irrigation methods are extremely rudimentary. Growers draw underground water from céanes (holes dug into the underground table) and from wells (deeper holes), and irrigate with watering cans or by tranches. Wealthier gardeners use motor-pumps and lay pipes with taps in their plots.

[26] Sixty percent of Dakar growers were rural farmers, while the remaining forty percent were urban citizens affected by economic difficulties.

The use of wastewater counters insufficient supply and underground water pollution, while satisfying the important nutrient requirements of intensive agriculture.[27] Wastewater is plentiful, free and rich in nutrients. Its use improves ground fertility and decreases or eliminates the need for inputs (CRDI, 2005). Wastewater use remains limited, but is spreading with increasing groundwater pollution. Gardeners dilute underground water with wastewater to reduce the salt content, or use wastewater alone. They puncture sewers pipes, and install PVC pipes or dig trenches to bring wastewater to ceanes and basins in their plots, sometimes with motor-pumps. Wastewater is stored in basins or poured into céanes.

Wastewater use in agriculture exposes the population to high sanitary risks. Produce from agricultural sites using wastewater is sold in all Dakar markets. In 1996, 400 reported cases of typhoid fever were apparently caused by the consumption of vegetables grown with untreated wastewater in Pikine (CRDI, 2005).[28] Wastewater contains pathogenic microorganisms, streptococcus, fecal coliforms (FC) and parasites, and on certain sites, toxic industrial waste.[29] In Rufisque, for example, agricultural sites had to be abandoned as industrial waste was poured into the sewage network.

The deterioration of underground water and the use of wastewater contaminate produce and affect the health of small gardeners, salespersons, and consumers. Vegetables are contaminated with chemicals, bacteria, and parasites, whatever the irrigation sources. Both underground water and wastewater are contaminated with bacteria and parasites and improper for the irrigation of vegetables that are consumed raw as well as for fruit trees or fodder plants. Vegetable contamination also occurs as they are cleaned in céanes or sprinkled in markets. Parasite larvae contaminate humans by direct penetration through the skin. Gardeners and

[27] Shocking as it may be, wastewater cultivation is not an invention of Third World countries. This practice was common the UK or the USA until the mid-19th century. Controlled wastewater irrigation developed in Europe, America and Australia since the turn of the 20th century (http://www.eolss.net/ebooks/Sample%20Chapters/C07/E2-14-01.pdf).
[28] Vegetables grown in Pikine were contaminated with parasites and fecal coliforms (6,500 FC/g in tomatoes; 175 FC/g in lettuces) (CRDI, 2005).
[29] In 1991, from 1,800 to 47 200 FC/ml were found in Ouakam untreated wastewater, and 110,500 FC/ml in Pikine.

saleswomen who enter céanes to fill watering cans and wash vegetables are particularly at risk: 66% of gardeners and 100% of saleswomen are infested with parasites (Niang & Gueye, 2002).

Thus, in the urban area, the use of increasingly polluted underground water cannot be reduced and compensated for with distributed water because it is unaffordable and/or unavailable. Since the reform, the use of underground water increased for many. The domestic, agricultural, and industrial pollution of underground water is a heavy burden on the lives of suburbs' residents, hindering their activities and affecting their health and well-being.

VI. Conclusion

This chapter showed that improving water access for the poor was not the objective of the reform. Water infrastructure investments, measures targeting the poor, and the commercial management of water distribution implemented since 1996 were geared toward increasing water consumption and ensuring the sector's profitability. They were, as a result, particularly unfavorable to the poor, increasing access difficulties and inequalities, forcing poor urban resident to reduce their consumption of drinking water and return to collective supply, and exacerbating a reverse redistribution among water consumers. The upper middle class gained the most important increases in the share of private tap installations.

New water exploitation infrastructures increased the volume of water available for distribution in Dakar, but induced access difficulties for non-urban populations. These infrastructures hindered access to the Lake of Guiers, and lowered water tables in the Niayes region, drying up village wells. Infrastructures realized to improve distribution in the Dakar region did not target the poorest areas, which remained without supply network or with insufficient collective water points. Large areas were left with no or very limited access to drinking water. Domestic private connections to the supply network were the focus of investments rather than collective standposts, which do not induce important water consumption increase per person, and are therefore less profitable. Meanwhile, new, better off neighborhoods benefited from network extensions, and domestic private connections improved

access in neighborhoods already served by the network.

The social connection program officially targeting the poor, applicable only in areas supplied by the network, excluded the poorest areas. In targeted areas, eligibility criteria excluded the poorest households, but wealthier families could benefit from the program.

The redistribution system based on cross-subsidized differential tariffs among water consumers became increasingly unfair. The application of the social price of water depends on consumption at each connection (meter) rather than households' income. The social price therefore benefits any small household, but not poor crowded ones where consumption per person is very low. As a result, the basic water needs of poor households cannot be satisfied with the social price. Furthermore, consuming beyond the social tariff threshold, the poor end up paying higher water prices and subsidizing the social consumption of wealthier but smaller households. The same situation was created by the new redistributive system among agriculture water consumers: the quota-based pricing system induces small producers with insufficient water quotas to pay more for water than large plantations consuming much more but benefiting from adequate quotas.

Other features of the tariff system disproportionately affected the poor. Collective standposts were the chosen means to improve water supply in poor peri-urban areas. But the higher price of water at standposts made water supply more expensive for these destitute populations. Standpost water consumers, who have a more limited access and are poorer than households with a domestic connection, pay more per liter of water than home consumers charged the social price. Finally, the across-the-board application of the high commercial tariff to all institutions (large and small, for-profit and non-for-profit) hinders the provision of basic services in poor neighborhoods.

High water prices and higher increases for lower block tariffs made water unaffordable for many and resulted in numerous and prolonged disconnections from the network. The disconnection policy led to the total disappearance of free public water, affecting the most

destitute. Small social, health or education institutions were hit hard by this policy, seriously impacting the lives of local residents. The commercial management of water distribution, by directing supply and good quality water to high consuming areas, left poor areas suffering from supply interruptions, low network pressure and poor water quality. Wealthy residential, commercial and industrial areas, on the other hand, benefit from sufficient and regular supply of better quality water.

If unaffordable, difficult and bad water supply forced urban residents to reduce their water consumption and return to collective supply, more serious is the increased use of extremely polluted underground water for domestic and professional needs, and the use of raw wastewater in urban agriculture. The reform benefited those who could afford water prices and whose activities are “economically relevant” enough to justify drinking water consumption (industries, plantations for export). But improved water distribution could not be afforded for informal subsistence activities that sustain the lives of the majority of Dakar residents. As a result, the poor bear the brunt of underground water pollution and depletion that worsened since the reform. Rather than contributing to health improvements and poverty reduction, the reform made precarious situations even more precarious, putting the health and subsistence of many at risk.

Chapter 3

The Water Sector Reform and Sanitation Services

This chapter considers the evolution of sanitation services since the 1996 water sector reform. It will show that though the Millennium Development Goals for sanitation will be officially achieved in Senegal, the desperate need for sanitation services, the related destruction of water resources, and the lack of an integrated approach to sanitation services, water supply and urban development deny the water reform's success at sustainable development. Numerous people suffer from lack of wastewater and sludge collection and treatment, widespread flooding, and associated pollution, diseases and increasing poverty. The cost-recovery management and demand-driven development implemented since the reform resulted in very poor and unequal access to sanitation services. This adds to the burden of pollution in poor suburb areas and constitutes an additional source of water pollution.

If the sanitation coverage rate increased in the Dakar region since 1996, this rate hides serious inequalities, service discontinuities and unmet needs. The purpose of the reform was to ensure the profitability of water distribution, thus to increase sanitation coverage and manage services at least costs, whatever the quality of services provided and the inequalities created. The development of sanitation lags far behind water supply development. Wastewater collection and treatment capacities did not follow the increase in water distribution, and therefore the increased production of wastewater. Existing infrastructures for both wastewater and rainwater are not only insufficient, but they are also technically, economically and environmentally inadequate. Insufficient resources, other defective sanitation services and irresponsible urban development affect their operation. As a result, they function poorly at a very high cost.

The first section addresses the institutional and strategic choices for the sanitation subsector. The 1996 reform separated sanitation activities from water distribution in order to ensure the profitability of the latter and transfer it to a private operator. As the international

development community set the sanitation goals for 2000 and encouraged the development of sustainable "environmental urban services," Senegal's sanitation development strategy endorsed international guidelines for sanitation services. The sanitation investments and management that followed responded to financial criteria, shifting the provision of services away from a public service, and thus satisfying neither human nor environmental sanitation needs.

The following sections analyze the effects of sanitation development and management on the availability and quality of services: bulk sewers remain very limited, badly serving a small fraction of the Dakar population (1/6); individual sanitation facilities, which are inadequate and more expansive for households, were installed in some peri-urban areas, and under-funded semi-collective small networks were installed in others. No sludge management services accompanied the realization of individual systems and small networks. Despite investments, wastewater treatment improved little, inducing pollution increases in the suburbs and pollution transfers between urban areas. Improving rainwater drainage was further removed from the reform's priorities despite its impact on people's lives and on other sanitation activities. In their attempts to fight floods, poor people and communities are impoverished further.

These negative results are due to the commercial orientations of the water sector as well as to the lack of an integrated management of sanitation services. The water sector ignored the interactions between sanitation activities, and between these activities, urban development, and water resources. Without managing these interactions as a whole, the provision of sanitation services can be neither effective nor sustainable.

I. Sanitation Development Strategy

At the time of the reform, the water sector had no sanitation development strategy and planned investments were minimal.[30] The reform was concerned with sanitation as far as it was necessary to separate this non-profitable activity from water supply. This separation was presented as an opportunity for the sanitation subsector: it would increase its autonomy and

[30] Out of the PSE total project cost US$ 223.21 millions, $24.20 million went to sanitation against $184.75 for water supply (World Bank, 2004, p. 22).

visibility, which would lead to improved financial resources and development. An autonomous public agency, the National Sanitation Agency of Senegal (ONAS), was created in 1996 responsible for managing collective sewers, wastewater treatment plants, and rainwater drainage.

In 1998, the sector adopted a National Sanitation Strategy and an investment program. The Strategy endorsed international guidelines for the development of sanitation services: financial autonomy, partnership with the private sector, and demand-driven development in low-income areas (World Bank, 1997). These orientations were embedded in the Second Water Sector Policy Letter (2001), which accompanied the second investment project (PLT). The PLT devoted more funding to the subsector, but the proportion of total investment cost remained small and far from matching needs.[31]

A. Institutional evolution.

Since its establishment, the status of ONAS has been an obstacle to the operation and development of sanitation services. As Commercial and Industrial Public Company (Etablissement Public a caractère Industriel et Commercial, EPIC), the ONAS' ability for investment planning, contracting, control and debt management is constrained. Reforming ONAS has been an ongoing issue. The options considered included creating a more autonomous public agency, allocating asset-holding responsibilities to the SONES while leasing sewerage operations to a private operator, or integrating sanitation and water supply in a public-private partnership (Min. de l'Hydraulique, 2001; ONAS, 1998, p. 6).

The World Bank envisioned eventually combining the management of urban sanitation and water supply under a concession scheme with the private sector at the end of the contract with the SdE in 2006 (World Bank, 2004). As an interim measure and to speed up procurements under its financed projects, the World Bank requested that the ONAS be

[31] The sanitation component of the PLT amounted to US$99 million. The sewerage and drainage component represented 28.2% of total project cost. Dakar water supply received 47.3% (World Bank, 2004).

exempted from public sector procurement procedures (Public Markets Code). [32] The exemption was lifted as soon as the projects ended, and contracts based on ONAS own resources or the government's investment budget did not benefit from it.

Final government decision on ONAS status was to be made before the end of 2002. This did not happen, but President Wade 2009 decision to establish a concession regrouping water supply and sanitation in 2012 would realize the World Bank's objective. [33] The implications for sanitation services are not promising. By increasing prices, this would make access to services out of reach for more people. No sanitation manager seemed to support this move. An ONAS manager explains:

> "This would require the prior rehabilitation of the old infrastructures or the price asked by a private operator will be outrageous. Financing rehabilitations, furthermore, is a problem, because the World Bank considers it a government's responsibility, and obtaining commercial loans depends on the sector's financial strength. And sanitation services are not profitable. That was the reason for separating them from water distribution in the first place" (ex-ONAS manager; Dakar, Nov. 22, 2006).

But this scheme became less likely after the February 2012 presidential elections when Wade was defeated. The future of ONAS will depend on the new president, Macky Sall's, position toward the provision of water and sanitation services and on international pressures.

B. Developing services.

To improve sanitation services in the Dakar region, the Sanitation Strategy determined different types of sanitation systems to be installed in different areas: expanding bulk sewers in the city center and developing on-site autonomous individual facilities in low-income peri-urban areas (ONAS, 1998, p. 13). International funds would serve to finance the extension of bulk sewers and treatment facilities, and subsidize a demand-driven program of autonomous sanitation systems in the suburbs. The government would transfer donors' grants as investment

[32] Under the Public Markets Code, tenders have to be made for all contracts above CFAF 200 million (US$ 400,000).
[33] In May 2009, the group NODALIS-SOGREAH was awarded a contract for a study on the institutional evolution of the water sector (Min. de l'Urbanisme, 2009; World Bank, 2010)

subsidies to ONAS to finance these investments. The operation and renewal of collective infrastructures would be based on cost-recovery management, and those of autonomous systems were an individual responsibility.

Both water sector reformers and sanitation managers supported the development of individual on-site sanitation facilities, but for different reasons. For neoliberal reformers, individual sanitation systems offered the possibility of implementing a demand-driven development. Following the World Bank Country Assistance Strategy (World Bank, 1997), sanitation officials adopted a demand-responsive approach to service delivery, matching the level of service provided to users' contributions. Thus, contrary to a public service, sanitation services would be differentiated with low investment and operation cost facilities to respond to households' effective demand. According to the Sanitation Strategy, this would allow users to make "knowledgeable" choices while ensuring their cooperation and financial contributions (ONAS, 1998, p. v). For the Bank, demand-driven sanitation facilities were:

> "… the most promising ways to increase access in a sustainable way and ensure effective maintenance" (World Bank, 2001, p. 12).

It would reduce poverty, improve living conditions, and ensure the social sustainability of basic services.

Sanitation managers, for their part, were aware of the impossibility of developing collective sewers in the entire urban area. They insisted that individual sanitation development be under the responsibility of the sanitation agency:

> "Before the reform, autonomous systems were unknown to most sanitation professionals. With their engineering-driven attitude, many were unfavorable to on-site sanitation as an alternative to bulk sewers. But some of us—me and others—suggested that autonomous sanitation development should be included in the missions of ONAS, because that was the only way to improve sanitation in many areas. I was interested in the technologies NGOs (the CREPA [Regional Center for Drinking Water and Sanitation] and others) used, and in their approach to sanitation. That's how we came to strongly

> insist at the time of the reform, and they followed" (ONAS manager; Dakar, May 15, 2006).

Thus, the mandate of ONAS includes the development of autonomous sanitation (household and community equipment). But, because of economic and settlement conditions in peri-urban areas, the installation of individual systems had to be promoted and subsidized.

Thus, international loans would finance the expansion of collective infrastructures and users' contributions would have to ensure their operation and renewal; in peri-urban areas, households would pay for the installation of subsidized individual systems and be responsible for their maintenance. This approach to sanitation development, the Strategy asserted, would contribute to better living and health conditions, allowing all strata of the population to benefit from "efficient, reliable and sustainable" sanitation services, while at the same time improving the management of water resources (ONAS, 1998).

C. Financial viability.

The Sanitation Strategy aimed at the sector's financial viability, but this goal was not reached. It was to be achieved by increasing resources from users' contributions, valorizing sanitation byproducts, and reducing costs by involving the private sector in infrastructure operation (ONAS, 1998, p. 11). Resources from water sales, however, insufficiently increased; the sale of sanitation byproducts (treated effluents, fertilizers) remained marginal, and the lack of resources impedes private sector participation. Corruption also diverts resources, while the government responds to the sector's financial difficulties by injecting public funds.

Ninety percent of ONAS' resources are provided by the sanitation surcharge applied to water consumptions in cities with bulk sewers (World Bank, 2001). These resources, however, are lower than operating expenses and the sector runs a constant deficit. [34] For revenues to cover costs by the end of 2003, the application of the sanitation surcharge, its level, and the water tariff structure had to be revised, but adjustments were minimal.

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[34] In 1998, the ONAS deficit was CFAF 484 million (27-29% of revenues, CFAF 1.63 billion) (World Bank, 2001). In 2001, the cumulated deficit amounted to CFAF 1.128 billion or 94% of the agency's capital.

Sanitation managers supported expanding the application of the surcharge:

> "We talked about applying the surcharge nationwide, to all water consumers whether they live in a town with sewers or not. But this was not accepted, even though the government committed to in 2001" (sanitation manager; Dakar, April 15, 2006).

Some managers consider that the non-targeted nature of the social water tariff affects sanitation resources:

> "The first 20m^3 of water of all consumers, even the rich, are charged the social tariff. The biggest volume of water consumed is charged the social tariff in which the surcharge is very low" (sanitation manager; Dakar, April 27, 2006).

The Strategy called for progressively increasing the sanitation surcharge and reducing the gap between the water and the sanitation parts of the water tariff.[35] It proposed an average annual increase of 13% between 2000 and 2005 was proposed, bringing the sanitation tax to 14% of the water tariff (international benchmarks range from 20 to 50% of water tariffs).[36] Increasing the surcharge, however, affects the price of water or revenues from distribution, impacting the water sector's financial equilibrium and the private operator's benefits. The 2003 water tariff grid raised the surcharge less than the 13% proposed and its proportion within the water tariff increased from 8 to 10% (Dir. de l'Hydraulique, 2004).[37] Thus, the surcharge is still very low.

ONAS' insufficient resources and the sector's deficit are unfavorable for obtaining international lending and force the government to inject money, directly or indirectly, into the agency on an *ad hoc* basis. An ex-ONAS manager explains:

> "In 2005, the government injected money into the agency, but soon the deficit returned. In 2008, the Director-General negotiated with the government, telling them: 'With what I get, maintenance cannot be done correctly.' The government accepted to artificially

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[35] In 1999, the surcharge was CFAF 36.54 (US$0.05) per cubic meter of water consumed beyond 20m^3 every two months.
[36] The surcharge would have increased from an average of CFAF 41/m^3 of water in 2000 to CFAF 61/m^3 in 2003 and CFAF 75/m^3 in 2005.
[37] The new water tariff set the sanitation proportion at CFAF 10 per cubic meter of water consumed within the social block, CFAF 45.65 within the full block and CFAF 62.45 for dissuasive block consumptions. This added CFAF 700 millions (US$ 1.4 million) to the ONAS budget (World Bank, 2010).

> raise the surcharge from CFAF 45 to 65/m³ for public water bills. Since one year we agreed on this, but we haven't seen any increase. The government has not yet told the SdE to bill an increased surcharge. The government said 'ok' and it's written in the Performance contract" (ex-ONAS manager; Dakar, Oct. 5, 2006).

In 2008, the state and the ONAS signed a Performance contract (August) that established the principle of financial equilibrium for the agency (World Bank, 2010). The state committed to provide ONAS with the necessary resources for infrastructure investments and management, i.e. to sufficiently raise the price of water, while ONAS would ensure the development of wastewater and rainwater services. The contract embedded the sanitation strategy, but proved so far ineffective:

> "Maybe the contract reassures international lenders. But if things don't move, nothing can be done. Lenders can remind the state of its obligations when they come to evaluate projects. The contract makes little difference. It cannot ensure adequate resources to ONAS" (ex-ONAS manager; *ibid*).

Based on insufficient resources, the sector's financial autonomy and cost-recovery management results in infrastructure malfunctioning, with negative impacts for public health and the environment.

The involvement of the private sector in sanitation services was supposed to improve the sector's efficiency and financial viability (ONAS, 1998, p. 7). Subcontracting the operation of new facilities to local private contractors would minimize ONAS operating costs, improve the sector's autonomy and sanitation services. The PLT would facilitate the outsourcing of operation of sewerage and pumping stations (Min. de l'Hydraulique, 2005). For the World Bank, the government's commitment to expand the role of the private sector in operating and maintaining sanitation infrastructure was key for sustainability (World Bank, 2001, p. 23). But outsourcing was hardly implemented for lack of resources and capabilities.

ONAS' financial difficulties are also the result of poor management and corruption, but neither the Strategy nor the Performance contract helped improve this situation. The agency

balanced its budget between 2002 and 2004 with a rigorous financial management and when the General-Director refused to "somehow" find the resources requested by a government official for his political campaign. A manager explains:

> "The ONAS is a political toy for the government. You have to give them money for their campaigns and their political clientele or you are fired" (ex-ONAS manager, *ibid*).

Corruption and clientelism are reflected in the constant and irrational turnover of ONAS General-Directors.

Thus, the sector's financial autonomy and increased private sector involvement were not achieved. The reform and the Sanitation Strategy failed to generate the financial resources and institutional capacities needed for improving sanitation services. After 15 years, the ONAS is unable to properly operate infrastructures. Restraining operations and development to users' contributions (cost-recovery), the strategy was effective in minimizing the weight of sanitation activities on water distribution, and moving the provision of sanitation services away from a public service. But this reduced the ability of the sector to provide services and made their access more inequitable.

II. Wastewater Collection

When they have access to sanitation services, Dakar residents benefit from very different systems. They are either connected to the bulk sewers or to a semi-collective small diameter network, or they have autonomous in-house facilities of different kinds. Each of these systems is predominant in different areas. Their price, the maintenance they require and the comfort they provide differ greatly, as do their impact on people's surroundings and health.

Since the reform, if sanitation development increased overall coverage in the Dakar region, the demand-driven and cost-effective strategy of the sector increased special disparities and inequalities in access to sanitation services. Investments expanded bulk sewers in the city center and subsidized individual and semi-collective small networks in peri-urban areas. Bulk sewers serve about one fifth of Dakar's population and their technology and inadequacy to the

local context make for heavy costs and bad services. The individual facilities installed in the suburbs are of low quality, expensive to maintain, and do not satisfy sanitation needs. Finally, the continuity of services provided by small networks is uncertain due to the lack of resources and capacities of the local communities put in charge of their operation.

A. Bulk sewers.

Since the reform, sanitation coverage by bulk sewers has little developed little. The Sanitation Development Strategy focused on improving the use of existing infrastructures, rehabilitating and expanding the network, and increasing the connection rate in order to make sewers' operation more cost-effective (ONAS, 1998, p. 14). These investments, however, were too few to significantly improve network efficiency. Furthermore, by concentrating and improving services in only a few areas, these investments increased inequalities between areas served by bulk sewers, and between served and un-served areas. Finally, the ONAS has insufficient resources to properly operate and maintain these infrastructures, malfunctioning and breakages are common occurrences.

ONAS' financial difficulties are compounded by social, economic and natural conditions at odds with the technical requirements of bulk sewers: low water consumption, sand intrusion, and inadequate rainwater drainage, trash collection, and urbanization. As a result, wastewater spills are frequent and long lasting in many neighborhoods. The inadequacy of collective systems to address sanitation needs in the Dakar region is clear and points to the need to integrate the management of sanitation services with activities, within and beyond the water sector, that impact these services.

1. Development.

The reform's investment projects did not include any large expansion of bulk sewers. Investments consisted in a few network extensions and a program of social connections, which benefited only a few areas. The goal of the sector was better network efficiency and coverage rate, not equitable service distribution.

Extensions.

At the time of the reform, collective sewers were located in the city center (Plateau), in the oldest urban areas (Medina, Université-Fann, Grand Dakar, the SICAP) and regular peri-urban neighborhoods (Parcelles Assainies, Patte d'Oie, parts of Guediawaye and Pikine).[38] Network extensions are intrinsically restricted and extension projects faced funding difficulties. Extensions were mainly densifications (+30km of secondary network between 1996 and 2003) in neighborhoods close to or where main sewers already existed (Guediawaye, Grand Yoff, Parcelles Assainies) (World Bank, 2004).

Extension funding was initially not fully borne by international loans. An ONAS manager explains:

> "Initially, financial institutions insisted that funding for network extensions was conditioned to beneficiaries' participation: households had to pay for the network to come their way. We were opposed to this and after long negotiations, it was agreed that extensions could financed by loans as long as a certain number of houses got connected to the new section" (ONAS manager; Dakar, April 19, 2006).

> Other funding difficulties delayed extension projects. In Guediawaye, for example:

> "A network extension near the stadium was undertaken in 2006 and households paid for their social connections. The pumping station to drain wastewater to the treatment plant, however, could not be built, because resources suddenly dried up in 2008 with the change in the dollar value. Even though contracts included formulas for revising prices in such cases, the 2008 change in parity exceeded the levels envisioned. Works were interrupted and new funds had to be sought. After more than a year, people who already had a connection could not use it, and those who had paid for one could not get connected. Additional resources were finally available" (ex-ONAS manager; Dakar, Oct. 5, 2010).

[38] The sewers system is made of two major networks: the Hann-Fann covering the oldest urban areas, and the Cambérène network collecting wastewater from more recent peri-urban areas (Parcelles Assainies, Patte d'Oie, parts of Guediawaye and Pikine, HLM and SICAP). It is difficult to know exactly what the sewers infrastructures are made of and the length of the networks as different documents provide different numbers without specifying what is being counted.

Beyond funding issues, the nature of bulk sewers restrains their extension to planned and relatively wealthy neighborhoods. Collective systems cannot be installed in traditional villages or floating neighborhoods where streets are too narrow and sinuous for laying wastewater pipes. Furthermore, these networks function properly only if the water consumption of connected households is above a certain volume (50lpd). A continuous wastewater flow at sufficient speed is necessary to avoid clogging from accumulated solids. Thus, selecting areas for extensions depends on housing patterns and on residents' water consumption, i.e. wealth. This adds favorable conditions to already privileged areas, while precarious neighborhoods where households consume little water or are supplied by collective standposts are not eligible for sewers extensions.

Thus, the sector's focus on densification, restricted funding and technical requirements limited sewer extensions. The investments realized improved sanitation coverage for a few areas with pre-existing sewers or favorable conditions, but did not reach most un-served neighborhoods, increasing overall disparity in access to sanitation services.

Domestic connections.

To increase the volume of wastewater in the network, more domestic connections were needed. Efforts at increasing connections complemented secondary network extensions, and with them contributed to coverage disparities. The price of a connection was a major hurdle. In 1996, it ranged between CFAF 250,000 and 300,000 (US$600, the monthly income of a comfortable household; Senegal GNP per capita at the time was US$800).

To palliate this obstacle, the PSE and PLT financed a social connection program, but affordability remained an issue and delayed the impact of the program. To be eligible, households had to be connected to the water supply network and have a water bill of maximum CFAF 30,000 every two months (70m^3 in 1995 and 60m^3 in 2003) (World Bank, 2001, p. 12). This implied that water pricing interfered with eligibility to a social connection, the bill of a poor but large household easily exceeding the maximum volume.

The program covered part of the connection cost and households could make multi-year payments, but the entry fee was too high, CFAF 100,000 (US$ 200) to be affordable. Many demands furthermore were made for houses located far from main sewers, calling for unforeseen extensions. Only 518 social connections were realized in 1999. To speed up the program's implementation, the entry fee was reduced to CFAF 19,000 (US$39), the application procedure was simplified, and secondary network extensions made more connections possible. [39] After these changes, the program became central to increase network connections.

In the early 1990s, there were 40,000 domestic connections to the sewers, serving an estimated 454,000 people (JICA, 1994). This number rose to 64,250 in 2005 (+24,250), bringing the estimated number of persons covered to 620,000—or one-fifth of the Dakar population (Dir. de l'Hydraulique, 2009). [40] [41] Between 1999 and 2004, the social connection program financed 13,000 connections, contributing more than half of total increase.

Great disparity exists between areas covered by bulk sewers. The social connection program increased this gap by improving services in targeted neighborhoods and for households who were eligible. In 1994, areas of "old Dakar" (Plateau, Medina) accounted for almost 90% of connections, while Pikine accounted for less than 10% (JICA, 1994). Social connections were realized in recent housing developments such as Parcelles Assainies, Sacré Coeur, Nord and Ouest Foire, Hann, Yoff or Grand Yoff, and in areas of "old Dakar."

Together network extensions and social connections increased spatial disparities in access to sanitation services. Sewer development benefited a few already privileged neighborhoods, while coverage remained limited or nil everywhere else.

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[39] The modern part of Grand Yoff, for example, benefited from 20km of extension and 3,500 connections in 2004, and Parcelles Assainies from 18km of extension and 4,300 connections.

[40] Data on the number of persons served by sewer connections are unreliable and incoherent. Raw estimates vary depending on sources: 454,000 persons or 29% of Dakar households in 1993 (JICA, 1994; Satterthwaite & UNCHS, 1996), 31% in 2000 (World Bank, 2001), 25% in 2003 (Dir. de l'Hydraulique, 2004; ONAS, 2006b). Also unreliable are estimates about the population of the Dakar metropolitan area. In 2005, official estimates were 2.4 million people; the 2002 census gave 2.3 million (ANSD, 2006). Knowing how information is gathered and estimates are extrapolated, these numbers are probably largely underestimated and collective sewers may cover a maximum of 20% of an urban population of more than 3 million.

[41] See ONAS site http://www.onas.sn/onas.htm (10/14/2010).

2. Operation.

In most neighborhoods with collective sewers, with the exception of residential areas, numerous breakages, clogging and overflow result in frequent and long-lasting sewerage spills, creating serious discomfort and traffic problems for both pedestrians and vehicles. During the rainy season, the frequency of spills increases and wastewater mixes with rainwater in flooded streets. The negative impacts on health and the environment are obvious.

Sewers' operation is not only hindered by ONAS' lack of resources, but also by the inadequate conception of infrastructures, their decay, insufficient rehabilitations, and by nonexistent or anarchic trash collection, rainwater drainage and urban development.

Dakar sewers were realized during colonial times and their decay causes numerous breakages (400 in 2006), which are increasing every year (ONAS manager). In 2000, the World Bank estimated that 45% (270km) of the sewers needed to be rehabilitated (World Bank, 2001, p. 5). But the PLT financed the rehabilitation of only 28km of the most damaged sections. In 2006, only 8km out the 28 planed in 2001 had been renovated when the contracting company failed on its commitments. An ONAS manager explains:

> "Because of the procedures imposed on ONAS by its status (a long process through the National Markets Commission), it took an entire year to annul the contract. Meanwhile, nothing was done" (ONAS manager; Dakar, May 15, 2006).

Breakdown and electricity cuts at wastewater pumping stations, specifically during the rainy season, are other causes of clogging and spills, with raw wastewater flooding entire neighborhoods and coastal areas sometimes for weeks. PLT investments included the rehabilitation of three wastewater-pumping stations out of 45.

Some observers see a contradiction in investing in network extensions when so much rehabilitation is needed. Extensions increase operation costs for which the ONAS has already insufficient resources. But the World Bank's infrastructure development policy goes against financing rehabilitations. A retired ONAS manager considers that:

> "It would make more sense to first renovate what we have, and then progressively expand. But international funding agencies support extensions, not renewals. They consider that renewals are the government's responsibility, but there is no budget. And adding new infrastructures when the existing backbone is weak only adds to operation costs (repair, maintenance). Curative interventions are expensive and increase every year with the number of breakages. The ONAS can't sustain new operation charges to these increasing expenditures. These are at the expense of preventive interventions and maintenance which make for better operation and longer equipment life, and therefore better services" (ex-ONAS manager; Dakar, Oct. 5, 2006).

Local social and natural conditions do not lend themselves to collective sewers, inevitably causing malfunctioning. Beyond the number of connections to the network, insufficient water consumption hinders network operation. The sizing of sanitation networks depends on the anticipated volume and quality of domestic wastewater. The Dakar network was built to serve 646,000 people, but only 620,000 are connected. Furthermore, even if 646,000 persons were connected, the network capacity was based on high European-type water consumption. As a result, wastewater flow is too little while pollution concentration is very high, provoking sedimentation and clogging. The flow of wastewater is further hindered by insufficient network slope in certain areas (Medina) and by heavy sand intrusions in others (Parcelles Assainies). Thus, despite investments in water distribution and sewers' connections, wastewater flow remains largely insufficient to ensure network efficiency.

Uncontrolled urban development creates additional problems for sewers operation. Though the overall network is oversized, segments outside the city center became undersized with the increasing number of buildings. Building size together with the disregard for connection requirements cause wastewater spills in new housing developments. A sanitation specialist from the University explains:

> "People transform their villa into a 10 rental apartment building without adapting the size of their connection to the sewers. When you see sewerage spills, look around! You'll see buildings where only houses were supposed to be. The Department of Urbanism gives authorization for replacing a house by a building. But nobody tells them to change

> the manhole to fit the new construction. When wastewater spills, the ONAS comes to unclog but does not tell people what to do and apply sanctions when they don't do it" (biologist, professor; Dakar, May 3, 2006).

The weaknesses of other public services, such as rainwater drainage and trash management, are more obstacles to sewers' operation. With insufficient trash collection in Dakar, many large solids end up in the sewers, clogging manholes and pipes. During the rainy season, flooding and anarchic rainwater management disrupt sewers' operation. Rainwater invades networks and people open sewers to evacuate water from their neighborhoods:

> "Even the ONAS does that. When you don't know what to do … you have to get rid of water somehow. It's also a housing construction problem. Yard drains are connected to the sewers or to the house sanitation system, which is connected to the sewers. Thus when it's raining, houses function like watersheds and drain rainwater into the network. When you add all that up, it's enormous. Sometimes the cast iron plate of manholes jumps up one meter under the pressure. It's a problem for all those connected because when wastewater canalizations are invaded by rainwater, the flow is impeded and starts running in the opposite direction, and wastewater ends up in houses" (ex-ONAS manager; Dakar, Oct. 5, 2006).

With malfunctioning and accelerated decay, the ONAS reacts to emergencies with costly curative interventions, but is unable to perform preventive maintenance:

> "We base ourselves on the water surcharge, and we do what can be done, not what should be done. ONAS budget is about twice as much as the surcharge. We cannot afford preventive maintenance. The entire network should be scraped clean every three years, but too short a portion of it is scraped every year" (ONAS manager; Dakar, Nov. 22, 2006).

The involvement of the private sector was to improve infrastructure operation, but the ONAS does not have the resources for subcontracting operation or repairs:

> "We had to implement this, but you need money. The ONAS was to keep only pumping stations and treatment plants. The network would have been operated by the private sector. Since 1998, the management of the network in the city center (about 600m) is sub-contracted to a private company for preventive and curative interventions. The

> further involvement of the private sector was considered in the institutional study, but since 2006, there are only small-contracts for scraping" (ex-ONAS manager; Dakar, Oct. 5, 2006).[42]

Thus, the ONAS does not have the resources to adequately operate sewers, nor to transfer operation to the private sector. Insufficient funds were invested in renewals and unfavorable social, urban and natural conditions compounded operation difficulties and costs. Malfunctioning and poor services are inevitable consequences of replicating European-type systems in a country where standards of living are much lower and institutions weaker.

3. The adequacy of bulk sewers?

The choice of technology is at stake in trying to improve sanitation services in the Dakar region. The high cost of sewerage systems, their water intensive nature, the natural environment and the kind of urbanization taking place make their widespread expansion and proper operation impossible. Sanitation specialists consider that collective sewers are neither technically, financially, nor socially adapted in most of Greater Dakar. A biologist:

> "There are housing pattern problems, but also peri-urban populations cannot afford network extensions, connections and sufficient water. Does it make sense to build collective sewers that cost billions to drain wastewater toward a treatment plant that costs more billions without being sure that the population will be able to get connected? You need to create social programs to connect them, and once connected they don't have the resources to consume enough water for the network to function. Do we need to create subsidies for them to use more water so that there is at least some self-scraping in the network? This is a problem even in the city center. For you [in the North], it works because you are wasting water, 400-700 liters per person per day. Here it's 90lpd—average, so it's not 90 liters in the sewers. That's seven or ten times less, so the model cannot work. Eating habits are also different: we use lots of oil. And other behaviors are problematic, like dumping trash in the network" (biologist, professor; Dakar, May 3, 2006).

And ex-ONAS manager:

[42] See ICEA institutional Study (ICEA, 2004) contracted by ONAS to a French consulting firm (ICEA) with financing from the EU.

> "After having worked for fifteen years with collective sewers, I realized that they are not the solution for our countries. They are very complicated, expensive, and constraining. They require a lot and produce little results. Collective sewers represent heavy investments; their maintenance and management are difficult and expensive, and they serve few people. We lose our feathers and it's as if we'd done nothing. Frankly speaking, I think that sanitation problems in our cities cannot be solved with this kind of technology" (ex-ONAS manager; Dakar, Oct. 5, 2006).

A manager from ONAS concludes:

> "Collective sewers, that's fine if the context lends itself to it, but they are not a universal panacea. It is useless to say 'we're going to get this technology because we want it, because it's the most sophisticated' when it doesn't make sense" (ONAS manager; Dakar, April 27, 2006).

Though bulk sewers appear inadequate in the Dakar context, they capture an important part of sanitation investments, and their operation takes up most of the sector's resources. Focused on improving network efficiency, the sector's development strategy promoted its densification in a few areas, thus contributing to increase inequalities and special disparities in access to sanitation services. The strategy on the other hand did not produce the resources needed for proper operation, while extensions and lack of renewal are increasing operation costs. Structural malfunctioning results from insufficient resources, low water consumption, and the natural environment, compounded by deficient rainwater drainage and trash collection, and uncontrolled urbanization. These problems point to the need to integrate all sanitation activities and urban development for coherent management and improved services, but also to consider alternative sanitation technologies. The technologies adopted by ONAS for areas not covered by bulk sewers, however, are problematic, and independent local initiatives that constitute promising solutions are not developed.

B. Individual sanitation systems.

The strategy to increase sanitation coverage in peri-urban areas promoted the installation of individual facilities based on users' effective demand and on technologies

affordable to the poor (ONAS, 1998). This strategy turned the provision of sanitation services into a private rather than a public responsibility. Individual "choices" expressed by households' ability to pay determined service provision. The PLT (2001-06) implemented this approach through a sanitation project for peri-urban areas (the PAQPUD).

This project resulted in the installation of low-quality facilities, unmet needs, increased disparity in access to sanitation services, and environmental pollution. If the project increased sanitation coverage, it left numerous neighborhoods without sanitation, and did not satisfy the needs of people in targeted areas. The poorest households could not afford any facility and the full set of equipment covering overall sanitation needs was affordable to no one. The facilities proposed furthermore were technically, socially and environmentally inadequate and malfunctioned or broke down very quickly.

1. Sanitation equipment in Dakar's peri-urban areas.

In the mid-1990s, out of the estimated 70% of the Dakar population with no access to collective sewers, much as 33% had no sanitation facilities of any kind (Enda-Rup, 1996; Ly, 1999; ONAS, 1998; World Bank, 2001). The lack of sanitation is a source of conflicts between neighbors, disease and pollution. In peri-urban areas, some neighborhoods were equipped with only a few public lavatories and collective sumps other had nothing (Mbao, Waxinane Nimsatt).[43] People without sanitation facilities, then and now, get rid of wastewater and relieve themselves in open spaces, on the beach, railroad tracks, side streets, or in dug holes. The sandy nature of the ground in Dakar's suburbs allows for quick absorption, encouraging these practices.

When houses are equipped with sanitation systems, many are rudimentary, too old, ill-conceived and ill-maintained to provide adequate services. Lost wells and collective or individual sumps are used for wastewater disposal. Traditional latrines or "wanacks" are used

[43] In 1996, there were 8 collective lavatories in Cambérène, 1 out of order in Malika, 8 in Thiaroye sur Mer, 3 in Yeumbeul Sud, 3 in Yeumbeul Nord, 4 in Hann Bel Air, 5 in Ngor (Enda-Rup, 1996).

for urinating and bathing. These systems evacuate liquids to side streets, creating ponds of stagnant wastewater between houses. Rudimentary pits or lost wells serve for excreta disposal (World Bank, 2001).[44] When pits are full after a couple of years, new ones are built. Septic tanks are rare and usually inadequately conceived, thus not performing expected functions. In some areas, tanks are so old that they collapse.

Individual sanitation systems require regular emptying. This requirement constitutes a heavy burden not only for households, but also for collective sanitation systems and for the environment. For lack of resources, emptying is irregular (from every week to never). In some areas, pits and tanks fill up rapidly and require frequent emptying, specifically during the rainy season when water tables rise and rainwater run-offs invade systems. If tanks are not emptied every week, the content of flooded systems flows back into houses (Yarax).

Tanks and pits are usually emptied manually (65%) by family members or professional "Baye-pelle" (Ly, 1999, p. 6). Pumping trucks mechanically empty tanks for CFAF 25,000-50,000 (US$50-100). Sludge trucks, however, cannot enter the narrow streets of many neighborhoods (Mbao, Yarax, Yeumbeul, Malika), and when houses are accessible the price deters households from using this service. Furthermore, the disposal of sludge is a real problem. Households and professionals dump sludge in dug holes, in side streets, improvised landfills, the ocean or collective sewers and rainwater canals.

2. Developing individual sanitation: The PAQPUD.

In 2001, the PLT financed a community-based demand-driven project for on-site services, the Sanitation Project for Dakar Peri-Urban Neighborhoods, PAQPUD.[45] Through this project, the PLT aimed at increasing sanitation coverage by 10% by 2006. An Autonomous Sanitation Division was established within the ONAS to elaborate and implement the

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[44] For excreta, households may use shared latrines (30%), their own latrines (20%), lost wells (40%), public facilities (1%), or private flush toilets and septic tanks (7%) (World Bank, 2001, p. 5).

[45] The PAQPUD covered the period 2001-08 with CFAF 10.1 billion (US$20.3M) investment costs for on-site sanitation systems to serve 400,000 people, and 4.9 billion (US$9.9M) for semi-collective small diameter networks to serve 128,000 persons (PAQPUD, 2009).

PAQPUD.[46] After a difficult start, the project reached its objective. But despite its official success, improvements in terms of access to services, equity and environmental protection are far from satisfactory.

The PAQPUD's target was to install 60,000 facilities to provide services to 400,000 people out of the estimated one million people without sanitation over five years. One million people without sanitation was based on a 1991 study, which by 2000 was an underestimation (Setude, 1991). The PAQPUD's target would therefore leave much more than 600,000 people without equipment.

Cost recovery and beneficiaries' participation guided the elaboration of the program. The PAQPUD provided matching funds to complement households' participation. Initially, the PLT covered only 50% of the cost of facilities. Households would pay investment costs and then bear maintenance and renewal costs. To realize these demand-driven services, households had to be able to choose among facilities of different prices. The technology menu for on-site sanitation systems was expanded, and a catalogue of technology options was elaborated.[47] A "social marketing" strategy with an Education and Communication Program were set up to promote the PAQPUD. Awareness had to be raised and demand stimulated. Local NGOs were hired as facilitators or "social engineers" responsible for the Education Program and for facilitating transactions between ONAS staff, local contractors and households.

Implementation.

The PAQPUD encountered many difficulties mid-way through its implementation. But after prices and procedures were modified, and new actors got involved, the project picked up.

A two-year pilot phase (2001-03) was implemented in three neighborhoods (Diamaguene Sicap Mbao, Waxinane Nimzatt and Ngor-Ouakam) (PAQPUD, 2009). The NGOs

[46] The first persons hired to staff the Division knew nothing about autonomous sanitation and its various technologies. Later on, a sanitary engineer and field technicians were hired, along with social workers responsible for promoting the acceptance of the new facilities by local residents.
[47] Options included latrines, Ventilated Improved Pit (VIP) latrines, manual flash toilets, showers, sump-washbasins, lost wells (spillways), and septic tanks with waterproof decantation reservoir.

assigned to each area hired local youth to visit residents and encourage them to get a facility. [48] By 2003, very few demands had been made and only 600 facilities were realized. As an ONAS manager explains, prices were the main obstacle:

> "The World Bank insisted people paid half of the cost of equipment up front. People could not afford it. We [ONAS] told the Bank these conditions were not adapted. But they kept insisting to keep trying, doubting our reasons. We negotiated for more than two years before the Bank finally accepted to lower the financial participation" (autonomous sanitation manager; Dakar, Nov. 21, 2006).

Beneficiaries were then asked to provide between 10 and 20-25% of costs depending on the type of facility.[49] Payments could be made over a few months and after the works' completion, and the possibility of in-kind participation was introduced.

After the pilot phase, the program was enlarged to 31 local municipalities, but implementation faced hurdles other than financial. In Ouakam, for example, where latrines were to be installed, the population resisted the project, knowing of negative experiences with these systems, their life span, maintenance cost, etc. For their part, residents in Yeumbeul, Thiaroye, Malika or Keur Massar questioned the need for sanitation equipment when they had no running water. In these areas, the lack of drinking water made concerns for sanitation secondary. To address these obstacles, more emphasis was put on social engineering.

New actors replaced the NGOs as social engineers and local notables were involved in the project's implementation, because for the ONAS:

> "The NGOs had their own procedures and approaches, and resisted using the communication tools of the PAQPUD. We wanted a uniform application of these methods. So, we hired OCBs (Community-Based Organizations) such as women and youth groups. In each neighborhood, a pilot committee was established with local notables, women and youth. Local officials often headed the Committees. Consulting firms (bureaux d'études) replaced NGOs to evaluate the feasibility of demands" (autonomous sanitation manager; Dakar, Nov. 21, 2006).

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[48] The CREPA in Waxinane Nimzatt, Enda-Graf in Diamaguene and Enda-Rup in Ngor-Ouakam.
[49] Beneficiaries' participation for washbasin was CFAF 13,000 (20% of cost) and CFAF 108,000 for septic tanks (25% of cost).

Local authorities often spearheaded the PAQPUD's implementation, using it to boost their popularity and fulfill their political agenda. In Icotaf (Pikine Est) in 2004, for example, the Local Consultation Committee (CLC), an association sponsored by the town hall, replaced the NGO working for the PAQPUD, and hired local residents as facilitators. In Tally Boubess (Pikine), town-hall employees were responsible for promoting the installation of sumps for which households had to contribute CFAF 35,000.

In addition to these changes, performance targets, which had not been set during the pilot phase, were assigned to all actors:

> "Consulting firms had to do x feasibility studies per week, facilitators had to get x demands for equipment, and contractors build x facilities to realize" (autonomous sanitation manager, *ibid*).

In 2004, demand rose to 91,000, but only 20,000 facilities were installed and only 46% of households' participation was collected (PAQPUD, 2009). To address this collection gap, local authorities were called upon to provide subsidies to cover parts of households' shares. Borrowing opportunities were created. The use of mutual aid groups and partnership with local financing institutions were encouraged. The latter was not successful as membership procedures were too constraining and interest rates too high (11%). But effective financing schemes were created in many neighborhoods.

In Icotaf, for example, the CLC made a CFAF 2 million credit available with no interest and no guarantee asked for households to acquire equipment. Only a CFAF 100 penalty per day of delayed payment was charged. In this neighborhood, where only 1,000 demands for equipment had been expressed during the first two years of the project, demand boomed after the fund was set up.

This evolution shows that populations acknowledged sanitation needs, and that the demand-responsive strategy leaving access unaffordable was inadequate to satisfy these needs. The involvement of local notables and civil servants in promoting the project also created social

pressures favorable to its implementation. Finally, with assigned targets, the new "social engineers" may have been more persuasive.

Altogether by the end of 2005, more than 63,000 individual facilities (out of 60,000 planned) had been realized, as well as 75 school sanitation blocks (out of 70 planned) and 16 public lavatories (out of 10) (PAQPUD, 2009). The ONAS estimated that the PAQPUD had provided some sanitation services to 44,000 households or 500,000 residents. In 2006, collected participation amounted to 62%. Collection continued through 2007 and reached 95%, with in-kind participation higher (59%) than financial contributions.

The project officially ended in March 2008. Its success and potential additional realizations caught the attention of development agencies and private companies in the sub-region. The facilities realized represented only 42.7% of expressed demands (148,500), of which more than half were technically feasible. This led to new projects' financing. In Diamaguene Sicap Mbao (Pikine), where poor families had been unable to gather the 25% of cost required for a latrine, Plan International financed 90% of cost for 133 households with children. To help the remaining households meet their financial contribution, Enda-Graf established a Local Solidarity Fund in partnership with UNDP's Public Private Partnership for Service Delivery Programme.[50]

As part of a sanitation project funded by the Global Partnership for Output Based Aid (GPOBA), the World Bank financed 75% of the cost of 15,000 facilities in six low-income peri-urban areas over two years (Faye, 2006a; PAQPUD, 2009). [51] Households obtained the remaining 25% through Enda's Solidarity Fund.

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[50] See: http://www.undp.org/pppsd/files/Project%20Library_PPPSD%20Support%20to%20Sanitation%20in%20Senegal.pdf (2/1/2012)

[51] GPOBA—also known as "performance-based aid" or "results-based financing" is a multi-donor World Bank administered trust fund targeting poor people excluded from basic services because they cannot afford their full cost. The GPOBA supports output-based aid projects with performance-based subsidies disbursed only after service providers deliver the outputs agreed upon. These new rules sought to ensure aid was well spent and benefits reached the poor. In July 2007, Senegal signed a US$5.8 million grant agreement (funded by the UK and the Netherlands) to provide on-site sanitation services to the urban poor of areas of Dakar: Diamaguene Sicap Mbao, Malika, Keur Massar, Yeumbeul Sud and Nord, Ndiareme Limamoulaye.

The implementation of the project faced many difficulties, in particular collecting beneficiaries' participation, and the level of realization was low. After the PAQPUD, sanitation officials took the population's acceptance of demand-driven projects for granted, and the GPOBA allocated few resources to communication. Renewed emphasis was put on this component, and Enda and community-based organizations were re-hired to implement a communication program. The project was extended until the end of 2011.

Thus, the PAQPUD was implemented and reached its target after equipment subsidies were increased, households' payments were eased and local communities provided lending opportunities. Residents' reluctance was countered by creating local implementation committees involving secular and religious authorities and setting performance targets that increased pressures for results on both project's actors and residents. The number of unmet demands showed populations' concern for sanitation and triggered new projects. But the demand-driven nature of projects requires continued "education" to convince people they have to pay for facilities that will required more expenses for maintenance and renewal.

Problems.

If the PAQPUD improved somewhat sanitation coverage for some in peri-urban areas, it did not provide beneficiaries with full coverage and left many without any services. Indeed, the project increased inequalities in access to sanitation services, installed inadequate facilities, and did not satisfy the sanitation needs of even households who benefited from it.

Inequalities to sanitation services were embedded in the size and strategy of the PAQPUD, adding to inequalities created by the differentiated service development strategy. As a result, people in poorer areas pay more for worse services, while their contribution to collective sewers constitutes a form of reverse redistribution. Households' participation to the cost of individual facilities (CFAF 22,000 average) was higher than a social connection to the collective sewers (CFAF 19,000). Furthermore, once equipped with autonomous systems, households have to pay to empty and eventually replace them. Then, whether connected to the sewers or not,

residents supplied by the water distribution network pay the sanitation surcharge included in their water bills. Thus, households with individual systems pay the sanitation surcharge while not benefiting from sewer services. Residents with collective sewers, on the other hand, once connected do not need to worry or pay for sanitation services other than the sanitation surcharge. Meanwhile, the level of comfort provided by these services varies greatly.

PAQPUD realizations were very sparse and unevenly distributed, creating disparities between and within local communities. In Diamaguene Sicap Mbao, for example, 4,511 facilities were built in 3,000 households serving about 36,000 out of 120,000 inhabitants (PAQPUD, 2009). One public lavatory and one school sanitation block were installed.

The PAQPUD embedded wealth inequalities in providing access to sanitation services, which runs counter to the spirit of public service, and contradicted the official "social" nature of the project. It may be useful to remember that the raison d'être of public services is to ensure that basic services are equally accessible to all through a redistribution system, rather than depend on individual wealth.

The demand-driven approach of the PAQPUD made it impossible for many households to qualify for any facility. The targeted areas were some of the poorest in the Dakar region, where households' average income (max. CFAF 40,000 or US$ 75 per month) is hardly sufficient to satisfy basic needs and allow indebtedness. Among PAQPUD beneficiaries, better-off households acquired better facilities, while the others were "satisfied" with equipment that did not fulfill their needs.

Finally, leaving households with the responsibility to maintain and renew equipment, the project did not ensure the continued provision of a service. Facilities subsidized through a one-time deal with financial institutions do not make for public sanitation services.

The sanitation facilities proposed by the PAQPUD were socially and technically inadequate. Not conceived based on Senegalese life-style and local socio-economic and natural conditions, the facilities were either not accepted by the population or broke down very quickly,

and none were suited to the local environment. These problems were aggravated by improper use and poor maintenance.

Very few demands were made for dry (VIP) latrines as customs and religious practice require the use of water. Installing manual flash toilets made sense where running water and sufficient means for higher water consumption existed. Otherwise, used with small volumes of water, these facilities get clogged. Sumps, washbasins and spillways are not very tolerant of the amount of oil used in Senegalese cooking (in which oil increases with poverty as a surrogate to meat and vegetables) and get rapidly clogged. In Limamoulaye (Pikine), sumps and spillways clogged by oily foods were no longer working one year after their installation. Improperly built tanks were clogged after a few months as sludge invaded the water compartment or grease intruded the entire system.

Typical on-site systems are inadequate to regularly flooded peri-urban areas. Floods destroyed facilities during the first rainy season after their installation (Icotaf). This was a reason why households refused paying their contribution. The GPOBA project learned this one lesson from the PAQPUD: not to install facilities in flooding areas or where the water table is shallow—and thus, not targeting the poorest.

If the PAQPUD raised the official sanitation coverage rate, it left most sanitation needs unmet, even for its beneficiaries. The limited scope of the project did not cover all areas in dire needs for sanitation, while required contributions resulted in numerous unmet demands. Furthermore, because of insufficient resources and the kind of facilities provided, the project did not satisfy the needs of those who acquired equipment. As many facilities broke down after one or two years and were not replaced, households returned to their previous situations.

With a broader choice of facilities to match effective demands, the project proposed systems that separated and responded to different sanitation needs (toilet, shower, washing, black or grey water disposal) when most targeted areas had none satisfied. Thus, the installation of one system within a household did not imply the sanitation needs of that family were met.

When adding the complete set (septic tank, sump, outpour, etc.) that made up a full system, households had to pay CFAF 300,000-400,000. After contributions were reduced, the cost was CFAF 100,000, making the realization of full systems unlikely. In addition, even a full system was inadequate to protect the environment from wastewater pollution—a function expected from sanitation services.

3. Insufficient sludge collection.

The difficulties of disposing from the sludge produced by individual systems make the spread of autonomous sanitation problematic. Since the reform, individual systems multiplied, but no parallel development of sludge collection and treatment was undertaken, and sludge contributes to deteriorating living environmental conditions. The gap between these complementary services indeed increased.

In 1996, only one small sludge station, located in Bel Air near Canal 6, existed in the entire Dakar area:

> "Access to the station is difficult and trucks have to wait on long lines. Only a small percentage of sludge is brought there. In any case, the size of the station can in no way accommodate much of the region's sludge" (sanitation manager; Dakar, April 27, 2006).

Building sludge stations was critical. As little experience existed in designing sludge facilities and septage treatment, the World Bank included the construction of three small sludge dumping sites as part of the PAQPUD (World Bank, 2001). The total capacity of the new dumping sites is around 220m^3/d.[52] Compared to the volume of sludge produced in Dakar every day (158,070m^3/d in 2001 and 172,445m^3/d in 2005), this can hardly be considered an improvement (Ndiaye, 2007; ONAS, 2006b).

The absence of options for handling sludge induces households to poorly maintain their facilities and to dispose of sludge in unsanitary manners. Haphazard sludge disposal creates pollution and health hazards, and causes accidents (in 2005, a child was found dead in a sludge

[52] A 100m^3/d station was built near the Cambérène treatment plant; two 60m^3/d stations were built: one in the niayes near the Technopole (2007); the other one in Rufisque.

hole). Anarchic sludge disposal also hinders the proper operation of collective sewers and rainwater drainage systems.

This section showed that the demand-responsive project for installing individual sanitation systems in Dakar peri-urban areas satisfied financial requirements, but not human and environmental sanitation needs. Providing services based on wealth, place of residence and available funds, the PAQPUD left many households without sanitation facilities, installed systems that did not resist local conditions or satisfy needs, and increased inequalities in access to sanitation services between households and neighborhoods. The PAQPUD individualized access to and continuity of services. Furthermore, this development was not accompanied by adequate sludge collection, contributing to worsening sanitary conditions in the region.

To be implemented, the project required a number of modifications: reduced household contributions; involving local notables and authorities in the project's implementation, setting performance targets.

The limited scope of the project and the cost of infrastructures impeded many households from obtaining sanitation systems. Many of those who had acquired a facility saw it useless soon after its installation due to natural conditions, "inadequate" lifestyle, or lack of maintenance. Furthermore, the facilities provided do not protect underground water resources from pollution in areas where people resort to underground water for all uses (Thiaroye, Malika, Yeumbeul, Mbao). These are areas with high incidence of malaria, cholera, diarrheal diseases and skin infections. Is a demand-responsive approach to sanitation development legitimate in such circumstances?

The differentiated sanitation development strategy resulted in more expansive, constraining and lower quality services in peri-urban areas, increasing inequalities between these areas and areas benefiting from collective sewers. Peri-urban households are not only responsible for the cost of facilities, but also for their maintenance and renewals. People in poor areas end up paying more for worse services, while contributing to public sewers services

through the sanitation surcharge, thus redistributing income from less to more privileged households.

More research and a different focus are needed to determine the kinds of facilities adapted to the Dakar region. Technical, financial, social, and environmental factors have to be considered, and public responsibility has to be engaged to ensure the existence and continuity of sanitation services, provided on a fair and equally basis.

C. Semi-collective small diameter networks.

Semi-collective small diameter sanitation networks are a promising alternative for addressing sanitation and environmental protection needs in the Dakar area. But the scattered and incremental small network projects implemented in the past 25 years approached sanitation services as a private responsibility, subjecting sanitation access to wealth inequalities. The projects required different levels of contribution from households, and left the operation of small networks to local communities with insufficient resources and to households who poorly maintain their in-house equipment. As a result, small networks differentially impacted communities and did not guarantee continued services, and thus did not ensure the satisfaction of sanitation needs in targeted areas. Experiences with small networks show that if the localized management of sanitation services makes sense, the technical and financial support of public structures remains necessary. Without public appropriation, small networks face operation and renewal problems, and the future of the services they provide is uncertain.

No such systems existed in the Dakar region until the early 1990s, when local NGOs, scientists and communities installed them in a few neighborhoods. Though the ONAS initially did not support these projects, the inadequacy of sewers and individual systems induced the agency to take up the realization of small networks in traditional village areas as part of the second phase of the PAQPUD.

Semi-collective small diameter networks provide neighborhood-wide sanitation services. They are affordable and adapted to the local context, and can provide alternative sources of

water supply for irrigation in urban agriculture. The systems include in-house equipment (septic tank, collector, decantation reservoir) that retains grease, sand and other solids before effluents flow in the small network (Ø90-100mm piping). Transporting only the liquid part of wastewaters, the flow speed and gravity needed for network operation are reduced. Infrastructures are smaller and cheaper (about 60%) than collective sewers, and their maintenance is simple (JICA, 1994). These systems can therefore be installed in irregular or traditional neighborhoods with reduced water consumption and terrain slope, and tortuous paths. Small networks may have their own treatment unit, or be connected to a local treatment plant or to the collective sewers.

1. ***Small network projects.***

In the early 1990s, scientists from the IFAN (Institut Fondamental d'Afrique Noire) and the NGO Enda-Rup realized semi-collective systems with international funds in two neighborhoods of Rufisque (Castor and Diokoul) (Niang & Gueye, 2005). The networks were connected to a "natural" treatment station. A similar project was later realized in Yoff Tonghor. These initiatives, however, benefited from limited funding, required important users' participation, and the ONAS did not endorse the projects.

Initially, sanitation officials did not support these alternative technologies. But the ONAS turned to small networks not only because they were most suited in areas where other types of systems could not be installed or survive local conditions, but also because small networks allowed neighborhoods to autonomously organize the management of their wastewater, which fitted the sector's strategy to transfer operation costs to local communities.

In 2005, the PLT allocated funds (CFAF 4.9 billions) to the PAQPUD for the realization of semi-collective networks in peri-urban. But consensus within ONAS was slow to build, as a manager explains:

> "The Autonomous Sanitation Division was alone to support these new systems. They had to insist and do a lot of convincing because a broad consensus was necessary. The

> construction of small networks involved most divisions: the Operation Division, the Lab, etc. If there is a slope, the small network can be connected to the collective sewers; otherwise a pumping station is needed; if the small network is far from any sewers, a treatment unit is needed" (ONAS manager; Dakar, April 27, 2006).

The small network component of the PAQPUD was to serve 128,000 residents (160 system-equivalent, each network serving about 800 residents) in eleven local municipalities (Faye Ngalane, 2007).[53]

Implementation.

Technical and funding problems, lack of prior consultation with local communities or constraining procedures delayed the implementation of small network projects sometimes for years. Projects were driven by households' demands, but the contributions required varied greatly due to differences in funding and local authorities' involvement. Lending opportunities were not always favorable, and projects' incoherence increased households' cost in certain areas. As a result, a few networks were not operational because too few households were connections were connected.

The diversity of financing mechanisms for small network projects implied aces inequalities. For independent projects as for the PAQPUD, collective infrastructures (network and treatment unit) were covered by international aid grants and loans. Households were responsible for the cost of in-house equipment, but contributions and financing opportunities differed with each project. Local authorities providing additional financial support in certain areas increased these differences.

In Rufisque, households had to pay around CFAF 200,000 (US$400) for in-house facilities, but a revolving fund financed by the Canadian Agency for International Development (ACDI) was set up and low interest rate loans were made available without requiring down payments or collaterals. The projects achieved good coverage with about 500 concessions

[53] PAQPUD small networks were planned in Ngor, Cite Ousmane Fall (Thiaroye sur Mer), Thiaroye Village, Yoff, Ouakam, Mbao, Cambérène Village, Hann Bel Air, Bargny and Rufisque.

connected to each network (Niang & Gueye, 2002). In Yoff Tonghor, the project financed by the French Development Agency (AFD) required CFAF 200,000 from households for in-house facilities, and lending conditions were not so favorable. Payments could be made over forty months, but an initial payment of CFAF 15,000 was requested and the interest rate was very high (12-13%). Only 15 connections (out of 150 planned) were realized, making the network's operation impossible. The project financed by UN-Habitat in Ngor, on the other hand, benefited from high subsidies and households only paid CFAF 7,000 to get connected to the small network. As a result, requests exceeded possible connections.

In Grand Yoff, the small network project implemented by the ONAS and financed by the Arab Bank for Economic Development in Africa (BADEA) (2003) overcame technical difficulties and residents' refusal to pay for connections thanks to local authorities' involvement and negotiating power. Technical problems induced additional expenses for households, who furthermore knew that the number of targeted connections had already been paid for by the lender to the contractor. By mid-2006, only 55 connections (out of 3,500) had been realized. The contractor in charge of realizing the network explains how this was resolved:

> "The local district negotiated with the BADEA to get more money. This was made easier because the Minister of Hydraulics was a neighborhood chief and the ONAS General Director also lived in the neighborhood" (contractor; Dakar, May 20, 2006).

The following years, local subsidies allowed households to cover the required expenses and the project reached its target.

The financial contribution required by PAQPUD projects averaged CFAF 22,000 for in-house equipment and network connection. In some areas, local authorities provided funds to raise the level of subsidies and facilitate projects' implementation. PAQPUD projects also benefited from social engineering. In each area, a Pilot Committee was set up headed by local authorities and including notables and representatives from local groups. The involvement of secular and religious authorities facilitated residents' participation.

In some areas, the incoherence of sanitation development unfairly weighed on households' budget. A natural scientist specialized in sanitation explains:

> "In Ngor and Ouakam, individual facilities had already been installed during the first phase of the PAQPUD, when the decision was made to lay a small network. Houses equipped with PAQPUD tanks were connected to the network. But households who had acquired other types of facilities had to pay for new tanks in order to get connected. In Ouakam, this resulted in an insufficient number of connected households for the system to operate (twice or three times that number was necessary)" (natural scientist, professor; Dakar, Nov. 10, 2006).

In Ngor, on the other hand, the local municipality contributed CFAF 10 million to subsidize household contributions to the cost of equipment (CFAF 15,000 out of 22,000), while the Imam who headed the Pilot Committee preached the importance of hygiene in Islam. The project achieved 447 connections (out of 517 targeted) serving 8,100 inhabitants.

Thus, the disparities between financial requirements, local authorities' contribution, and lending opportunities made access to sanitation services through small networks unequal and out of reach for some households.

By 2009, five PAQPUD networks were operational (Ngor, Yoff, Ouakam, Mbao, Cité Ousmane Fall), connecting 6,419 households (out of 9,963 potential) (PAQPUD, 2009). The realization of the other networks was delayed as projects were riddled by technical and funding incoherence and social difficulties (Norman, Scott, & Pedley, 2011). In some cases, the allocation of funds covered only parts of the infrastructure, leaving the population with non-operational networks. Poor network designs ignoring sites' particularities, lack of consultations with local populations, contractual rigidities, limited capacities, and procedural constraints caused more delays.

In Cambérène Village, the network financed with PAQPUD funds was achieved mid-2010, but the construction of the collector and the pumping station to drain wastewater to the Cambérène treatment plant, which was financed by the national budget (Budget Consolide

d'Investissement), had not started. In Thiaroye Village, the network and household connections were realized, but the pumping station draining wastewater to the treatment unit could not be built. No funds were available for the treatment unit, and the population living near the site conceded for the pumping station did not benefit from the project and rejected the construction. Another World Bank financing was expected for both the treatment unit and for connecting this uncooperative population to the network. In Hann Bel Air, problems of gravity and the proximity of the underground table (1-1.50m deep) made the network realization technically difficult and more expansive. The project was stuck for five years.

The realization of the small network in Grand Yoff reflected poor project design and lack of consultation. In this old neighborhood, the network was laid on main streets whose level was higher than houses' ground level. The network was therefore between 1 and 1.50m higher than the in-house facilities it was to be connected to. More than 3,000 houses were too low to get connected or they would receive wastewater from the network rather than getting rid of their own. Households had to elevate their toilets or build new ones on the roof of their one-story houses. Not surprisingly, very few demands for equipment were forthcoming. This was solved when increased subsidies financed the installation of elevated facilities matching the street level.

The Grand Yoff project also suffered from the poor quality of technical studies. Without technical staff, the ONAS subcontracts studies to the lowest bidder. As a result, many studies contain erroneous data incorrect measurement. The project's contractor explains:

> "The topographic data were wrong. We had to do everything over, or the network would have been totally dysfunctional. The linear metering was also off: plans were made for a 28km network, when only 16km were needed" (contractor; Dakar, May 20, 2006).

The UN-Habitat project in Ngor began mid-2006 and was scheduled for completion mid-2009. But mid-2010, the system was still under construction. Local concerns and conditions, problems with contracting companies, and the uneasy cooperation between the ONAS and UN-Habitat caused these delays.

Thus, the implementation of small network projects has been uneasy, and realizations are below targets. The costs for households and technical difficulties are major hindrances. Furthermore, contrary to individual facilities, which were all counted whatever their sanitation function, coverage by small networks is evaluated by the number of connections, i.e. the number of households benefiting from full services. Results can therefore not be confused by including any acquired facilities even if they do not represent real coverage.

2. Satisfying needs? Coverage, operation and management.

Most small networks did not ensure the satisfaction of sanitation needs in targeted areas. If financial requirements made it impossible for some households to connect to the networks, the limited number and size of projects made it impossible for others. Once in place, networks' operation was left to households and local communities with insufficient resources, thus not guaranteeing service continuity and sanitation needs.

Coverage.

Projects were not designed to provide sanitation services to the entire population of the areas they covered. In Ngor (12,000 inhabitants), for example, a pilot site for the PAQPUD's semi-collective systems, the project covered only one side of the village corresponding to a watershed, leaving the other side (4,000 people) without sanitation. An ONAS manager explains the rationale behind this decision:

> "It's the first project; it's pilot, so we wanted to limit investments. To cover the entire village, we would have to build two pumping stations on the other side, and three stations in the same village for one project, that's too much for a first experience" (ONAS manager; Dakar, Nov. 7, 2006).

The ONAS called upon UN-Habitat to finance a second project to complement coverage. But this project did not address all sanitation needs either. UN-Habitat identified 130 households to be connected, but requests for connections exceeded this number, as the contribution asked of households was affordable (CFAF 7,000 or US$14).

Operation.

The capacity of small networks to provide services was further reduced by operational difficulties. The proper operation of semi-collective systems rests largely on the performance of in-house facilities. But these facilities are improperly built, used and maintained, and therefore increase networks' maintenance and repair costs and disrupt services. Some projects attempted to counter this obstacle by introducing technical modifications or providing some education. But no projects provided funds to ensure the management of in-house facilities and small networks: service provision had to be financially self-sustaining based on users' contributions.

In theory no maintenance is necessary for small networks. With adequate in-house facilities, grease, sand and other solids do not clog the network and damage treatment units. The quality of in-house facilities, their use and regular emptying are, however, an ongoing issue.

Old and new tanks are almost never properly built and do not perform expected functions. With ONAS projects, tanks were officially installed by the PAQPUD. But even PAQPUD tanks were inadequately built, and in many areas, pre-existing tanks were connected to small network for the sake of expediency and reaching targets. In Hann Bel Air, for example, poorly conceived tanks were connected to the network, soon debilitating its operation.

Households tend to misuse and insufficiently maintain equipment, throwing trash in the facilities, connecting too many outlets to the same facility, and not respecting required emptying frequencies. A field visit in Yoff Tonghor (2009) found that up to ten households were connected to a one-house tank, and most facilities were not regularly cleaned. The PAQPUD's "Education" component sought to improve the use of facilities and influence behavior:

> "With the Pilot Committees, we put a lot of emphasis on education to modify behavior so that the networks would have a chance to function: how to use the facilities, what not to throw in, etc." (autonomous sanitation manager; Dakar, Nov. 21, 2006).

But these interventions were punctual and did not last beyond the projects' completion. Emptying costs and the existence of too few sludge collection sites hinder households from regularly maintaining facilities.

To counter the lack of regular cleaning and avoid sludge and solids from entering the network and damage treatment stations' filters, Enda installed a mixed system in Yoff Tonghor: in-house facilities were connected to collective septic tanks retaining solids from ill-maintained equipment before effluents flowed into the network. The UN-Habitat adopted a similar approach in Ngor, connecting the network to new shared tanks.

These modifications facilitated networks' operation but are not always possible and do not solve problems of in-house facilities' poor conception, maintenance and use. Some projects attempted to include the maintenance of in-house facilities into the overall management of the systems, but this has so far not materialized.

Management.

No funds were made available for the on-going operation of either Enda or ONAS small systems. The management of infrastructures had to be financially self-sustaining through users' fees and transfer to local private companies, Economic Interests Groupings (GIE). But contributions are insufficient.

Households' monthly contributions for systems' operation ranged between CFAF 500 and 1,500 depending on location. In Rufisque, CFAF 500 contributions were paid to a local GIE in charge of the network. To finance the operation of the treatment unit, the project had envisioned selling treated wastewater for use in green areas, but this was not successful and created difficulties for the treatment unit.

For PAQPUD projects, local communities took charge of their sanitation systems (Norman et al., 2011). Volunteer management committees would receive households' contribution, hire private operating companies and supervise network operation. The ONAS also

sought to include the maintenance of in-house equipment in the systems' management. A manager explains the strategy:

> "The ONAS envisioned rapidly (six months to a year) transferring the operation and maintenance of networks and pumping stations to the private sector through the creation of small local companies. These local GIEs will be hired for maintaining both networks and individual tanks. Because if responsibility is left with households, as long as wastewater is drained, people don't empty their tanks. Households contribute CFAF 1,000 every month and when the GIE intervenes they don't pay anything. In each area, a municipal Management Committee made of volunteers was established to watch over the use of infrastructures and the private companies' operation" (ONAS manager; Dakar, Nov. 7, 2006).

By mid-2010, however, no GIE had been hired. Resources and capacities were lacking. Municipal employees, Management Committees and residents were left trying to maintain their networks, calling upon the ONAS when things get out of hand. But with very little resources, they can hardly ensure networks' operation. In Ngor, local authorities took charge of the maintenance of the PAQPUD network. Elsewhere, Management Committees are taking care of problems with local residents. For its network in Ngor, the UN-Habitat tried to organize a strong Management Committee, and trained community members to repair equipment. The municipality will supervise the Management Committee. But here too, resources and capacities are minimal.

So far, the private management of small systems based on users' contributions was not successful. The strategy toward financial sustainability created unfairness and operational problems. Households' contributions and service quality are not uniform. The maintenance and renewal of in-house equipment fall under individual responsibility when they are crucial to the operation of the network and the provision of services to the entire community. When the operation and renewal of both networks and in-house equipment are not under public responsibility, services are at risk of disruption.

Thus, the decentralized management of context specific sanitation systems appears impossible if it is privatized and has to be financially self-sustaining. Basic services cannot be profitable and accessible to all at the same time. Therefore, when private, services are interrupted or unavailable.

3. What future?

The ONAS took up the realization of small networks 10 years after the reform. Implementation has been difficult and realizations are below targets. As with individual systems, developing and operating semi-collective networks was based on households' contributions, which restricted access and created operation problems.

Small network projects were limited in size and funding. They were not designed to provide sanitation services to all in targeted areas. Funding and technical incoherence plagued a number of projects. These factors resulted in implementation delays, operational problems, increased costs, suboptimal coverage, access inequalities, and unsatisfied needs. The financial contributions required of households and lending opportunities were not uniform. The cost of in-house equipment deterred lower-income households from getting connected, and the cost of emptying in-house facilities makes for poor maintenance and poor services.

The strategy for managing small networks based on private operation and users' contributions failed to achieve financial sustainability and to ensure service provision. Households' monthly fees cannot cover maintenance and repair costs, and no private companies took over the operation of small systems. Local communities manage their network with little resources and capabilities, while the ONAS restricts its interventions to serious problems.

Local politicians took advantage of the realization of small networks in their communities, endorsing projects as their own, helping households' financing, and getting involved in network management. But if the involvement of local municipalities facilitated the realization of small systems, it cannot ensure their continuity. Financial constraints, limited capacities and households' poor maintenance make for networks' operation and renewal

difficulties. Thus, the future of these community-based systems and the continuity of sanitation services are uncertain.

III. Insufficient Treatment

Sanitation development since the water sector reform did not fill the gap between wastewater collection and treatment. Despite some investments, treatment capacities barely increased. Only one third of wastewater collected by bulk sewers is officially treated, but the few existing treatment plants operate poorly and release much less, and dirty, effluents into the ocean. Individual sanitation facilities do not constitute treatment systems. They discharge polluted effluents into the ground and the underground water table, and the sludge they produce is disposed of untreated in the environment. Wastewater and excreta materials are therefore a source of environmental pollution, disease and social conflicts. If individual facilities pollute “on-site”, bulk sewers displace pollution from neighborhoods where they collect wastewater to other areas and to the ocean, thus transferring the burden of pollution from some residents onto others.

Existing treatment plants face daunting operation problems due to ONAS’ insufficient resources and cost-recovery management, as well as its choice of treatment technologies. Expensive and complicated technologies hinder the development of treatment capacities and the effective use of existing infrastructures. They make for heavy investments and costly operation that cannot be covered by ONAS resources. The absence of an integrated management of all sanitation activities, and unfavorable urban, social and environmental factors further compound operational difficulties. Meanwhile, the sector neglects promising low-cost alternative technologies developed locally and geared toward the use of treated effluents. Recent projects to treat domestic wastewater and industrial effluents will build infrastructures using sophisticated technologies, and manage them based on cost-recovery.

A. Existing treatment plants.

Before the reform, small wastewater treatment plants were abandoned in favor of a larger "modern" plant that would never properly function, and as the need for treatment in the Dakar region was far from fulfilled. Five small treatment plants built in the 1970s and 1980s were no longer, or had never been, in service by the time of the reform. Three of these stations had an activated-sludge treatment process; the others had a lagoon system.[54] These stations suffered from poor maintenance and some received insufficient wastewater, which growers diverted for agriculture purposes. The unique industrial treatment plant (1982), located in the Mbao industrial zone, was never in service.

In the 1980s, plans for the construction of the larger Cambérène plant took the attention and resources away from other stations. When Cambérène opened in 1987, insufficient wastewater reached it as the required number of sewers connections was not realized. Wastewater from other stations was therefore diverted toward Cambérène, and the old stations closed down. Not the entire volume of wastewater previously treated by these stations, however, was transferred to Cambérène and became a source of environmental pollution.

B. Expanding Cambérène.

By the time of the reform, the Cambérène plant treated a minute portion of collected wastewater (JICA, 1994).[55] The sector's investments and management strategy since 1996 were not successful at increasing that proportion.

The Cambérène plant has an activated-sludge treatment process of 9,6000m^3/d capacity. The plant receives wastewater from the Cambérène network in the north of the peninsula, and

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[54] Activated-sludge processes are technically complicated systems using air, bacteria and protozoans for treating wastewater. This process oxidizes carbonaceous and nitrogenous matters present in biological materials, and removes phosphate and gases. The success of the process depends on establishing an adequate community of microorganisms to consume organic waste and settle it in such a way as to produce a concentrated sludge that can be recycled. For more information see: http://www.college.ucla.edu/webproject/micro7/studentprojects7/rader/asludge2.htm (12/11/2011).
Lagoon systems are natural processes using solar energy and the self-purifying power of aquatic or semi-aquatic ecosystems to degrade organic matter.

[55] In 1994, out of the estimated 66,210m^3/d of collected wastewater, the plant treated only 3,600m^3/d.

intercepts some wastewater from the Hann-Fann network.[56] It was meant to discharge wastewater after secondary treatment in the ocean off of Cambérène Village.[57] In 1995, the plant actually released 3,600m³/d of dubiously treated effluents (World Bank, 2001).

After the reform, the PSE and PLT financed the rehabilitation and increased capacity of the Cambérène plant. A tertiary treatment unit (5,000m³/d) with an adduction pipe (2004) draining treated effluents to the golf course in the Technopole were added to the station, and an additional secondary treatment line (10,000m³/d) was built (2006).[58] [59]

The official volume of treated wastewater rose to 19% of collected wastewater (from 8,397m³/d to 14,466m³/d) with the PSE (World Bank, 2001). After the PLT, this percentage increased to 35.6%, and the de-pollution rate (organic pollution eliminated / total pollution) rose from 13% to 25% (World Bank, 2004). The concrete operation of the plant, however, belies these data. Mid-2010, the plant released 5,200m³/d of dirty effluents (out of 25,000m³/d; +1,600m³ from 1996)

The sanitation sector's resources and capacities are insufficient to properly maintain and operate the Cambérène plant, while other sanitation activities (rainwater drainage, trash collection), as well as urban, social and environmental factors hinder treatment. These problems raise the question of the pertinence of chosen treatment systems in the local context.

Activated-sludge processes are complicated, very expensive to build and operate. Once realized, they require important technical and energetic means, as well as sufficient wastewater, i.e. volumes of water consumed. Observations at the Cambérène site early 2010 showed broken equipment, accumulated sludge in decantation basins, many suspended solids after filtration and foam on the aeration basin. One of the secondary treatment lines was down and wastewater

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[56] See note 111.
[57] The purification process included pre-treatment (screening), primary treatment (decantation) removing suspended solids (SS), aeration, secondary treatment eliminating organic matters (carbon and nitrogen measured by Chemical Oxygen Demand (COD) and Biological Oxygen Demand (BOD)) and disinfection.
[58] Tertiary treatment further removes bacteria so that treated wastewater can be reused in certain activities.
[59] The Technopole is a 200-hectare area of reed marshes and sandy flats north of the expressway set aside in 1996 for the development of a cyber-technical center and an 18-hole golf resort. So far the Technopole gets heavily flooded during the rainy season and serves to drain rainwater.

flow was insufficient on the other. Effluents in the clarifier were dirty, and what came out in the ocean was black. Sludge drying beds were broken and ill maintained.

Of the entire volume of raw wastewater (about 20,000m^3) entering the station, less than half undergoes secondary treatment. An even smaller volume undergoes tertiary treatment. A partial breakdown often means the entire plant shuts down. Replacement parts have to be ordered abroad and repairs can take weeks. Electricity cuts are frequent and the only generator is not always working. To avoid wastewater spill, a bypass connects each treatment unit to the ocean discharge pipe so that wastewater at whatever stage of the treatment process can be disposed of and not flood the station.

The plant's design is inadequate to the volume and quality of wastewaters.[60] Low water consumption in Dakar induces high pollution concentrations and insufficient wastewater flow, impeding the plant's functioning.[61] During the rainy season, on the other hand, flow and pollution load become totally erratic, as rainwater inundates the Cambérène "separatist" network meant to drain only wastewater to the station. An ONAS manager explains:

> "Sometimes huge volumes of rainwater disturb the plant's operation. Wastewater flow regularity is important for the plant, but when it rains, nothing can be controlled. The flow can double from one moment to the next. Also, the plant is located in a depression and can get entirely flooded, shutting down and at risk of destruction" (ONAS manager; Dakar, April 27, 2006).

Thus, despite investments, the plant's treatment capacity remains very low and its poor operation reduces it further. As a result, important volumes of raw wastewater with very high pollution loads are discharged into the ocean at Cambérène.

C. Pollution transfers and conflicts.

The lack of treatment of collected wastewater, the poor operation of the Cambérène

[60] The Cambérène plant was designed for a BOD load of 6,000kg/d and a Suspended Solids (SS) load of 9,000kg/d, with BOD concentration of 625mg/l and SS concentration of 938mg/l. In the treated effluent, these concentrations were to be reduced to 20mg/l and 30mg/l respectively.
[61] The physical and chemical parameters of wastewater in the Dakar urban area are from two to ten times higher than those in developed countries due to differences in water consumption levels and cultural habits.

plant, and the absence of industrial sanitation cause the degradation of coastal waters around the peninsula and have dramatic consequences for local populations. In the case of Cambérène, this led to an intense conflict between the population and ONAS. This conflict illustrates how local politics facilitated the implementation of a project that benefits some areas at the expense of poorer communities. The handling of the conflict shed light on Senegal's politico-religious clientele type politics and disregard for local populations.

Traditional coastal fishing, a major source of subsistence in the region, is seriously affected. Catches have diminished since the 1980s, forcing fishermen out to sea. Those who can afford an engine for their "pirogue" and gas to run it might find fish further off shore. The others are out of business. Divers have to dive deeper and deeper to find shellfish. Their income dwindled, making the acquisition of now necessary tanks even more difficult. Industrial and domestic pollutions have affected the Baie de Hann for decades, reaching the point of destruction. Local residents now call the bay where fish was once plentiful the "dead sea," and fishermen have to sail 5 to 6km outside the bay to find fish. As for the contamination of fish and its impact on human health, little data are available.

For years, the Cambérène population denounced the health impacts of wastewater discharged on their shore. Heavy metals pollute waters in which swimming is authorized. Noxious smells infest the village where all the children are sick. [62]

Conflict over the treatment plant began when the Cambérène population opposed its construction in 1987. Cambérène Village is located 2km away from the plant, on the shore where effluents are discharged. The particular religious status of Cambérène Village made the nearby installation of the treatment plant the worst abuse that could be done to this community. [63] The

[62] There is a strong correlation between the prevalence of certain diseases in the area and wastewater discharge. Endemic diseases among the population include tuberculosis, dermatitis, parasitizes, rheumatisms, headaches, night fever, eye irritation, etc.

[63] The Layenes inhabiting Cambérène are a religious community with a mystic relationship to the ocean whose waters are said to have a healing power, where cleanliness is revered and where saints' mausoleums were established.

conflict worsened as untreated effluents poured in the surroundings, on the shore and the beach of the village. An educated resident of the Village explains:

> "The marabous had given their approval for the construction, but the population rejected it. The youth destroyed the first pipe laid on the road from the plant to the ocean. But we were in front of a fait accompli. Wastewater from Dakar was imposed on people who were not even connected to the sewers. Then, we realized that wastewater was not treated. Certain days it's impossible to breathe. And we saw an upsurge of tuberculosis in the village; the average number of people affected here is higher than the average nationwide. Also, manholes often burst and wastewater pours into our houses" (professor; Dakar University, May 28, 2006).

In 2000, an uprising erupted after a burst pipe released raw wastewater and flooding got worse than usual. The same resident continues:

> "One day wastewater spilled over several hundred meters and reached a mosque near the village. In reaction, the youth clogged a number of manholes and wastewater spilled everywhere flooding residential neighborhoods downstream, the treatment plant, and even the expressway. But the rich put pressure for this to stop" (professor, *ibid*).

After mediation, the government and the ONAS committed to extend the discharge pipe into the ocean and asserted that treatment would improve and discharge would stop, while local politics and clientele weakened the village's position. The president of the Village Committee created to negotiate with the authorities explains:

> "We signed an agreement. The government committed to treat wastewater to the third degree before the end of 2001, and they said they would stop discharging wastewater in Cambérène because it was going to be sold to cultivators for irrigation. This is what I signed as president of the village committee in 2000! We won but later the marabous received bribes. They met with the Prime Minister and they stopped coming to Committee meetings. Without them the Committee lost its weight. More people got bribes as time went on. In October, the police came to force us to unclog the manholes. The confrontation was violent" (village representative; Dakar, May 13, 2006).

In 2002, the PLT financed an ocean pipe, which was snatched by a storm in 2005. Since then, a temporary 200m long flexible pipe discharges the plant's effluents where waves form

and bring effluents back to the shore. After 2006, plans for an additional outfall draining effluents further into the ocean (1.7km) were elaborated without consulting the population or undertaking any environmental assessment. For the Cambérène population, this project means more wastewater on their shore.

The project has been mired in technical, financial and social difficulties. In 2009, the European Union provided financing (US$13 millions) for the ground section of the pipe (2,9km), but financing for the ocean section was yet to be found: the price offered was much higher (US$17 millions) than the anticipated cost (US$7 millions), and a new tender was launched. The project faces technical uncertainties and is potentially inadequate. A technical assistant explains:

> "Dimensioning the discharge pipe is drowned in uncertainties: if many more connections are made to the sewers, it will be too small, but nowadays water consumption is insufficient for the station. Nobody knows what will be needed in 5 years. But the construction site is the same whatever the size of the conduit, and it's huge: a trench of the pipe's length will be opened in the ocean with metal fences" (technical assistant; Dakar, Feb 10, 2010).

Works were to begin in February 2010 but in January the population vociferously rejected the new outfall. An ONAS manager reports that:

> "They say we [the ONAS] will have to walk on their corpses to install a second pipe. And there is no funding for the ocean outfall" (ONAS manager; March 16, 2010).

After the January blow out, the European Union declared it would finance the project only if the population accepted it. This could encourage dialogue, but the project's funding had to be disbursed by the end of 2011, and bribes are being efficaciously distributed.

D. Choice of technology and sanitation projects.

The choice of treatment technologies depends on powerful interests rather than sanitation needs. Despite the inadequacy of activated-sludge systems, the ONAS neglects locally developed alternatives aiming at effluent reuse in favor of sophisticated technologies. The PLT

financed the rehabilitation of three treatment plants with the same technology as the Cambérène station, and new sanitation projects follow suit. These technologies and their cost-recovery management hinder the development of wastewater and sludge treatment, and the use of treated effluents in non-domestic activities.

1. Alternative technologies.

In parallel to official sanitation development, local scientists applied natural treatment processes to treat wastewater at the neighborhood level and use treated effluents in urban agriculture. Natural processes require no fossil fuel energy, and their agriculture-type management does not call for qualified technicians. These systems proved effective and provided important pointers for the development of systems appropriate to the local context, but their further development is hindered by the lack of public endorsement.

The NGO Enda and IFAN scientists developed natural treatment systems to connect to small diameter networks (Gaye & Niang, 2002; Niang & Gueye, 2005). The treatment units used plant lagoons adapted to the local climate and type of wastewater. Treatment efficiency reached EU standards for Suspended Solids (SS) and oxygen demand (BOD_5 and COD) and parasites were removed, but bacteria remained.

Without official support, scientific follow up was impossible. The experiments were not pursued and the installations fell in disrepair. Participants to these initiatives explain:

> "Small projects that do not drain billions are not interesting for the government or the water sector. Cooperation with official structures is impossible. There is a prejudice in favor of 'sophisticated' technologies but they don't do any research on their suitability to environmental and economic conditions, or cultural behavior. These are obstacles to the development of alternative systems" (biologist, professor; Dakar, May 3, 2006).

> "The ONAS refused to take over the Rufisque plant or to adopt the treatment technologies as possible options. They said there was insufficient data and their staff did not know these systems. No money was allocated to scientifically evaluate the systems" (Enda worker; Dakar, May 28, 2006).

UN-Habitat, on the other hand, adopted these systems as “best practices” and supported their installation in other African countries, and currently financed research to provide more scientific data on these treatment systems.

Seeking to develop wastewater reuse in urban agriculture and other non-domestic activities, experiments with natural treatment systems encouraged new practices (Niang & Gueye, 2002; Niang & Gueye, 2005). As streptococcus and fecal coliforms remained after treatment, irrigation and cooking methods were elaborated to eliminate all bacteria before consumption. These experiments also pointed to the need to integrate land and sanitation development activities so that domestic, sanitation and agricultural activities can complement each other. In two areas, the lack of coherence between topography and land development hindered effluent reuse: treatment units were downstream from agriculture sites, and using energy to pump treated effluents to farmlands was not feasible.

Though developing wastewater reuse is part of ONAS’ responsibilities, the agency’s choice of technologies and cost-recovery management impede this development despite the important need for alternative sources of water supply. For the ONAS, effluent reuse is a source of income subjected to cost-benefit calculations. Wastewater reuse can be considered so far as there is proof of demand (Pigeon, 1999).

In 2004, the ONAS signed a contract with the Technopole to provide 2,000m^3/d of purified wastewater to the golf club. A few construction companies buy treated wastewater on an ad hoc basis. To increase demand, developing horticulture on the Technopole or bringing treated effluents for irrigation in the Niayes were suggested. But the costs of treatment and transportation impede broader use. Expensive treatment produces expensive effluents, and even if the need for treated effluents is important, supply only responds to effective demand.

As seen above, there is no sludge treatment in the Dakar region. Progress for developing adequate technologies are constrained by the sector’s management and by private interests. Existing sludge stations are collecting points, not treatment plants. After decantation, effluents

are drained to the ocean via the collective sewers or to treatment plants.

To improve sludge treatment technologies, an experimental station was set up next to the new sludge dumping site at Cambérène (Ndiaye, 2007; ONAS, 2006b). According to the ONAS, the experimental station was to test different treatment processes and guide its choice of sludge treatment technologies. A research partnership between the ONAS, a private Swiss company, SANDEC, and the IFAN was to take place for this project. In the 1980s, IFAN scientists created an Experimental Treatment Plant to develop locally adapted treatment methods.[64] Research was elaborated in response to the need for independent sludge treatment stations as multiplying dumping sites was urgent but connecting all of them to classic treatment plants would not be feasible. More recently, these scientists elaborated projects for connecting sludge treatment stations to small networks.

But the ONAS avoided cooperation with local actors, apparently under pressure from its private partner. This lack of cooperation hinders the continuity of research and local capabilities. An ex-ONAS manager considers that:

> "SANDEC wants to own research results. In fact, they're not doing research on alternative treatments. They use the project to test and install a particular technology they are promoting everywhere. This also means that research will end when SANDEC leaves as very few people in Senegal are knowledgeable about these technologies" (ONAS retiree; Dakar, June 23, 2010).

Even in-house research on non-conventional treatment processes, which was undertaken in the 1990s, was never used. A manager explains:

> "We had two persons who researched on lagoon process with local plants. They developed the 'Hierarchical Mosaics of Artificial Ecosystems': results were very promising in terms of space and performances. Treated wastewater could be used. These studies were important; they even won the President's Prize for Science. But we never used this research. When the ONAS decided to renovate an old station, our idea [managers] was to use this station to test this technology. Unfortunately, the ONAS has a

[64] The station is part of the IFAN Wastewater Treatment Laboratory (LATEU) within the Department of Animal Biology.

> problem when it comes to the choice of technology: who decides? Someone influential pushed the idea not to use the Hierarchical Mosaics, and we did an activated-sludge station. There is no clear decision-making procedure that everybody respects when strategies have to be determined. If anybody, because of his power can impose a technology because he has a friend who manufactures it; it's a problem. The choice of technology is sometimes not even a choice: it's part of the investment package financed by development partners. If we don't solve this, outside influences will continue to impose their technologies" (ex-ONAS manager; Dakar, Oct. 5, 2006).

Thus, the choice of technology within the ONAS is affected by external influences and does not follow any established procedures. Together with the absence of official support to and cooperation with local initiatives, this does not anticipate an optimistic future for improved wastewater and sludge treatment and reduced pollution in the Dakar region.

2. Future projects.

Two ambitious sanitation projects backed by international financing are currently under study to address the pollution of coastal water by untreated domestic and industrial effluents around the Corniche (peninsula's head) and the Baie of Hann. These projects suffer from the same shortcomings as most development undertakings in the sector: elaborated without consultation, ignoring social and environmental aspects, and driven by the unquestioned primacy given to modern technologies and financial mechanisms.

The Corniche project plans to intercept and treat all domestic effluents discharged into the ocean from the Cap Manuel to Almadies.[65] An interceptor and a pumping station will drain wastewater to a new activated sludge treatment plant (Teroubi). As of early 2011, however, what will be done with the effluents and sludge produced by the plant and with rainwater currently drained by the Hann-Fann unitary network, or how to finance the operating costs of these infrastructures were unsolved.

The Baie project was spurred by the increasingly infamous pollution of the "Clear Waters" bay, and addresses industrial pollutions (ONAS, 2006a). Investments include a 13km

[65] Study in progress financed by the US Trade and Development Agency (US$48M).

collector on the beach around the bay, 8 pumping stations, the rehabilitation of the Mbao industrial treatment plant, and a 3km long outfall into the bay. Industries would have to pre-treat their effluents before discharging them in the interceptor. International loans will finance the project's infrastructures, but the industries will bear the cost of operation. An industrial sanitation unit was established within the ONAS (March 2010) to follow up effluent management and provide the interface between the ONAS and industries. With a single staff member, however, this division has neither sufficient resources nor leverage.

The polluter-pays principle with sanitation charges and pollution taxes served as basis for a Memorandum of Understanding and a Discharge Convention negotiated in 2009. [66] With the Memorandum of Understanding, industries committed to adopting environment friendly production processes, pre-treating their effluents, and paying charges for the infrastructures' operation. In exchange, they will benefit from a pre-treatment investment-financing program and tax exonerations for pollution reducing investments. Individual commitments have yet to be made. To help industrialists comply with pre-treatment requirements, the Senegalese government enlarged the mission of the Upgrading Program to include environmental upgrading and support environmental protection investment. [67] The Discharge Convention determined an acceptable level of effluent pollution for discharge in the future network. Each company will sign an individual convention specifying the acceptable pollution load for its particular effluent and its sanitation charge.

The World Bank had approved funding for the project when the project was arrested. [68] Actors whose involvement was needed for the project's implementation but who had not been consulted during its elaboration raised important concerns. Local authorities from the districts bordering the bay criticized the project, which did not integrate domestic wastewater and

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[66] Negotiating parties were the ONAS, the Ministry of the Environment, industries' unions, the Upgrading Program Office and the Port de Dakar.
[67] The "Upgrading Program" of the Ministry of Industry helps firms improve their competitiveness through financial and technical support. The UNIDO (United Nations Industrial Development Organization) as technical partner encourages production processes without negative environmental impact and reasonable consumptions of energy.
[68] A Euro 50 million loan from the European Investment Bank (BEI) and the AFD.

rainwater drainage in an area without sanitation. The Port de Dakar's managers noted that planned infrastructures integrated the harbor's wastewaters, but their connection to the interceptor required restructuring the harbor's existing network.

The feasibility of a collector on the beach was uncertain: with fishing boats coming and going, moving sands and tides, the collector would have to be buried at least 5m deep. Installing it on the national road up above was suggested. The treatment plant's location and even its necessity were questioned. Initially the plant was to be located in Thiaroye, but residents refused, concerned with pollution and because they would not be connected to the system. Rehabilitating the plant in Mbao was then decided, but a collector could as well drain wastewater to the Cambérène plant.

Finally, the rehabilitated plant would perform only primary treatment (decantation), leaving the organic pollution load of "treated" effluents intact, and the environmental impacts of the discharge pipe were unknown. A civil servant from the Ministry of the Environment explains:

> "A 3km long outfall would release effluents in the middle of the bay where currents are weak. No study on currents, flow or tide patterns was done, and no one knows what would become of discharged effluents. With weak circulation, they may concentrate in the middle of the bay. A study was finally undertaken to determine the relevance of this option" (DEEC employee; Dakar, Jan. 20, 2010).[69]

A project technical assistant:

> "Data on currents will determine the technical options, which will impact the sanitation charge. The bay's currents are key but they are considered last" (technical assistant; Dakar, Feb. 3, 2010).[70]

The involvement of new actors uncovered the shortsightedness of a project designed by technicians and financiers and with a narrow sectoral approach:

"Solving industrial sanitation problems cannot be done through an industrial sanitation

[69] The study is being done by the IRD (Research for Development Institute) and the ocean and atmospheric physics laboratory of the polytechnic school; final report to be published at the end of 2010.
[70] According to the new calendar, works will start in 2012 and sanitation services will be available in 2014.

> standpoint alone. We were supposed to validate the project, but instead we are questioning it. Donors don't like this" (technical assistant, *ibid*).

Though enlarged involvement induced a more integrated approach since 2010 and led to the creation of an inter-institution committee, this is far from the integrated management needed to ensure reducing the bay's pollution:

> "There is no global vision for the Baie. When the French military leaves [a base that takes up an important land area near the harbor], what will happen to the land they occupy? Speculation will be tremendous, and what will happen to this land will bring new sanitation problems. The inter-ministerial committee for the Baie de Hann[71] was supposed to develop a vision for the Baie, but the interests of powerful actors are blocking the process—Wade wants a piece of it, and the President of the National Assembly is also the Mayor of Mbao" (technical assistant, *ibid*).

If these two sanitation projects see the light of day, their technology and cost-recovery management, the lack of integration of sanitation activities and urban planning will most likely lead to the same operation and overload problems facing existing sanitation infrastructures, and result in continued pollution.

This section showed that wastewater treatment lags far behind needs. Since the reform, the ONAS technical orientations, its cost-recovery management, and its non-integrated approach to sanitation activities in their urban, social and natural environments restricted the development of treatment infrastructures and implied their very poor operation. The proportion of wastewater and sludge that is treated is of no consequence compare to their production.

Developing cheaper alternative treatment processes that can be generalized to the Dakar region is necessary to increase treatment capacities and the use of treated effluents. But the ONAS did not support or capitalize on the contextually integrated systems developed by local scientists and resists collaborating with them. As a result, rather than evaluating social, economic and environmental conditions to determine suitable treatment methods, investment

[71] An Inter-Ministerial Committee for the Baie de Hann headed by the Ministry of the Environment was established in 2002 to address issues of solid and liquid wastes, as well as land restructuring and industrial delocalization.

decisions are influenced by special interests and seek to replicate sophisticated technologies developed elsewhere to suit other contexts.

Sludge treatment is non-existent, and sludge contaminates the entire suburbs. Untreated collected wastewater pollutes coastal waters, transferring the burden of pollution from residents served by bulk sewers onto others. The Cambérène plant, though receiving continued international funding, releases untreated effluents. This provoked a serious conflict with the local population, which officials handled with bribery, lies and the use of force. Despite these consequences, new sanitation projects pursue the same technical and financial trends.

IV. Rainwater Drainage Services

Rainwater drainage is an important component of sanitation services in a region that gets heavily flooded three months every year. Flooding is a natural occurrence in certain areas, but uncontrolled urbanization made them worse and new areas now get flooded. Drainage infrastructure development did not keep up with increasing flooding, and none exists in the most affected areas. In 1996 the ONAS was entrusted with the management of drainage systems, but no additional resources. Rainwater drainage was even less a priority for the water sector than wastewater collection and treatment. Few new infrastructures were realized, and their operation is hindered by poor maintenance and the inadequacy of other sanitation services. Without drainage services, flood management becomes an individual and local responsibility, and leads to increased poverty. Floods strongly affect people's lives, the poorest bearing the highest cost.

A. ONAS and drainage services.

Before 1996, local municipalities were responsible for the management of rainwater infrastructures (drainage canals), while the SONEES managed unitary networks draining wastewater and rainwater. After the reform, responsibility for rainwater infrastructures was transferred to the ONAS (Law 96-02 of 22 Feb. 1996). Various funds and taxes were identified as sources of funding for drainage services, including resources from Local Communities'

Equipment Funds, but no mechanisms for transferring these resources to the ONAS were established. As a result, the management of rainwater infrastructures suffers from insufficient resources, while overlapping responsibilities with local municipalities make for confusing roles.

At the time of the reform, sanitation managers were against the transfer of rainwater management to the new agency, but a sanitation manager working for the SONEES at the time explains:

> "The government insisted, saying they were not going to create a national sanitation agency without putting it in charge of rainwater. This is a source of many problems. The management of rainwater systems in a city like Dakar is very expensive, difficult and risky. Floods come about quickly and it is a catastrophe. And the operation of rainwater infrastructures is closely related to street maintenance" (ONAS manager; Dakar, May 15, 2006).

After the ONAS was created, local districts refused to transfer resources to the ONAS. Responsible for flood management and street maintenance, local districts contribute to the operation of drainage facilities and their own funds are limited.

Thus, drainage services are a challenge for the ONAS. Tasks and problems are numerous, and its resources and capabilities are limited.

B. Floods.

Living conditions during the rainy season are horrendous. Streets are impracticable and dangerous. Diseases spread. The situation is worst in peri-urban areas, where the poorest are most affected. For many, living in flooded homes has become part of life, and the worst off are trapped in flood camps.

After a strong rain or cumulated rainy days, "Dakar is paralyzed" is banal news. Roads are cut off, and the city along with them. Even the city center is paralyzed; streets turn into rivers; traffic jams develop in minutes and are inextricable for days; drivers get trapped by water and pedestrian life becomes a tortuous wet ordeal. Everywhere, rainwater mixes with rubbish, rotting animal corpses, and leaked sewers. People wade and jump from sand bags to stones.

In peri-urban areas, floods are worst due to the rising underground water table. Reduced pumping in the Thiaroye water table aggravated the phenomenon in areas where people settled on low grounds. The flow speed of run offs can be powerful and dangerous, and sometimes carry reptiles. Numerous houses and public buildings, including schools and hospitals, get flooded. People are forced to leave their homes during the rainy season, and in certain neighborhoods water stagnates in streets and houses all year round.

	Max flood surface (ha)	*Max flood height (cm)*	*Max flood duration (days)*
"Lansar"	17,7	170	210
Diameguène/Diaksao	12,8	80	90
Médina Gounass	8,7	130	180
"Ganaw Rail"	4,7	80	90
Entrée Pikine	14,2	80	10
Fass Rue 22b	7,1	45	14
Ngor	5,0	100	180
Grand Yoff	5,8	140	30

Table 1: Characterization of floods in some suburb areas in 1989
(JICA, 1994)

In addition to daily nightmares, floods constitute a health hazard. Stagnant water combines with wastewater and trash, causing diseases. Insects proliferate, malaria crises multiply and cholera outbreaks resurface (IRIN news service, 2007). Peri-urban areas are particularly affected. In 2002, the most frequent consultations in Yeumbeul were related to water: malaria, dermatitis, diarrheal diseases, and helminthiasis (A. Diop, 2006). In 2004, malaria cases were three times higher than the average for the entire Dakar region.

C. Drainage infrastructures and increasing floods.

Drainage infrastructures are inadequate and unequally distributed throughout the Dakar region. New investments since the reform barely improved the situation, and uncoordinated projects made for ineffective infrastructures and irrational rainwater management.

Furthermore, the operation of drainage systems faces a number of problems, which reduce their effectiveness further, while urban development increases the magnitude of flooding.

1. Urban development and increasing floods.

The increasing intensity of floods is primarily attributed to incoherent urbanization and land speculation—led by the president himself in the past 10 years (CONAGPI, 2002, p. 24). Housing constructions are progressively reducing ground permeability, blocking infiltration, obstructing natural rainwater courses, and rendering rainwater facilities ineffective.

On the Dakar peninsula during the rainy season, flooding occurs naturally in low-lying areas and where the water table rises. Elsewhere, rainwater is drained by gravity towards the ocean or the niayes, if it is not obstructed by constructions. Floods, however, have grown worse. In 1989, 45 flooded areas were identified in Dakar and Pikine; three were added four years later (JICA, 1994). This trend sped up in the 2000s.

Floods now occur in the city center and on low areas (26) near the Port de Dakar, Gueule Tapée and the Triangle Sud (Centenaire, Gibraltar and the Senegalese broadcasting, RTS). There was no flooding in Gibraltar 30 years ago: what was not drained naturally or by infrastructures was absorbed in the sandy ground. Since then, numerous constructions made this impossible and increased run offs.

In addition to building where water used to flow or infiltrate, construction regulations are not respected, hindering infiltration further. A hydrologist explains:

> "By law, we can cover only 70% of a plot, but yards and house fronts are paved; gutters end up on the streets where there is nothing to evacuate it. Most streets have no draining systems, and when they do, the systems are overwhelmed by the volume of water" (water specialist, consultant; Dakar, Oct. 19, 2006).

In the suburbs, irregular settlements developed in low-lying *non-aedificandi* flooding areas.[72] On higher grounds, housing and road constructions obstruct rainwater flows. Areas where the ground is highly permeable, which were rarely flooded, now face serious floods.

In 2010, the airport was flooded. An agent from the African Aerial Security Agency (ASECNA) explains on TV:

> "We don't have to look very far, it is the constructions taking place on the airport land reserve that are responsible for this disaster. These lands had a great capacity to absorb run offs" (August 17, 2006)

In the Grand Yoff area, floods are now important (up to 1.4m) and long lasting (1 month). Grand Yoff is located in a small valley and receives run-offs from higher grounds, which have been densely built and where rainwater can no long infiltrate, thus increasing the downward flow towards Grand Yoff. In Ouakam, where constructions obstruct a natural channel, floods rise up 50cm and last for more than a week at a time.

The long and narrow niaye areas of Pikine are not suitable for housing and get regularly flooded (40 to 70cm up to 3 months). The most affected areas are Medina Gounass (Guediawaye) and Waxinane Nimzatt (Pikine) where the water table is shallow. Some neighborhoods are flooded all year round. In Yeumbeul Nord, persistent flooding affects 12 out of 13 neighborhoods (A. Diop, 2006).

In the Yoff-Guediawaye area, the building process continues even where water flows are already blocked by constructions. In 2006, a resident of Guediawaye exclaimed:

> "… and they continue building! The site the authorities chose for the library and the community hall is a flooding area. So they are difficult to access in the rainy season" (security guard; Guediawaye, May 5, 2006).

At the health center, an employee explains:

> "The Roi Baudoin [health center] gets flooded. It's down a slope and water cannot go

[72] Irregular settlements occupy 50% of inhabited space in Dakar, mainly in Pikine, Guediawaye, Bargny and Rufisque (CONAGPI, 2002).

> towards the niayes, it's blocked by constructions. Water stagnates for more than one month. The house of the nurse gets flooded every year" (hospital employee; Guediawaye, April 14, 2006).

South of the peninsula's neck, coastal areas are naturally drained toward the Baie de Hann. But urbanization increasingly hinders rainwater from Pikine, Thiaroye and Mbao from flowing to the Baie. These coastal areas now know long lasting floods (up to 1m). In Thiaroye, 12 neighborhoods out of 25 get flooded. Most of Hann Bel Air gets flooded. The Zone de Captage, which used to receive and infiltrate waters from Grand Yoff, Castor, Maristes, Liberté 6 and Khar Yalla, was filled in and built in the 1970s. Rainwater from the Zone de Captage now runs all the way down to Hann Park and increases flooding in the low areas of Hann.

Roads are built higher up without considering run-offs, enclosing houses in bowls where water stagnates. Cambérène now gets flooded (up to 50cm) for more than a week:

> "Since 2002, the village faces floods we did not know before. They built a road which drains run offs into the village. Despite the ground's high permeability, flooding now occurs in half of the neighborhoods and along the roads" (resident; Cambérène, Nov 18, 2006).

The in filling of the Maristes Lake for the construction of the new expressway blocks run-offs. A local civil servant explains:

> "The construction cuts the lake in two; they didn't think that this would create a problem for the water flow?! Water has to go somewhere!" (Town hall employee; Bel Air, Jan. 12, 2010).

Considering urban development, a water specialist explains:

> "Public works and large constructions make surfaces impermeable. The president's 'Grands Travaux' are undertaken without thinking where water is going to go. We cannot only build roads; we have to build drainage systems with them. When one builds, one has to think about drainage. We must preserve wetlands that receive water; for this reason we must protect the Niayes. We need to think differently about land development" (hydrologist, consultant; Dakar, Oct 19, 2006).

Thus, urban development does not respect the needs of rainwater drainage. Natural water paths were not preserved, nor were land areas set aside for agriculture and water infiltration, which regulated flooding. This increased the extent of floods and the number of their victims, overwhelms the few drainage systems, and impedes water table recharge.

2. Drainage infrastructures.

Overall investments in drainage infrastructures have been minimal and made little difference. After 2001, the PLT financed a few infrastructures, while other actors implemented their own drainage projects, resulting in small and uncoordinated systems. Where rainwater infrastructures exist, they are undersized, not operational or inadequately located. Full-fledge drainage networks cover only a few areas. Elsewhere, rudimentary or no infrastructure exists. All infrastructures are overwhelmed by the intensity of floods.

In 1994, drainage systems (networks, rainwater canals and a few pumping stations) covered the areas of Dakar city and the airport (documents ONAS 2005, unpublished).[73] The Dakar city area is elevated and rainwater is evacuated by gravity and via drainage systems. But as equipment became undersized, floods worsened. To limit the severity and duration of flooding in the Triangle Sud, the PLT financed new infrastructures.[74] The situation improved somewhat in Gibraltar, but water still accumulates in front of the RTS. Around the airport, open-air canals drain rainwater toward Ngor and Yoff. But these canals are now insufficient and the airport is no longer safe from flooding.

The other areas of the region have no or rudimentary rainwater infrastructures. The Grand Yoff area had no drainage system until 2002 when the PLT financed a gutter, a pumping station and two outlets draining water toward a holding basin in the Zone de Captage. Not only

[73] The total length of rainwater canals is 89km, including Canal 5 (Ouagouniaye-the harbor), Canal 6 (Sicap Liberté-Hann), Canals 4 and Gueule Tapée (Colobane-Soubedioune) (2007 ONAS documents; unpublished). The unitary Hann-Fann sewers drain rainwater. The ONAS manages 4 rainwater-pumping stations; 12 more are operated by other public structures.

[74] Infrastructures include 3,550 linear meters of drains, a holding basin, a pumping station, and a new and steeper collector with numerous openings draining rainwater toward the harbor and the Canal 5.

was the gutter filled with trash and partly broken after a few years, but it is also insufficient in this area where floods are increasing.

Since sedimentation, obstruction and tides reduced the drainage capacity of a canal south of the airport, a large area of Ngor gets flooded (up to 1.5m for 6 months every year). A canal at the entrance of Ngor drains some rainwater from Ouakam, but none from Ngor. Furthermore, with the tides, seawater ebbs back into the canal, causing more flooding.

On the coastal area of Yoff-Guediawaye (north), a drainage canal exists along the road east of Yoff, but new housing developments have no drainage systems and lower areas get flooded. In Guediawaye, some rainwater is drained through a steep valley and a collector onto the Technopole, but many areas get flooded. The few gutters in Pikine Régulier did not prevent flooding. In Pikine Ouest, schoolyards and classrooms are still flooded 7 months after the end of the rainy season. In Pikine Est, a retiree describes the absence of drainage systems:

> "… some networks near the stadium (Alassane Djigo) and between Texaco and Sotiba. The pumping station near Texaco drains water to the Technopole, but we have to pump water into the station. But areas that get more flooded, such as Waxinane, have nothing. In Icotaf, we have no rainwater network and floods are getting worse" (retired civil servant; Pikine Est, Nov. 13, 2006).

In 2006, a project for Pikine and part of Guediawaye was launched under the Jaxaay Plan (Sous-Commission Etudes, 2005). In 2010, the four holding basins were not finished, and each time it rained water overflew and flooded nearby houses. The construction of the pumping stations to drain water from the basins to the ocean had not begun. Another project financed by the water sector (PEPAM) was under construction (canals, collectors, pumping stations) to drain water from Pikine to the ocean (Thiaroye) and the Technopole. Drainage facilities were also under construction in Icotaf (canal, increased pumping station's capacity). Residents hoped the canal would be finished before the next rains.

In the south, Thiaroye sur Mer has no drainage system other than a gutter to the west. In Hann Bel Air, the ineffective 600 meter long gutter in Hann Village is the only drainage

infrastructure. Further into the suburbs, Yeumbeul Nord has a small gutter, which fulfills its function when pumps are working. Yeumbeul Sud or Malika have no drainage system and no infrastructures are planned for these areas.

3. Uncoordinated projects.

The lack of coordination between drainage projects built independently by different actors results in incoherent rainwater management and ineffective infrastructures. More serious, however, is the negative environmental impact of many projects that will lead to worse flooding in the future.

The Ministry of Housing and Urbanism builds pumping stations or the Road Works Authority builds drainage systems. Cooperation between these actors and the ONAS does not always exist because of different and sometimes opposed agendas. A retired sanitation manager explains the resulting incoherent patchwork of drainage systems:

> "There is no rationality in these constructions. People have a sectoral view. If there was some cooperation, instead of three stations in that one area, we would have built only one in a better location, or we would have considered other options. But that is not in the interests of these institutions. Their purpose is to build. When we tell them not to build there are problems—opportunity problems. Many agencies are like this, so lots of pumping stations are built, but not much improvement. Officially, the ONAS has to deliver authorizations for these infrastructures, but people do what they want. And if you hinder people who must build to justify their existence, you create problems" (ex-ONAS manager; Dakar, Oct. 5 2006).

The lack of coordination creates technical problems, and the ONAS cannot always take over the new infrastructures. The same manager continues:

> "These infrastructures have all the same outlet problem: the station is pumping, but what to do with the water?! Where to drain it? They create floods elsewhere. The stations in Pikine, for example, are away from the Technopole and should drain toward the new station at km14. The Road Works Authority built that pumping station, and there was some cooperation with ONAS. K14 is a very low point on the national road and when the road gets flooded Dakar is cut off. The pumping station has a large reservoir and drains

water on the other side of the road where it flows toward the ocean. The ONAS followed that construction and later took it over" (*ibid*).

Beyond drainage issues, projects are not environmentally sustainable and create worse long-term problems by reducing natural flood regulation capacities. A university professor explains:

> "Projects are segmented and temporary; nothing is conceived for the long-term or with a global perspective. Many rainwater networks transfer sands into lakes or rivers, and speed up the silting process. Before discharging anything, a rainwater network is supposed to do some decantation and filtration. This is never done. Now rainwater is drained to the Technopole; it is not the function of the Technopole to receive this much rainwater. We only tinker out of emergency and we are creating more problems for the long run. Engineers are taken by immediate political considerations and seek to achieve things quickly to please politicians" (hydro-geologist, professor; Dakar, Nov. 21, 2006).

Thus, the impact of most drainage projects was minimal at best.

4. ***Rainwater facilities' operation problems.***

Rainwater facilities are not only inadequate to drain the volumes of rain pouring down during the rainy season, but their operation is hindered by poor maintenance, and insufficient trash, sludge and wastewater collection. Despite their depth, rainwater canals are rapidly filled and overflow; drains and network get clogged.

The conception of most drainage systems, which were built during colonial times, does not match rainfalls. Their decay and lack of maintenance reduce their effectiveness further. According to a hydro-geologist from the University of Dakar:

> "The conception of drainage systems is a fundamental problem: important discrepancies exist between networks' capacity and rains. And the lack of knowledge about the structure of rains (precipitation patterns, intensity) hinders the development of appropriate systems" (hydro-geologist, professor; Dakar, Nov. 21, 2006).

None of the drainage projects undertaken in the past ten years considered the need for such knowledge before planning infrastructures.

Local characteristics, in particular the sandy ground and the lack of trash, wastewater and sludge management, affect drainage systems and make ONAS limited resources even more constraining. Solid waste, wastewater, sludge, and sand, illegally dumped or discharged via "pirate" connections, encumber and clog the systems. An ONAS manager describes:

> "The canal 6 which drains rainwater through the industrial area receives industrial effluents. Many people and pumping trucks dump sludge into the canal. That reduces its capacity to drain rainwater. People also pour wastewater and sludge into underground networks. Wastewater outlets are connected to canals and networks. We know that these parasitic connections are predominant in neighborhoods where sanitation coverage is insufficient. These practices are also responsible for awful stinks in the city. In certain neighborhoods, people broke drains to hinder sludge dumping" (ONAS manager; Dakar, Nov. 22, 2006).

The ONAS seeks to reduce sludge and wastewater disposal in the drainage system. A project for disconnecting pirate connections, which was under discussion as part of the PLT sewers extensions, was not implemented. Part of it (for Canals 5 and 6) is now included in the Baie de Hann sanitation project. The water sector presented the PAQPUD as an initiative to counter wastewater and sludge dumping, providing people with individual facilities and building sludge stations. As already mentioned, however, sludge collection facilities are too few to reduce anarchic disposal, and individual sanitation facilities are installed in suburbs where few or no rainwater systems exist. Thus, the impact of the PAQPUD on improving the operation of rainwater infrastructures is probably nil.

Poor maintenance reduces the capacity of drainage infrastructures. Each year, the ONAS undertakes a pre-rainy season campaign to scrape clean drainage facilities, but can hardly fulfill this task. The same manager explains:

> "We have to ensure that equipment function to full capacity. We constantly scrape, clean, check, rehabilitate. During the rainy season, people supervise 24 hours a day the operation of networks and stations, make sure outlets are cleared, remove the sand from drains, and check generators when electricity shuts down" (ONAS manager, *ibid*).

To improve maintenance, the ONAS subcontracts the cleaning of a portion of the drainage network (53km of pipes and 4,700 drains) to the private sector:

> "We could not continue to hire 300 people every year. We wanted to avoid yearly contracts, and rather to give that for 5 years to allow private companies to get the necessary materials and to plan the work well" (ex-ONAS manager; Dakar, Oct. 5 2006).

The ONAS intervenes "somehow" on the rest of the network. Overall infrastructures remain ill maintained, and trash and sand return quickly after each cleanup. Many drains are refilled before the rains come.

Thus, irrational urbanization increases the severity of floods in the region, overwhelming existing drainage infrastructures. The few investments made by the water sector and other institutions did not provide for more adequate and better distributed infrastructures. The lack of trash, sludge and wastewater collection hinders the operation of these infrastructures, increasing maintenance costs. Their conception indeed facilitates these intrusions. Consequently, the provision of drainage services is very limited, seriously disrupting daily life and economic activities during the rainy season.

D. Flood management.

Without or with very poor drainage services, individuals and local communities are left fending for themselves against floods. The worst flooding occurs in the poorest areas, where people pay the highest price for public inaction. Insufficient infrastructures make poor populations more vulnerable, and floods make them even poorer. Reiterated flooding constitutes an impoverishment process. Meanwhile, the government reacts when it is forced to by catastrophic floods, and does so for political and financial reasons. Few flood victims benefit from these interventions, while no coherent strategy to manage floods is being developed.

Each year, many people leave their homes because of floods. They stay with relatives, settle in schools, move to rental accommodations if they can afford it, or become homeless. Since 2005, tens of thousands of people were displaced from their homes; at least 20,000 were

suddenly homeless in the suburbs of Dakar. With external aid, the government provided shelter in tents, schools or military barracks to 5,600 homeless people. Each year, new cohorts of flood victims add to those living in flood camps, where sanitary conditions and crowding are horrendous: 6 showers and toilets for 500 persons and no trash collection in the Ganar camp, for example—so much for irony, "ganar" means "chicken" in Wolof (IRIN news service, 2006).

Leaving their home, however, is a decision that people postpone as long as possible. Until then, they live in flooded houses, removing water with buckets and piling bags of sand or trash in front of their doors to fence off water. People resort to infilling, stacking their houses with trash, wood residue and sand, elevating floors up to 1.5m. A resident of Médina Gounass (Guediawaye) explains that:

> "People use garbage to shore up houses and streets. Garbage, packed down tight and then covered with a layer of sand, is used to raise the floors of houses that are always flooded, and it is also packed into the streets that otherwise become rivers" (Oct. 14, 2006).

Each year, rows of bricks are added to the walls. People spend significant amounts of money buying sand or paying horse-carriage owners to bring in trash. Residents bear heavy costs to transform their homes in hope of keeping them. Entire savings disappear in that attempt. Over the years, the cost of these works equates the cost of a new house, but people do not have that full amount at once and cannot hope for loans. Thus, residents of flooded homes get poorer before having to move out anyway, but with less options (A. Diop, 2006).

Collectively, people organize to fight floods. They pump, dig or fill in trying to make streets and buildings accessible, and pick up trash from drainage facilities. Local municipalities get involved in these efforts. The 1996 law on decentralization transferred responsibilities for environment and natural resource management, including floods, to local governments, but these authorities have insufficient resources and capacities to address the problem in any

effective manner.[75] The size and complexity of floods are beyond municipal means and territorial mandate, and no collective framework exists to address the problem. Beyond localized and punctual infillings, digging, pumping and disinfections, local authorities cannot intervene. They rely heavily on the population, local organizations, and on international cooperation with foreign governments, cities or NGOs, and try to get aid from the Senegalese government.

Obtaining pumps is a major challenge, as is buying gas to run them or in some area finding an outlet for pumped water. In Pikine-Icotaf, a local resident involved in the Flood Committee explains:

> "The town hall owns two or three motor-pumps and people got together to buy another one which is managed by a neighborhood organization. Sometimes we rent trucks for a few days to pump water. We discharge it in the Technopole or at the sludge station in Hann. And we organize trash pickup because trash hinders drainage" (local resident; Pikine Est, Nov. 13, 2006).

Flood management goes much beyond managing water. In 2009, faced with catastrophic situations, residents in various neighborhoods created flood management committees to deal with floods and their consequences: the informal economy, which provides for most people's daily needs and resources, gets completely disorganized as people are busy pumping and disinfecting.

Drainage operations undertaken at the local level may lack foresight, and always face the problem of where to drain water. In Hann Bel Air, for example, a town hall employee explains:

> "Water was pumped into the Maristes Lake, but the lake overflowed and snakes and other animals were pushed out of their natural habitat. This put everybody in danger" (civil servant; Bel Air, Nov. 21, 2006).

Wherever the ocean or the niayes are too far, and where possible, holes are dug to receive rainwater. In Pikine-Guediawaye, firemen dig large holes on low grounds and drain water with

[75] Law nº 96-07 of 22 March 1999 on the transfer of responsibilities to regions, municipalities and rural communities.

tubes and pipes (mechanical pumps are rarely working). Water stagnates in these holes for months.

At the national level, after each catastrophic flood, a new inter-ministerial structure is created, regrouping all—and the same—institutions, but headed by different ministries and changing purpose depending on immediate political necessities.[76] In 2001, the National Commission for the Forecast Management of Floods (CONAGPI) was created to determine a long-term preventive flood management strategy, promoting coherent urban planning, and low cost housing settlements.[77] The Ministry of Urbanism headed the Commission, which made a lot of sense due to the impact of urbanization on floods. Regional consultations were held (2002) to elaborate the strategy. The resulting document covered sanitation, environmental and urbanization plans; the integration of flood management with economic and social development, and land restructuring; the need for systematic impact studies and research on hydrology, climatology, topography, oceanography, etc.; and the creation of a fund with international assistance to fight flood (CONAGPI, 2002).

Political maneuvering, however, halted the Commission's work. A consultant participating in the strategy's elaboration explains:

> "Resources were transferred to another ministry, because the Minister of urbanism did not belong to the presidential party (PDS) but to the opposition (LD/MPT). The dossier was transferred to the Ministry of the Interior, which is in charge of emergency plans, and therefore has a totally different approach and the plan [CONAGPI] was abandoned" (water specialist, consultant; Dakar, Oct. 19, 2006).

After heavy rains (278mm in 6 days) and flooding in 2005, the government launched the five years Plan Jaxaay (eagle), and the National Agency to Fight against Floods and Shanty

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[76] The National Commission for the Forecast Management of Floods coordinated by the Ministry of Urbanism was set up in 2001; the National Unit for the Prevention and the Fight against Floods headed by the Ministry of Interior and Local Collectivities in 2003; the National Agency to Fight against Floods and Shanty towns in 2005; a National Commission for Prevention, Supervision and Monitoring the Fight against Flooding headed by the Prime Minister in 2007; after the 2009 floods, a High Commissariat in charge of Flooding "responsible for the definitive resolution of the flooding problems in the country" (APS, 2009).

[77] Arrêté Primatoral 6124, Journal Officiel de la République du Sénégal, J.O. N° 6001, 18 août 2001.

towns (ANLIB) replaced the CONAGPI (Sous-Commission Etudes, 2005). The Plan Jaxaay was to relocate some 60,000 flood victims in 3,000 cement houses in new settlements with electricity and running water further into the suburbs. Important resources (US$107 millions) were made available.

A year later, empty fields remained across the periphery where the Jaxaay houses were to be built. In 2008, 1,500 families were moved to Keur Massar and Kounoune (IRIN news service, 2008); in 2010, 2,000 were living in Cité Jaxaay. Meanwhile, thousands of the flood victims still lived in temporary camps. In 2009, the flood affected about 300,000 people in the capital. In August, violent demonstrations broke out in the suburbs against power cuts and flooding.

The Plan was a vast construction undertaking that excluded many within the targeted populations and in some cases provided very poor housing. Many families were unable to afford the Jaxaay homes. Though the Plan covered about 65% of costs, residents had to pay about CFAF 4 millions (US$8,000) over 20 years (IRIN news service, 2006). Families who were not officially registered as residents in their district—a frequent situation in irregular neighborhoods—were not eligible. Worse, however, many Jaxaay houses were not given to flood victims, but to politicians, celebrities and individuals of the president's favor, or to people resettled for the sake of urban showpiece constructions and other public relations reasons. Still worse, most new settlements have no hospital, no market, no school, no public transportation and no roads. Finally, though 20-30 persons on average crowd the four-room homes, residents are not allowed to add any room to the houses until the mortgage is paid in full. The Plan was also to overhaul communities. Medina Gounass (80,000 inhabitants), for example, was allocated one water-pump to fight flood. With little resources for diesel oil, the pump run for half an hour and stopped.

A water specialist considers the Jaxaay Plan:

> "This is not a preventive plan. It is not a strategy based on climatic risks, which we can't do as long as we don't have any reliable data. We have only one hydrometric station that fulfills World Meteorological Organization's norms. We don't have sufficient equipment because the government does not want to invest in that. Jaxaay was a political strategy. This transfer of population shows the government's lack of responsibility. Land development is based on political strategies, when flood risk management requires tools to gather data. And everything is scattered between different ministries: land development with local municipalities, prevention with energy and urban hydraulics, agriculture with rural hydraulics. There is no institutional coherence to manage water resources, and that affects everybody in different ways" (hydrologist, consultant; Dakar, Feb. 8, 2010).

This section showed that since rainwater drainage services became a responsibility of the water sector, little improved while floods worsened. The few rainwater investments realized since the reform could not catch up with increasing flooding. The ONAS, which was made responsible for operating rainwater infrastructures, was not given the needed resources. Poor maintenance, as well as the intrusion of sand, trash, wastewater and sludge hinder their operation. This exemplifies the inadequacy of all sanitation services, and the lack of coordination among ONAS activities. Furthermore, actors other than the water sector independently build rainwater infrastructures, leading to a patchwork of small systems and incoherent rainwater management.

In better off areas, ineffective rainwater infrastructures and irresponsible urban development led to poor services, but effects are worse in poorer areas: long-lasting flooding, diseases and increased poverty. Individuals and local communities attempt to manage floods, losing their meager resources in the process. The government created successive structures and launched ambitious plans that were opportunistic moves, but made no real difference. No preventive strategy was developed. Nothing was done to promote the respect of urbanization regulations or elaborate regulations more concerned with drainage needs.

V. Conclusion

This chapter showed that the focus of the 1996 reform on the profitability of water distribution meant the provision of sanitation services would depend on cost-recovery management and demand-driven development. The sector's choice of inadequate technologies and its non-integrated management of sanitation activities accompanied this strategy. The results are the increasingly unequal access to very poor services that do not satisfy sanitation needs. The consequences for people's lives are devastating: worsening pollution, floods, diseases and poverty.

Water reformers separated the non-profitable sanitation subsector from water distribution by creating an autonomous public sanitation agency, the ONAS. Increasing sanitation coverage at least cost and achieving financial viability became the goals for the subsector. This would be achieved through differentiated services among urban areas, a demand-driven development, increased user contributions, and involving the private sector in service provision. If constraining the provision of services to users' contributions implied poor and unequal services, it ensured that sanitation activities did not burden water distribution, and moved sanitation services away from a public service.

Coverage by bulk sewers increased little and provides poor services to a few at very high costs. Because of the focus on coverage rate and network efficiency, and the heavy technical requirements of these systems, bulk sewers investments benefited a few already privileged areas. But based on water sales, ONAS resources are insufficient for the expensive and complicated operation of bulk sewers. Furthermore, these technologies are inadequate to local conditions (low water consumption, the natural environment, uncontrolled urbanization, deficient rainwater and trash management), which increases operation costs. Breakages and wastewater spills are frequent and long lasting in many neighborhoods.

In peri-urban areas, the PAQPUD project promoted the installation of individual sanitation facilities and semi-collective networks based on users' effective demand. Households'

ability to pay determined the level of service provided. Thus, the PAQPUD turned the provision of sanitation services into a private responsibility, increasing access inequalities based on wealth. For the project to be implemented, however, the ONAS and its financial partners had to introduce modifications: reducing household contributions, creating lending opportunities, involving local authorities in the project's implementation, and setting performance targets.

If the project officially increased coverage rate, it did not satisfy sanitation needs. In targeted areas, the poorest households could not afford any facility; the others obtained low quality facilities that do not satisfy sanitation needs and fail to protect underground water resources from wastewater pollution in areas where people resort to this source of supply for all uses. Furthermore, the facilities did not survive flooding, eating habits, or poor maintenance. This compounded inequalities created by the differentiated service development strategy. Residents in poor areas end up with more expensive, constraining and lower quality services, while, when connected to the water supply network, contributing to sewers' operation.

The demand-driven development approach had similar effects with small diameter network projects: unequal access to services, service discontinuity and unmet needs. The diversity of small network projects exacerbated access inequalities, requiring different levels of contribution from households and providing different lending opportunities. The involvement of local authorities, as well as technical and funding incoherence increased inequalities further. The small size of projects, their poor designs, and the cost of in-house equipment made for uneasy implementation. The PAQPUD did not meet its small network targets.

For the sake of cost-efficiency, the ONAS left the management of these systems to local communities with insufficient resources and capabilities, while the poor conception and maintenance of in-house equipment hindered their operation. This made for precarious services and uncertain future. Individual and community management based on users' contributions is a form of privatization at the local level that cannot ensure decent services.

Investments to increase wastewater treatment capacities made little difference. The sector's choice of technology combined to its cost-recovery management hindered this development, as well as the effectiveness of existing infrastructures and the use of treated effluents. The ONAS has insufficient resources for operating sophisticated infrastructures, which are not adapted to local water consumption and the natural environment, and suffer from inadequate rainwater, sludge and trash management. As a result, a tiny fraction of collected wastewater is treated, and the poorly functioning Cambérène plant releases dirty effluents into the ocean. Despite these negative consequences, projects currently under study envision the realization of similar infrastructures to be managed on the same basis. The unquestioned preference for "modern" technologies, special interests and potential income derived from large international contracts influence ONAS investment decisions. Meanwhile, local scientists and NGOs developed promising low-cost treatment alternatives for better services and affordable treated effluents, which are abandoned for lack of support.

Without treatment, collecting equipment provide incomplete sanitation services. Wastewater and sludge become a source of pollution, disease and social conflicts. Bulk sewers displace wastewater pollution from some neighborhoods onto others. Fishermen are strongly affected by the pollution of costal waters. When conflicts erupted at Cambérène because of pollution from the treatment plant, they were met with police force, and diffused by public officials bribing local notables and feeding the population with lies.

Since the reform, the gap between drainage services and worsening floods widened, strongly affecting people's lives. The reform transferred responsibility for rainwater drainage to the ONAS, but no additional resources to fulfill it. While uncontrolled urbanization provoked more serious and widespread flooding, very few rainwater drainage investments were realized. Uncoordinated small projects made for ineffective infrastructures and incoherent rainwater management. Drainage infrastructures are inadequate, unequally distributed and ill functioning. No infrastructure exists in the most affected areas of the suburbs. Poor

maintenance and the intrusion of sand, trash, wastewater and sludge hinder the operation of drainage systems, exemplifying the inadequacy of other sanitation services.

Insufficient drainage systems and irresponsible urban development contribute to long-lasting flooding, diseases, and increased poverty. The government created successive structures and launched ambitious flood management plans, but these were opportunistic political moves that made no real difference. No attempts at developing a preventive flood strategy or regulating urban development were made. Individuals and local communities are left managing floods and their consequences with almost no resources, and become poorer in the process.

Beyond the need to manage sanitation services as a public service, concerns for coherent management and improved services point to the need for integration and research. Research on sanitation systems adapted to local economic, social and natural conditions, and based on water resource knowledge is essential. Furthermore, the lack of an integrated approach to sanitation activities is equivalent to attempting to solve a growing problem without ever addressing its causes. Flooding cannot improve, for example, without integrating rainwater drainage with wastewater and trash collection, and urban development. The development and management of these activities have to be integrated. Activities under ONAS' responsibility are interdependent: the insufficiency of one contributes to the inadequacy of the others. Trash collection and urban development strongly affect sanitation services. Trash management needs not only to improve but also to be coordinated with sanitation services. Urban development has to be fully reconsidered to respect sanitation needs. Finally, integrating sanitation activities and water supply, both within the water sector, would allow improving water supply, thus contributing to a number of economic activities and, as the next chapter will show, better protect water resources.

Chapter 4

The Water Sector Reform and Water Resources

Though labeled "sustainable development," preserving water resources was not the purpose of the 1996 water sector reform in Senegal. Its purpose was to ensure that water was available for economic growth, and that the sector becomes financially self-sustaining without public subsidies and profitable for the private operator. Increasing and commercializing supply for profit became the crux of the sector's management. Sustainability concerns were financial and economic, not environmental.

This chapter assesses the impact of the reform on water resources. Rather than reducing the destruction of these resources, the management of water supply implemented since 1996 intensified their exploitation, accelerating the destruction of underground water resources and ignoring the long-term consequences for surface water. Infrastructure investments and water supply management were geared toward supplying water to the Dakar region, where population is rapidly growing (5%/y) and where economic activities are concentrated, whatever the consequences for water resources' sustainability.

The first section of this chapter will show that the water needs of powerful enterprises mostly determined the exploitation and management of the Lake of Guiers' water resources, preventing the implementation of an effective water resource protection strategy. Furthermore, the scope of the lake's management is too narrow to ensure the future of its resources.

The second section will show that the water sector, by increasing the exploitation of underground water tables and ignoring factors affecting these resources, contributed to their destruction. Water-saving and protection measures, guided by financial considerations, are ineffective, while no meaningful protection policy, regulations, or strong institutions were developed. The third section analyzes the implications of the commercialization of water supply

combined to the lack of political will to preserve water resources: a management that caters without hindrance to any effective demand for water, sustainable or not.

I. The Lake of Guiers

Increasing the exploitation of the Lake of Guiers' waters for Dakar's supply was the main purpose of the investments conditioned on the 1996 reform. Decisions to increase exploitation, however, were made with little knowledge about the lake's hydrology or sustainability mechanisms or the implications for the Senegal River that feeds it, i.e. without regard for long-term consequences.

Because of the strategic importance of the lake for Dakar water supply, and growing concerns about the quality of its water and potential conflicts among users, the water sector financed the elaboration of lake studies and management plans (DEEC, 2008). Proposed measures that were favorable to all powerful users (water level) were implemented, but those dividing them (pollution control) were left to good will and consultations. Management plans also proposed measures to reduce the negative impact of local populations on the lake and to improve their access to water supply. But these measures may be ineffective because of induced costs for local populations.

A. The lake and its users.

The Lake of Guiers is long and narrow (35 x 8km) located 250 km northwest of Dakar. Fed by the Senegal River, its resources depend largely on two dams built in the 1980s: the Manantali dam in Mali and the Diama dam at the river delta. The lake's water serves many users whose needs and impacts differ and may conflict (drinking, domestic, agriculture, industrial activities). The lake's numerous uses and pollution sources and its modified hydrology render its management quite complicated.

The dams on the Senegal River reduced the upstream flow of seawater in the river, and regulated water inputs in the lake. The lake salinity thus decreased and its volume increased and stabilized. This evolution was favorable to plantations' irrigation systems and to the SONEES'

water supply infrastructures. But high and stable levels and reduced salinity also have negative consequences, including increasing water loss from evaporation, the proliferation of aquatic plants (Typha) harmful to water quality, access difficulties and the destruction of flood recession farming around the lake. A civil servant from the Ministry of the Environment explains:

> "Seawater used to clean everything, but now freshwater, stable levels and the lack of circulation in the lake facilitate the growth of aquatic plants. These plants also make it difficult to access the lake" (DGPRE manager; Dakar, April 26, 2006).

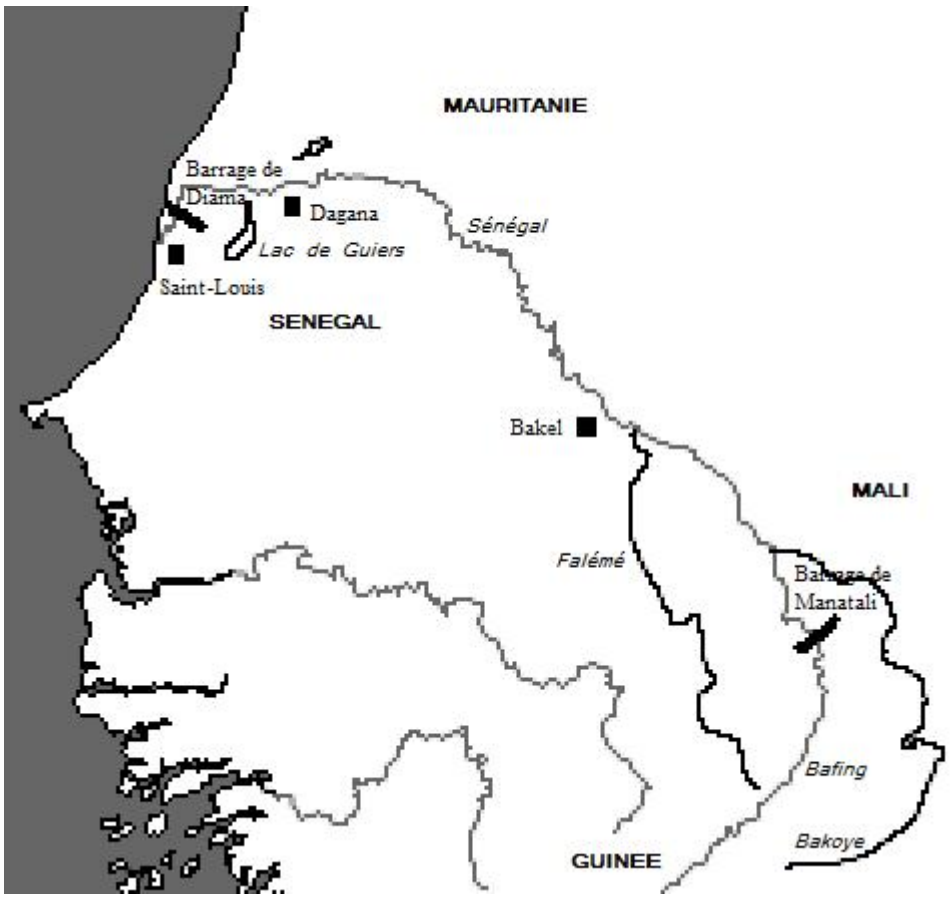

Figure 4: Map of the Senegal River with Diama and Manantali dams
(Wikimedia Commons) [78]

[78] See http://commons.wikimedia.org/wiki/File:Bassin_du_S%C3%A9n%C3%A9gal.jpg?uselang=fr (9/27/2011).

Large water consumers (plantations, industries, SdE) use pumping systems that require high and stable water levels. Some need high quality water, other do not. The SdE, the private water company established by the reform, draws off large volumes of water (180,000m^3/d) and needs good quality water. Deteriorating water quality increases the cost of treatment or renders it impossible depending on the types of pollution. A manager explains:

> "Water level is important for the SdE. The KMS [Keur Momar Saar] plant pumps near the shore and pumps can run only if levels are regulated and high enough. KMS is at the south end of the lake where there is no circulation and pollution is a problem. And water quality determines treatment cost and water price" (SdE manager; Dakar, May 17, 2006).

Rice cultivation, and sugar cane plantation and refining consume significant volumes of water (172,000m^3/d) and discharge the most polluting effluents. The River Delta Water Resources Development Corporation (SAED, Société d'Aménagement des Eaux du Delta) is the largest rice cultivator in the area (75,000ha). The Senegal Sugar Company (CSS) uses enormous quantities of water to drain plantations (7,000ha) around the lake and process sugar.

Local populations need good quality water and access to the lake, and have traditionally performed flood recession farming. These require low and varying water levels in the lake. Riparian populations have been most affected by the growing activities around the lake since the early 1990s. The development of irrigated agriculture not only took up lands at the expense of traditional agriculture and husbandry, but also makes an extensive use of the lake's water. An ex-employee of the CSS explains that:

> "Dikes, pumping infrastructures, and Typha block access to local populations, fishermen and animals. Access difficulties and the lake's pollution are a problem for populations who get their subsistence from it" (engineer; Dakar, May 28, 2006).

The water consumption of riparian populations is negligible. But their need for quality is made more acute by the poor quality of underground water, inexistent access to drinking water, lack of sanitation, and the prevalence of waterborne diseases.

B. Managing the lake.

The goal of the water sector was to increase the exploitation of the lake's water and ensure water quality to supply Dakar at least cost. The lack of knowledge about the nature the lake and the mechanisms affecting the quality of its water did not stop the water sector's exploitation and management decisions.

An Action Plan (2004) and a Lake Management Plan (LMP, 2006) financed by the PLT recommended measures for regulating water levels and controlling quality. The LMP called for the creation of a national agency that would be responsible for the lake's management (Tropis, 2006). An Environmental and Social Impact Study and an Environment and Social Management Plan (ESP) were later elaborated and implemented within the framework of PLT investments (DEEC, 2008).

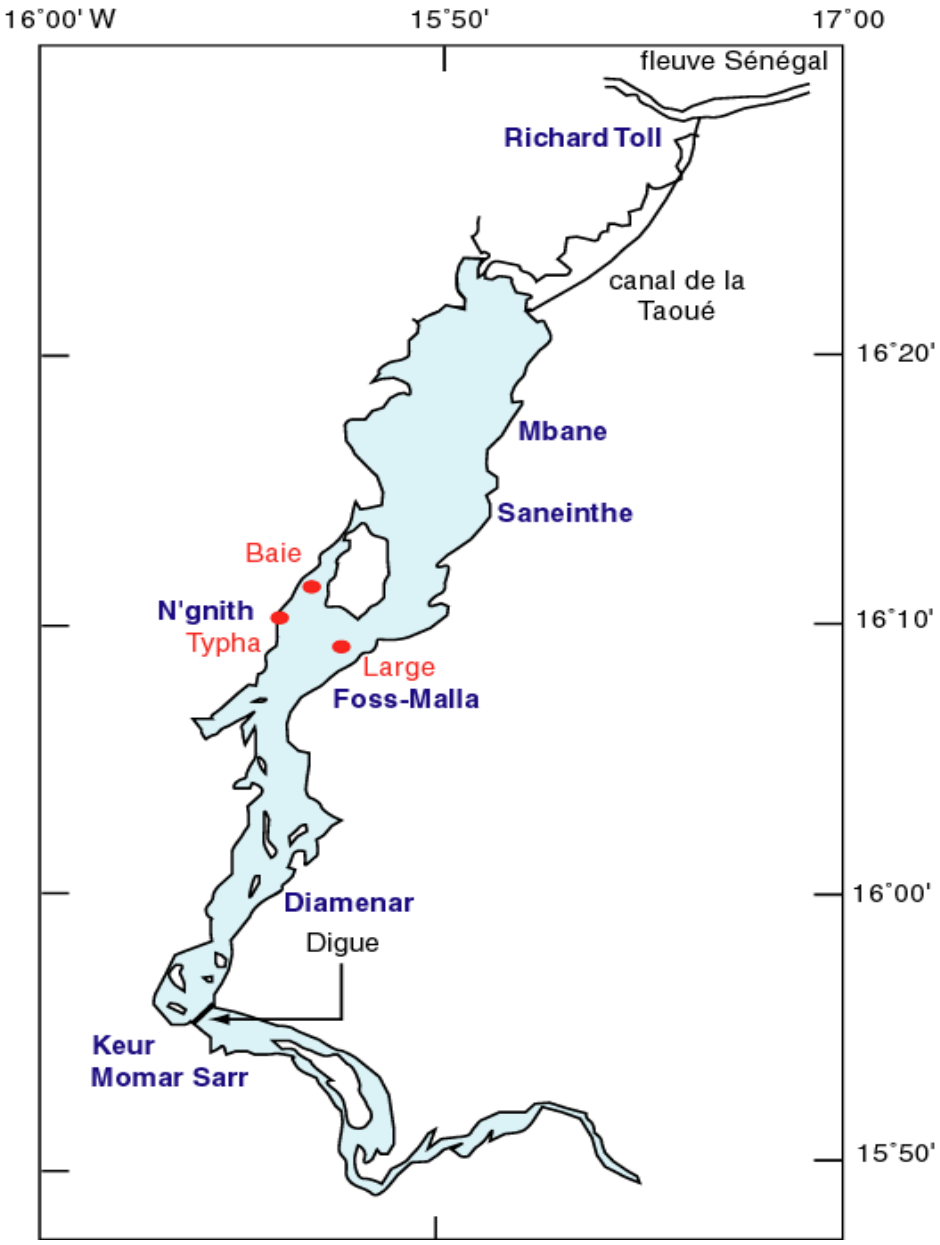

Figure 5: Map of the Lake of Guiers
(Arfi et al., 2003)

1. *Increased intakes.*

After the reform, existing water infrastructures on the lake were upgraded and new ones were built. The exploited volume rose from less than 40,000m³/d in 1995 to almost

200,000m³/d in 2008.[79] The water sector asserts that increasing draw-offs from the Lake of Guiers is not a threat to its resources; with the dams, the lake can be fully filled and supplied with important flow rates, suffice to open the valves at the Taouey canal (Pigeon, 1999).

Indeed since the dams reduced water circulation and level variations, increased intakes became beneficial to water quality. A lake specialist explains:

> "The problem with the lake is not quantitative but qualitative. Stillness is the major problem. Increasing draw offs improves circulation. Pumping important volumes gets water moving" (hydrologist, consultant; Dakar, Oct. 24, 2006).

Despite these statements, the Lake Management Plan noted inadequacies between the lake resources and water needs and suggested a study to specify the annual balance sheet between available resources and needs (DEEC, 2008).

Furthermore, potential conflicts underlie an increased exploitation of the lake's water. Increasing the lake's volume implies taking more water from the Senegal River, a resource shared by three countries. In the long run or under certain circumstances (drought), this may affect users in Mali and Mauritania. A violent conflict about the use of the Senegal River erupted between Mauritania and Senegal in 1989:

> "There are problems with sharing the River's water: Mauritania suffers from a deficit because gravity brings water to Senegal. Drought aggravated the disequilibrium created by the Diama dam" (hydrologist, consultant; Dakar, Feb. 8, 2010).

The Senegal River Basin Development Authority (OMVS) was created in 1972 to promote the concerted management of that common resource. Conventions determined the status and financing of the River's common infrastructures. But these did not help avoid conflicts. The 2002 Charter for the River's Waters established the principles for water repartition between sectors (agriculture, fishing, husbandry, domestic, etc.). But responsibilities for coordinating management remain unclear, and the OMVS does not effectively manage environment issues (World Bank, 2008).

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[79] The Ngnith station pumps 63,000m³/d; Keur Momar Saar pumps 135,000m³/d.

Finally, the lake belongs to a complex ecosystem that was deeply altered by the dams, and the impacts of intakes on the overall system are unknown. Thus, the water sector did not undertake any long-term evaluation of the impacts of its exploitation. Environmental, economic and political factors, crucial for the future of the lake's resources, are beyond the scope of water sector management centered on ensuring water availability for Dakar supply and agriculture development around the lake. The Lake Management Plan envisioned the future Lake Agency would be responsible for protecting water resources against irrational use, but without authority over impacting factors, the Agency is unlikely to effectively fulfill this task.

2. Managing levels.

The SdE needs high water levels in the lake. If they allow for better quality by dilution, however, high and constant levels contribute to the growth of aquatic plants and to sedimentation. A low level for an extended period of time hinders plant growth, but increases water salinity. Regularly lowering levels allows renewing the lake water, partially flushing it and thus avoiding sedimentation and clogging.

A bathymetric study financed by the PSE helped determine adequate water levels for drinking water purposes (Carl Bro Int'l & Hydroconsult, 2000). A manager from the Direction for the Management and Planning of Water Resources (a department within the Ministry of Hydraulics) explains:

> "The study helped better understand the impact of intakes, floods and pollutions on drinking water supply. The purpose was to organize the lake's management: when to open and close the valves at the Taouey; and for the treatment plants, when to pump, at which rate, etc. " (DGPRE manager; Dakar, May 26, 2006).

The Lake Management Plan (LMP) recommended scheduled level variations (Tropis, 2006). The duration of lowering would depend on its impacts on water quality improvement and reduced sediments deposit. These measures secured large-scale pumping, while allowing water quality improvement and the restoration of some flood recession farming. The PLT financed the rehabilitation of infrastructures to better control levels and protect irrigated lands

from flooding. The future Lake Office, responsible for monitoring water quantity and operating infrastructures, will regulate water levels.

The Plan's measures were most favorable to large plantations and to the SdE. The Environmental and Social Plan recognized that level regulations would be a burden for the poorest peasants and recommended measures to compensate for lost access and land (motor-pumps, irrigation systems, money, lands) (DEEC, 2008).

3. Managing quality: pollution control and implementation strategy.

To protect water quality, the lake plans recommended to control effluent discharge and Typha, to establish protection perimeters, animal drinking points, and sanitation systems in riparian villages, and to improve knowledge about the lake (Tropis, 2006). Because of the economic interests at stake, however, these measures are limited and their implementation is unclear. Users' consultations and a managing institution with insufficient authority may be ineffective to enforce anti-pollution measures.

Pollution sources and control measures.

The Lake of Guiers is subjected to numerous sources of pollution (domestic, industrial, agriculture, food processing) (Cogels, Frabouiet-Jussiia, & Varis, 2001). The lake has no exit point, and stillness and evaporation facilitate the accumulation and concentration of mineral and toxic substances. The PSE impact study pointed to such risks: increased pesticides, salinity, eutrophication, the proliferation of organic matter affecting water treatment efficiency, micro-pollutants which are difficult to process and whose admissible concentrations in drinking water are very low (Lauras & Pigeon, 1995).

The use of agrochemicals around the lake and along the Senegal River is massive. Effluent drainage deteriorates water quality with pesticides, nutrients and chlorides. Untreated industrial effluents from sugar refining and its byproducts contain many toxic chemicals that are discharged in the lake and the river. Chemical fertilizers enrich the lake with phosphate and nitrates. Mostly drained by the river and CSS discharge points (4) in the Taouey canal, nutrients

support the growth of aquatic plants (Typha Australis, Salvinia Molesta, and other unknown submersed plants), which can provoke eutrophication and affect water quality and treatment (DEEC, 2008, p. 115). [80] A DGPRE manager confirms:

> "Now there are Typha islands throughout the lake. The Typha proliferates and transform the lake's ecosystem and can provoke eutrophication" (DGPRE manager; Dakar, Oct. 10, 2006).

To control the proliferation of Typha, the LMP recommended selective and localized technical removal. But the extent of removal needed to impact water quality is unclear:

> "If you remove too much of it, it's also a problem, because the Typha consumes nutrients, and this creates other imbalances" (SdE manager; Dakar, Jan. 26, 2010).

Pesticide pollution has been detected in the lake. Concentrations of a few pesticides are increasing and new products (2.4 D, Amethrine, Atrazine) were found in 2004 (Tropis, 2006). The toxicity of agrochemicals (organo-chlorine pesticides, herbicides, fungicides, insecticides) increases as they accumulate in the environment.

Salt concentrations remain a concern for water quality. Salt drainage from sugar cane plantations contributes important chloride inputs into the lake. An engineer explains how:

> "The CSS drains the water table to lower it so that sugar canes can better grow. If their roots meet salty underground water, the canes stop growing and get sick. The CSS buried pipes deep in the ground to drain salt water. That water is pumped into the river or the lake" (ex-CSS engineer; Dakar, May 20, 2006).

Industrial pollutions are not identified, and are a concern for SdE managers and local populations:

> "The CSS discharges dangerous chemicals. And they give no information. There is no transparency. The head of the CSS is a very powerful businessman in Senegal. The DGPRE is in charge of monitoring water quality but has no resources, and the SdE has no alert station to know what's going on. So we put pressure on the government. We

[80] Eutrophication is the process by which the buildup of nutrients provokes the overgrowth of aquatic plants. When their numbers become unsustainable, most of them die and their decomposition uses up so much of the oxygen in water that most animals die, creating more organic matter for bacteria to decompose. Deoxygenating and the accumulation of toxins cause the death of the water body.

meet with consumer associations twice a year" (SdE manager; Dakar, Jan. 26, 2010).

According to an ex-CSS employee:

"The chemical product used to whiten sugar is very toxic and can cause cancer. Water used to clean engines is charged with acids and chemicals. Used waters are treated and reused for irrigation. But when pumps don't work, very dangerous effluents are discharged in the Taouey, which the local population uses for drinking and irrigation" (engineer; Dakar, Jan. 28, 2010).

A civil servant from the DGPRE asserts that:

"There are agreements between the state and the CSS: the company pays the State and discharges untreated effluents into the lake. There is no pre-treatment or control of industrial effluents, so we don't know. The CSS does not respect effluents norms. The company's attitude was that its pollution of the lake had to be proven. The CSS has to invest in drop-by-drop irrigation systems which reduce drainage effluents" (DGPRE manager; Dakar, Jan. 21, 2010).

So far, the lake pollution is managed by increasing water inflow and dilution:

"Valves [at the Taouey canal] are opened to fill up the lake. In 2006, inflows were frequent because of the presence of sulfur and organic matter in the lake" (SdE Manger; Dakar, Jan. 26, 2010).

In 2002, the Direction for the Environment and Landmarks, DEEC, (Ministry for the Environment) elaborated a monitoring and control program to address pollution discharge into the lake. Activities around the lake and pollution sources were identified. But the program was useless in reducing effluent discharge, because controls were not implemented, existing regulations do not address authorized levels of fertilizer use or drainage, and no inventory of withdrawals and discharges exist.

The Lake Management Plan established legal authorizations for discharge (based on NS 05-061). But to mitigate the negative impact of strict and sudden discharge controls on polluters' investments and activities, the Environmental and Social Plan (ESP) suggested progressively introducing control and compliance adapted to actors' technical and financial capabilities (DEEC, 2008).

The establishment of a protection perimeter, as recommended by the LMP, would require resources and authority beyond the scope of any sectoral institutions. A lake specialist explains:

> "We defined the perimeter where all activities have to be regulated. But for this, acceptable activities and chemical use have to be determined. We need to control agricultural pollutions. When someone develops some land, we need to know the irrigation technology, because with certain techniques, pollution is transferred to the lake through the underground water table. We want to discourage rice cultivation in favor of cultivations that use drop-by-drop irrigation" (hydrologist, consultant; Dakar, May 10, 2006).

A civil servant form the Environment Ministry sums up the complexity of managing pollution:

> "Water quality rests on a fragile equilibrium, and there are many interests around the lake. Big and small polluters are spread out and their activities are difficult to control. Illegal pesticides are used. There are big development projects for the region. How to reconcile this with environmental protection? Everybody wants to develop intensive agriculture around the lake, and land speculation is strong. Lands are sold to those offering the most and who develop irrigated perimeters that will pollute the lake. Up to now, it was on a small scale but there are hectares and hectares. Agriculture, infrastructures and land development must be integrated if you want to manage the lake. We focus on the resources and we neglect crucial aspects—development planning and water uses. The mission of the Lake Office should be to organize the communities surrounding the lake and land distribution, and development planning… If you give 6 or 7km of land to be developed with drop-by-drop irrigation and pumping systems which don't impact on the lake, then you can talk about sustainable management, otherwise it does not make sense" (DEEC officer; Dakar, June 2, 2006).

The Environmental and Social Plan noted that the lake agency would have to know development projects around the lake to facilitate decision-making (DEEC, 2008). But if the agency has only a consultative authority and no veto power on land use and activities around the lake, this will have limited impact.

The lake bacteriological pollution (E. coli, streptococcus) from domestic wastewater,

human and animal excreta, and trash dumping is worrisome, and affects domestic activities the most (DEEC, 2008, p. 80). The town of Richard-Toll discharges untreated wastewater into the Taouey. The Senegal River receives wastewater from towns and villages in Mali and Senegal. Villages around the lake have no sanitation systems. Animals' drinking in the lake adds to this pollution.

To protect the lake from domestic pollution, the Action Plan provided for the installation of individual sanitation systems (latrines, septic tanks) (DEEC, 2008, p. 172). But the polluting impact of these equipments on the water table and the lake led the ESP then to suggest limiting them to small villages and installing treatment systems in larger settlements (DEEC, 2008). The project may not be feasible, however, as some equipment (e.g., septic tanks) require households to be connected to a water distribution network—which none were—and to contribute 10% of cost. The ESP noted the incoherence of the project: with hard-built latrines installed in straw huts, the price of sanitation facilities would be much higher than that of houses. To solve this, the ESP suggested a social housing construction program (DEEC, 2008, p. 127).

The ESP also suggested creating a perimeter free from trash dumping and to elaborate a trash management plan (DEEC, 2008, p. 161). To reduce pollution from animal excreta, the LMP recommended building animal drinkers further from the lake. But pumping systems to feed these points are costly, inducing farmers to stick to current practices.

Even if proposed measures are implemented, however, they are too limited to ensure the quality of the lake's water, which is affected by the entire watershed. A hydrologist explains:

> "Water quality is not guaranteed by regulating activities around the lake, because it is affected by the quality of the river's water. There are parameters we cannot control: heavy metals from mining in the upper basin, and cyanide, and mercury … we don't know. There are many cities on the river discharging God knows what in it. From Mali to Saint Louis, everything is discharged in the river. And worries about the quality of the river's water are not only about the perimeters along the river but about the watershed: when there are grasshoppers, for example, planes come and spray pesticides. Watersheds are drained and everything ends up in our glasses" (hydrologist, consultant;

Dakar, Feb. 8, 2006).

Thus, controlling the quality of the lake's water goes much beyond the scope of current management.

The same hydrologist explains much more knowledge on the lake is required for adequate quality monitoring and impact reduction:

> "It is important to know the exact stabilization mechanisms to determine an optimum management of the lake. We need to monitor the mechanisms and risks that determine water quality. We don't know enough about the lake functioning, its vulnerability. Studies on pesticides, on the impact of agricultural drainage and wastewater effluents have to be done. Analyzing sediments and fish flesh are needed to determine contamination and possible sources. We need to know the interactions between the lake and the underground water table. The sea, the river, the lake and underground water are constantly interacting. The lake recharges the water table, so what we do with the lake affects the water table. When water level is high at Diama, the River recharges the table, but the capacity of the dam is limited. When seawater is high, which is most of the year, it recharges the table. Long-term sustainability investigations should be part of the lake agency's responsibilities" (*ibid*).

The LMP stressed that the future lake agency should dispose of a constantly updated knowledge of the lake's environment, its water balance sheet, and activities and land use within the watershed (Tropis, 2006). The ESP recommended research on the lake's natural mechanisms be undertaken within two years of the agency's creation (DEEC, 2008, p. 167). But the resources and scientific capacities required for such studies and knowledge are quite important and may never be available.

Users' conflicts and consultations.

The main tools proposed by the lake plans for addressing users' conflicts about the use and pollution of the lake are consultations and awareness raising: annual environmental reports, meetings about agricultural practices, trash disposal, water use, sanitation, and public health. Consultations bring some visibility on actors' activities and impacts on water quality, and hold them accountable: concerns and dissatisfactions are expressed, and information is

requested. Even if far from disclosing everything, pressure forces polluting actors to somewhat modify their behavior or risk facing increasing hostility and being tagged with a negative image. Non-participation, meanwhile, is equated to an admission of guilt and refusal to cooperate. The CSS, for example, committed to undertake an environmental audit to evaluate the impact of its effluents and to elaborate a management plan after consultations took place. The company installed drop-by-drop irrigation systems to reduce effluent discharge. A DGPRE manager confirms:

> "Since a consultation framework was established, industrialists have reduced their pollution. Agricultural activities have also reduced their effluents by installing drop-by-drop irrigation systems" (DGPRE manager; Dakar, Feb. 5, 2006).

Consultations, however, are not impervious to power struggles, intimidations, bribery, and obedience to the hierarchies of a traditional society. Leaving conflict resolution to consultations is to count on good will when powerful interests are at stake and actors with very different resources face each other. The ESP recognized the risk of not:

> "… taking certain local actors and environmental issues sufficiently into account: powerful actors leave little space to local growers and fishermen, the most numerous around the lake whose subsistence depends directly on the lake water. A balance has to be found so that the lake management is not solely geared to the satisfaction of Dakar drinking water. Local populations relate other uses of water to its unavailability for their own needs. Frustration is even stronger as this resource at hand's reach escapes them" (DEEC, 2008, p. 109).

No recommendation was made, however, on how this "balance" could be found, and the future Lake Office may not have sufficient authority, independence and knowledge to arbitrate among users.

The Office of the Lake of Guiers.

The Lake Management Plan called for the creation of a National Agency with strong legal status and financial autonomy (Tropis, 2006, p. 100). A contributor to the plan explains**:**

> "We needed a structure to organize the management of the lake's resources. We agreed

> that because of the strategic importance of the lake it was necessary to have an agency with the authority and resources to talk to all actors, including the state" (lake specialist, consultant; Dakar, Oct. 24, 2006).

But the proposal got stuck within the upper echelons of the Ministry of Hydraulics which, instead of a National Agency, decided to establish an office within the Ministry:

> "People in the Ministry are afraid that an Agency would be a counter-power. An office will have less authority, less capabilities and less independence. It will be at the mercy of political maneuverings and the lake management may be affected by decisions motivated by other interests—political or economic" (lake specialist, consultant; Dakar, Feb. 8, 2010).

A DGPRE manager expresses concerns about the ability of the future office to fulfill its mandate:

> "The mandate of the office is to manage the lake. Will it have the power to do it? Now it's up to decision-makers to translate the missions into capacities, into authority. Otherwise, creating an office for the sake of creating an office…" (DGPRE manager; Dakar, Jan. 21, 2010).

Despite asserted concerns for a fair management of the lake's water resources, their rational use and protection, politicians showed little urgency in the establishment of the Lake Office. By 2011, four years after the LMP, the office was still to be born. The Office was first planned for July 2007, but:

> "It was delayed because of institutional changes. The minister in charge of this changed and the dossier had to start over in the circuit and that takes time" (*ibid*).

The office was then scheduled for 2008. The law for its creation was voted in December 2009 (Law 2010-01 of 20 Jan. 2010). The law established the Office's mandate and funding sources. Toward the conservation and rational use of the lake and its surroundings, the office will be responsible to develop policies for both resource management and land use, to monitor water quality, ensure users' respect of environmental protection rules, control protection perimeters, deliver discharge and withdrawal authorizations, and promote users' consultations.

The State budget and users' contributions will finance the office and the management of the lake. The ESP noted, however, that charges and taxes would weigh heavily on poor growers and discourage development initiatives (DEEC, 2008, p. 171). They concerned overwhelmingly populations around the lake, compared to those living further away but benefiting from the lake. They were not adjusted to income or users' practices, but once paid could lead to un-moderated behavior. These issues were left unresolved. By 2011, the implementation decree expected for 2010 was not yet published.

The mandate assigned to the office requires tremendous technical, scientific, human, financial and administrative resources that no environmental or water-related institutions have ever had. It would be surprising if the resources attributed to the Office matched its responsibilities. The Office may elaborate management policies and increase knowledge, but have no means to enforce them. In the absence of arbitration power, claims of controlling land use or arbitrating among users cannot materialize. A gap between mandate and capacity may only perpetuate a situation in which the needs of powerful actors determine the lake's management. Meanwhile, the pollution and exploitation of its water resources continue with little idea of their extent and consequences.

C. Uncertain future.

This section addressed the increased exploitation and the management of water resources from the Lake of Guiers since the 1996 reform. As exploitation intensified, the numerous lake's users and sources of pollution called for a management strategy that would address potential conflicts and protect water quality. Water level and quality, which condition accessibility and uses, raised important financial stakes involving powerful actors and economic activities the government bet on for the country's development.

The management elaborated for the lake determined specific water levels and variations, which ensured the water needs of powerful companies (SdE, SAED, CSS). But measures to control pollution constitute a constraint for large plantations and industries, and will be more

difficult to implement. Far-reaching, these measures require controlling development projects and land use, and call for substantial power and resources, which consultations and the future Lake Office are unlikely to garner. The proposed managing institution was weakened before its creation was endlessly delayed. The political will to enforce protection measures proved lacking. As a result, decisions for the lake's management rest on the balance of power between strong interests, as increasing needs for Dakar water supply compete with agriculture and industrial development. The lake's management and its future may continue to be de facto determined by powerful actors using its water.

Local populations suffer most from a management satisfying the water needs of large consumers and leaving pollution sources unchecked. Recommended measures to compensate for hindered access to the lake, loss of land, and lack of drinking water and sanitation are not feasible as they induce costs these populations cannot bear.

Decisions for the lake's exploitation and management were made with insufficient knowledge of its natural mechanisms and ecosystem. In addition, management only concerns regulating activities around the lake, when pollution sources extend far beyond its surroundings. All activities, domestic and economic, affecting the watersheds around the Senegal River and the lake have to be sustainable for the lake's water to be protected. Impacting political, economic and environmental factors are, however, beyond the scope of the current "integrated" management of the lake by the water sector and the authority of the future Lake Office.

II. Underground Water Resources

In addition to increasing the exploitation of the Lake of Guiers, infrastructure investments that followed the reform increased the exploitation of underground water tables located between the lake and Dakar. For the water sector, managing underground water resources meant increasing the exploitation of good quality tables and reducing that of tables whose quality had become a problem for distribution. But exploitation decisions were made in the absence of knowledge about water resources, and despite known or suspected negative

consequences. Environmental impact studies did not contribute any knowledge and recommended inadequate mitigating measures that were not implemented. The sector financed a few studies on water resources after investments had been realized, and did not use them to inform management decisions. Monitoring capabilities remain extremely limited, and responsible institutions have no authority over pumping decisions. The sector thus increased draw-offs in tables that were already overexploited or are "fossil" resources, i.e. non-renewable. Tables are not replenished, their levels are dropping, and water quality is degraded.

Contrary to official claims, no integrated management of water resources for the sake of their preservation is implemented within and beyond the water sector. The management of the sector's own activities are not integrated and goes against preserving water resources. In addition to overexploiting underground resources, the sector developed sanitation services that contribute to resource destruction. Furthermore, no coordination exists with sectors, such as trash management, agriculture and industrial activities, or urbanization, which carry on oblivious of water resources' sustainability requirements and contribute to their degradation. The negative consequences on all tables are dramatic.

Fifteen years after the water sector reform, underground water tables are not being replenished, their levels are dropping, and all sorts of pollution degrade water quality. Underground water contamination in the Dakar region is real and beyond prescribed norms in all respects, while contamination is increasing in the Niayes. Some resources are already lost, and because of hydraulic continuity between aquifer systems, continued overexploitation and pollution anticipate the loss of other tables, including non-exploited ones.

A. Increased draw offs: overexploitation and salinization.

Before the reform, and despite warnings on the risks of underground water destruction from overexploitation, the World Bank financed an investment program for Dakar supply

(1992), increasing draw offs in overexploited underground tables.[81] Investments after 1996 followed suit without further studies.

The aquifer systems concerned by draw-offs for Dakar water supply include the superficial Quaternary Sand tables on the Cape Verde peninsula and the Littoral Nord area, the semi-deep Paleocene aquifer (Pout and Sebikotane), and the deep Maastrichtian aquifer (Pout and Thies) (GKW Consult, 2009). These aquifers are interconnected: deeper layers depend for their recharge on superior compartments fed by rainfall. These characteristics imply that the pollution of superior tables transfers automatically to deeper layers. Furthermore, located near the ocean, these tables are susceptible to salt water intrusion when their levels lower, inducing their destruction as freshwater sources.

[81] The overexploitation of water tables occurs when draw-offs are faster than replenishment rates, thus provoking lowering and salinization.

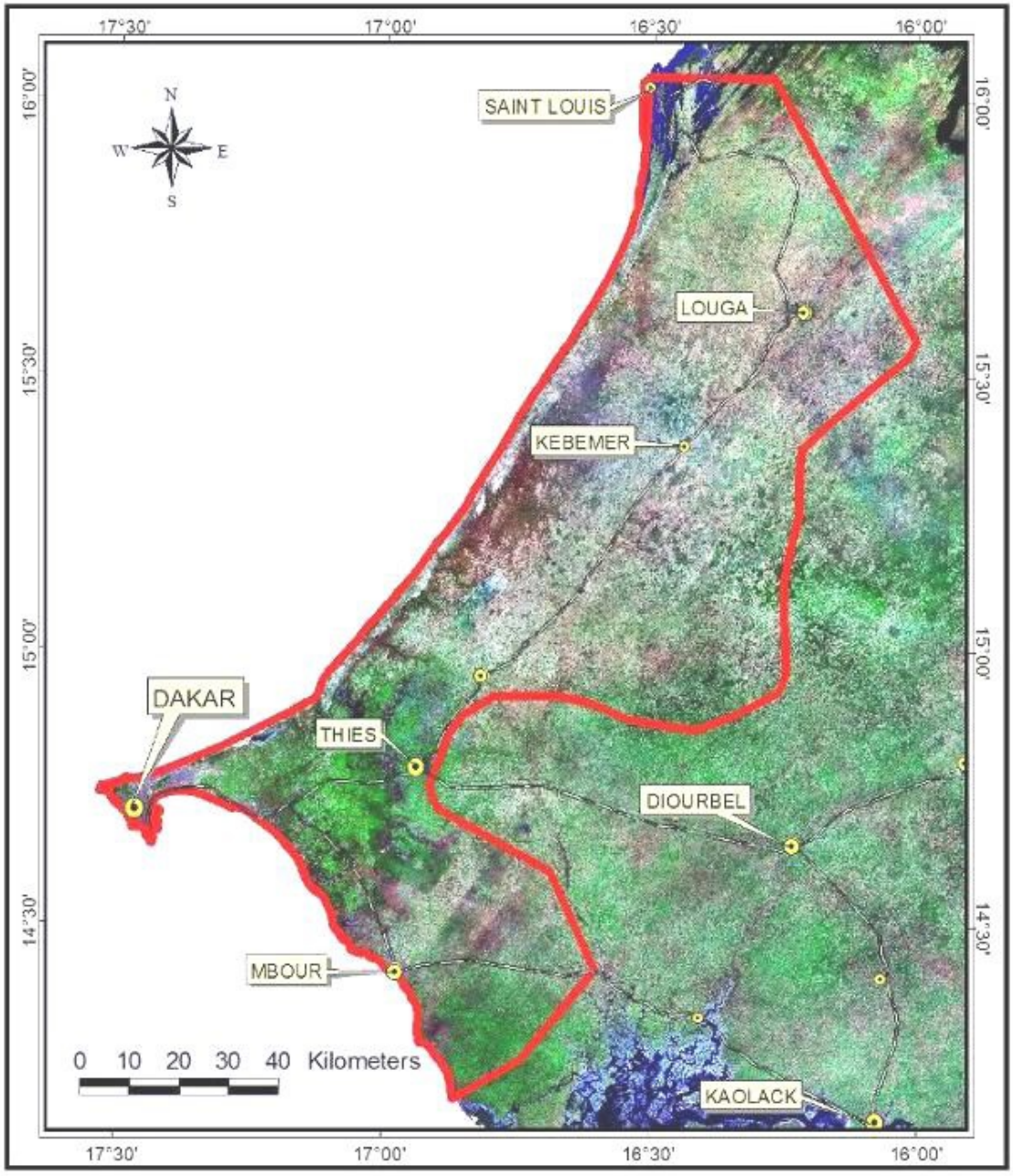

Figure 6: Zone concerned with underground water draw-offs
(GKW Consult, 2009)

A 1992 diagnosis of Senegal water resources stressed the difficulty to quantify the exploitable potential of underground tables (volume annually renewed) and concluded that with unknown potentials, variable annual recharge and growing demand, overexploitation was

unavoidable (Normand, 1992). [82] The study predicted generalized and pronounced lowering would put the tables out of reach of seasonal rainwater replenishment, and warned against salinization: "this hardly reversible phenomenon affects almost all aquifers along the Senegalese coast" (Normand, 1992, p. 53).

In 2009, 13 years after the reform and investment decisions, hydro-geological studies of the Dakar and Littoral Nord aquifers (contracted by the sector to GKW Consult) showed the extent of on-going destructions and predicted a bleak future if current exploitation rates were maintained (GKW Consult, 2009). The studies specified the geometry of the aquifer systems, their potentials, recharge rates, and hydraulic functioning. They delineated overexploitation and saline intrusions more precisely, and made predictions based on different exploitation scenarios.

1. The Quaternary Sand tables.

The Quaternary Sand groundwater is a shallow aquifer extending along the Atlantic coast from Dakar to Saint Louis. This aquifer system is made of three compartments: the Littoral Nord aquifer, the Cape Verde peninsula infra-basaltic table, and the Thiaroye table in the suburbs (Normand, 1992). This aquifer system has until recently supplied most of the Dakar region's water needs.

The Littoral Nord table.

The Littoral Nord table has been exploited since 1978. This table is recharged by rainfall only when it produces run-off. Since 1975, rainfall did not compensate for evaporation (300,000m^3/d) (Normand, 1992). By 1992 the table's piezometric dome (water altitude), which protected it from salt-water invasion, had dropped 10 meters, dramatically increasing the risk of salinization. Elsewhere, levels had dropped 2 meters.

Despite this situation, PSE investments increased draw offs (+35,000m^3/d) with 11 new boreholes. The PSE impact study evaluated that additional draw offs would induce a 2.5 to 5m drop in the Gueoul-Thies area over 15 years (Lauras & Pigeon, 1995). Around the new boreholes,

[82] This diagnosis was part of UNDP "Water resources planning" project in Senegal, undertaken in the early 1990s.

drops would reach 15m, but would be negligible 20km away. The study pointed out that under current climatic conditions, the Littoral Nord resources were not being renewed. It recommended monitoring the table, and that a long-term project allowed reducing draw-offs by increasing the exploitation of other sources. The study estimated that additional draw offs would not affect the piezometric dome further, thus not increasing salinization risks. Wells up to 3km from the ocean, however, causing saline intrusions in their surroundings, pump salt water.

The GKW studies confirmed the negative hydraulic balance sheet of the Littoral Nord tables induced by rainfall deficits and excessive draw-offs. Annual recharge (38Mm^3) is short of annual out flows (47Mm^3), including drawn, flow towards the ocean, and descending percolation towards deeper aquifers. At current rates, annual draw offs (22.5Mm^3) consume about 75% of recharge, and should be reduced to 9Mm^3 to ensure a stable hydraulic balance. The GKW study established that if the table had never been exploited, its level would have dropped because of low rainfall and few effective recharge areas, but much less (1-2m along the north coast, 4-5m in the center, 6m on the peninsula). The study concluded that:

> "If the exploitation of the superficial tables continues at current rates, the condition of these tables will worsen" (GKW Consult, 2009, parag. 2.5.4.2).

The Infra-basaltic and Thiaroye compartments.

Dakar city lies on top of the captive infra-basaltic compartment of the Quaternary Sand aquifer, and the suburbs, from Pikine to Kayar, on the free and open Thiaroye table. These two compartments communicate and rest on salted water bodies. The infra-basaltic table is fed by rainfall through basalt fractures and by the Thiaroye table, itself fed by rainwater. Thus, replenishment depends on rainfall, which largely evaporates before reaching the tables, and which has increasing difficulties infiltrating as recharge areas shrink to urbanization every year. The open nature of these tables makes them extremely vulnerable to pollution.

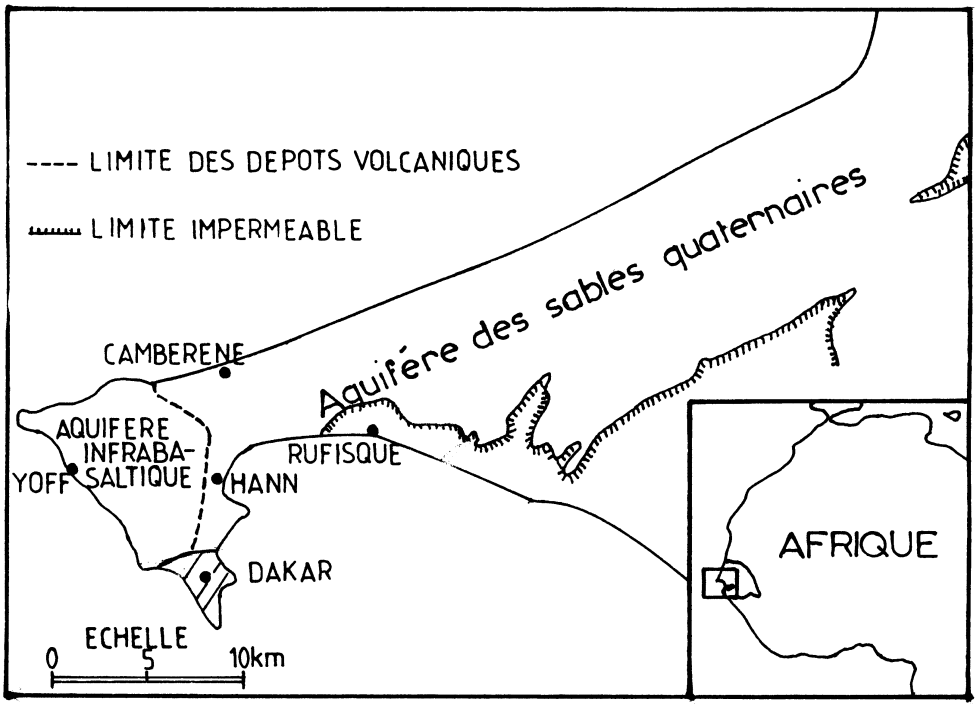

Figure 7: The Quaternary Sand aquifer in the Dakar region
(Tandia, Deme, & Sarr, 2004)

By the time of the reform, the level of these tables had considerably dropped. Though rainfall had been insufficient for decades, the PSE impact study considered that volumes drawn could be maintained but "presupposed satisfactory rainfall." It recommended carefully monitoring piezometric evolution and chloride contents until overexploitation was arrested in 2005 (Lauras & Pigeon, 1995, p. 27). By then, the quality of the table was so degraded that the resource was lost.

Though the infra-basaltic compartment was contaminated by salt water, and though it was exploited beyond its estimated potential (18,000m^3/d), the PSE increased draw offs (reaching 20,000m^3/d). With the PLT, draw offs were reduced to 12,000m^3/d in 2007. The GKW study confirmed persisting over-exploitation and saline intrusions:

> "The current exploitation of the table is still abusive and constitutes a great danger for the water resource" (GKW Consult, 2009, parag. 0.9).

At current levels, annual draw-offs are 2.3 times higher than annual recharge. With draw offs progressively reduced since 2000, the table's piezometry stabilized, but at a very deep level. The GKW study determined that no less than a 50% reduction of draw-offs (to 6,000m³/d) could bring piezometric levels back to balanced conditions and reverse saline contamination. The study also recommended modifying the repartition of draw-offs, and increasing recharge with rainwater basin and artificial recharge bowls to reduce saline intrusion and concentrations.

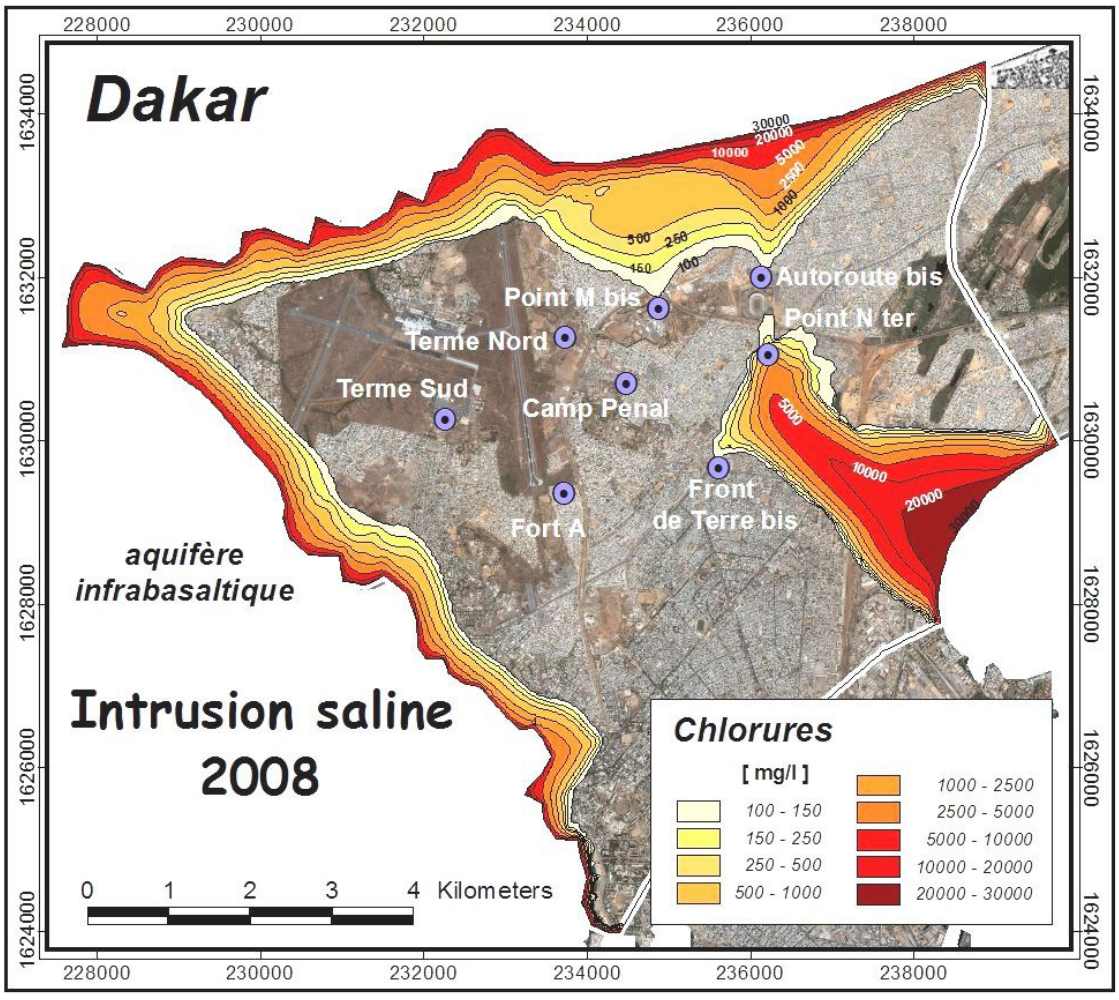

Figure 8: Delimitation of saline intrusion in the infra-basaltic table in 2008 (simulation)
(GKW Consult, 2009)

In the suburbs, the Thiaroye table had been intensively exploited for Dakar supply (20 boreholes), and industrial and agriculture needs since 1950. Originally dome-shaped, over-pumping created its current valley shape with a 30 to 70 meter gully (Tandia et al., 2004). Exploitation dried up depressions where the table surfaced, and lowered it by 7-9m (GKW Consult, 2009). Around certain boreholes (Yeumbeul), the table is 15 meter deep when its average depth in the area is 1m. The PSE slightly increased draw-offs (reaching 8,300m^3/d). The impact study noted the need to maintain exploitation to avoid flooding in now urbanized areas. With the PLT and additional water from the Lake of Guiers, draw-offs were reduced and drawn only at peak hours.

Though the PSE impact study considered the table was not at risk of salt-water invasion, further analyses showed salt progression was important. Very high nitrates concentrations were also found, leading the SdE to abandon a few boreholes when the PLT was implemented. A manager explains:

> "The progression of salt bezel is important; along the Baie de Hann, in particular. Some boreholes were shut down or slowed down. Nitrate concentration levels are also very high and create quality problem for distribution. Concentrations have been higher than 300mg/l in certain boreholes since 1980. Some were abandoned in Thiaroye because of nitrate levels" (SdE manager; Dakar, Oct. 10, 2006).[83]

[83] WHO recommendation for nitrates in drinking water is 50mg/l.

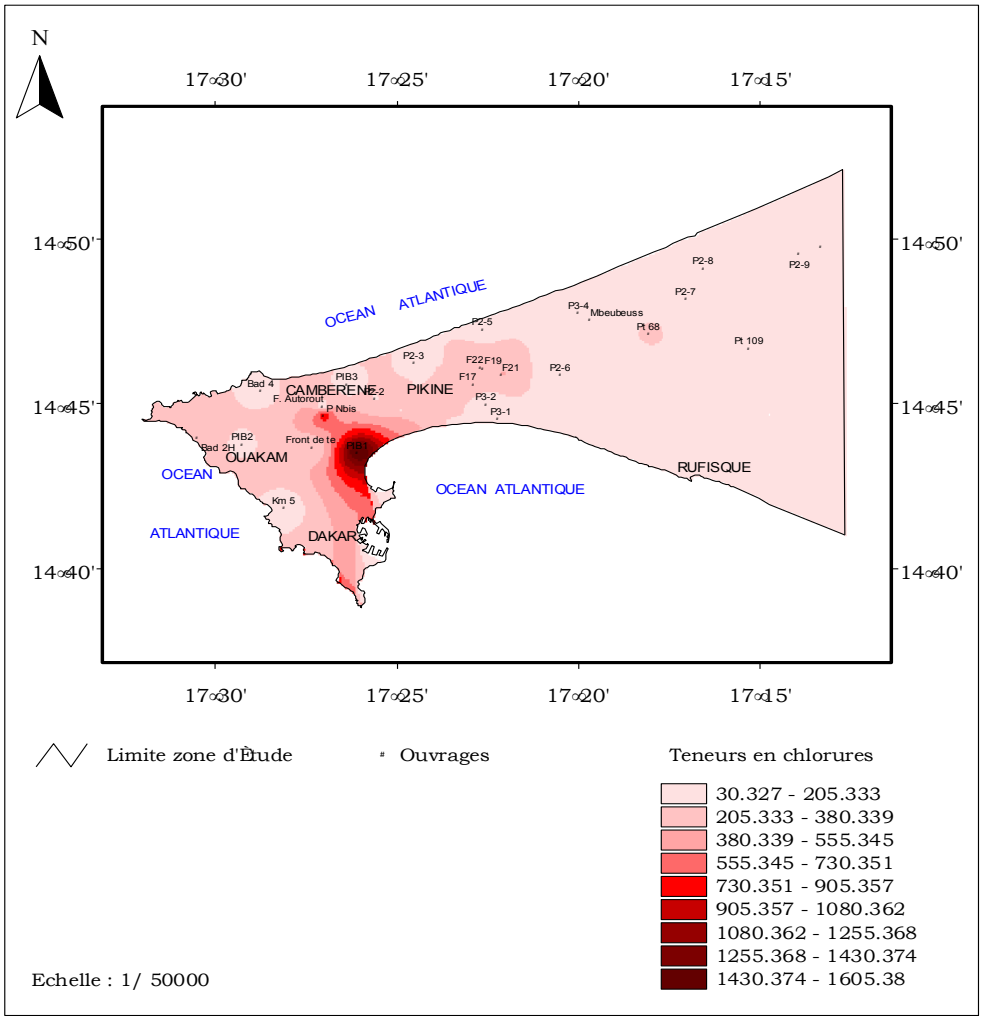

Figure 9: Map of chlorides content in the Dakar aquifer
(Tandia et al., 2004)

But reduced pumping was insufficient to stop overexploitation. Water specialists explain:

"Bringing more water from the Lake of Guiers helped slightly reduce the overexploitation of low quality tables in the Dakar region. But overexploitation continues" (hydrologist, ex-DGPRE manager; Dakar, Nov. 12, 2006).

"Since the second lake conduit, it's a bit better. They reduced the exploitation of tables that endanger the quality of water supply. But, pumping from the lake should be tripled, or we should treat seawater for over-pumping to stop. Reductions were insufficient for the tables to replenish and self-purify" (hydrologist, consultant; Dakar, Feb. 8, 2010).

Meanwhile, to overcome water shortages scheduled to resurface in 2013, the water sector

plans to drill new boreholes on the peninsula. Exploitation will intensify anew while a new long-term solution of 10 years is being sought. Decisions are therefore ignoring recent recommendations to protect resources.

2. The Paleocene limestone table.

The semi-deep Paleocene limestone table comprises the Sebikotane and Pout compartments, parallel to each other and extending from the ocean in the north to the ocean in the south. In the north, both tables are captive and fed by exchanges with other aquifer systems. In the south, the tables are free and fed by rainwater infiltrations (low or nil since the 1970s). Overexploitation since the 1960s caused salt water invasion (Lauras & Pigeon, 1995).[84]

But after the reform, draw-offs were maintained at Sebikotane (25,000m³/d) and increased at Pout (reaching 20,000m³/d). The PSE impact study noted a 60cm yearly lowering and an alarming progression of dry residue (Lauras & Pigeon, 1995, p. 14). Expected additional drops (5m) by 2010, the study recommended creating refilling basins and flushing the Panthior dam every two years. As a SdE manager explains, this recommendation was never implemented:

> "When the Panthior dam is cleaned, the water table rises after the rainy season. The Ministry of Hydraulics is in charge, but nobody takes care of this" (SdE manager; Dakar, May 28, 2006).

With the PLT, exploitation declined in both compartments (-7,500m³/d at Sebikotane and -9,000m³/d at Pout). The PLT Environmental Management Plan recommended further reductions due to very high iron levels affecting supply quality (World Bank, 2009). A SdE manager explains:

> "In 2009, iron levels reached 0.62mg/l when WHO recommended level is less than 0.3mg/l. With the expansion of the KMS plant on the lake, we could abandon boreholes in Sebikotane" (SdE manager; Dakar, Jan. 26, 2010).

But for this table, even reduced exploitation constituted overexploitation. Specifying the

[84] Chloride contents rose from 35mg/l to 300mg/l in the Sebikotane table and from 120 to 275mg/l in the Pout table between 1985 and 1993.

aquifer hydraulic conditions, the GKW study determined the Paleocene table is a quasi-isolated compartment and therefore a “fossil” resource. The table is primarily recharged by percolation from superior tables (85%) and by some lateral flows (5%). With losses from draw-offs (20 M.m^3/y in 2007), lateral flows and descending percolation towards the deeper Maastrichtian table, the Paleocene table has an important yearly deficit (-6 M.m^3/y). In these conditions, any draw-off depletes the table.

Up to now, the table has compensated its deficit by strong vertical sucking from the above Quaternary Sand table. But this resource is being depleted and can in the long run disappear. The deficit will worsen as the underlying Maastrichtian table increasingly needs to compensate for its own deficit, and sucks more water from the Paleocene table. Indeed both the Paleocene and Maastrichtian tables appear to be quasi-fossil resources with very limited freshwater recharge.

3. Maastrichtian table.

The Maastrichtian is a deep and important water table covering the entire Senegalese territory. The table is only replenished with water from the above Paleocene tables (COWI, 2001). This aquifer has been considered the resource to turn to when the exploitation of other tables becomes insufficient. It is now exploited at Pout, Thies and Mbour.

At Pout, draw-offs reached 74,000m^3/d when 10 new boreholes were drilled in 1992, after which the table’s level dropped 1-2m per annum (Normand, 1992). Drawing rates were maintained during the PSE. The impact study considered that drops were acceptable for 10 or 20 years, and recommended drilling a new borehole (Lauras & Pigeon, 1995). The study noted that the water quality of this table was very good except in the south where salinity was increasing due to the salinization of the upper Paleocene layer. If salinization continued, drilling into the Paleocene would have to stop. At Thies, where the level was already dropping 80cm per year, the PSE financed new boreholes. Because of insufficient data, the impact study could not reach any conclusion about the consequences of draw-offs.

Indeed, knowledge of this table was very scant. The PSE financed a hydro-geological study to improve knowledge of the table's hydro-dynamic functioning and "plan the consequences, in the short and long run, of the exploitation of its resources" (COWI, 2001, p. 1). The document noted that estimated recharge volumes represented only half the draw-offs, and risks of salinization existed. The study recommended installing a piezometric network to monitor evolutions, stabilizing and then reducing draw-offs, and developing artificial recharge.

In 2009, the GKW study confirmed that the table lowered 20-25m in Pout and Thies, and between 1 and 10m towards Mbour. About 69% of this table's freshwater recharge comes from percolation from the above Paleocene table and 31% from lateral flows from other tables and from the ocean. Overexploitation creates a negative balance sheet (-16 M.m^3/y) with draw-offs (-25 M.m^3/y) higher than recharge (12 M.m^3/y). The potential of the table is about 9 M.m^3/y, while current draw-offs are 25 M.m^3/y.

So far, the Maastrichtian has covered its deficit by vertical sucking, but resources from above tables are diminishing, and limited permeability between tables makes for slow and reduced transfers. In the long run, vertical percolation can drain the Paleocene reservoir. If exploitation stops, the Maastrichtian reservoir could replenish through time, but at the expense of emptying the Paleocene table.

Both the Paleocene and Maastrichtian tables are limited, non-renewable resources, and available quantities will progressively diminish with exploitation. The lowering of these aquifers is solely caused by their exploitation. Without any draw-off, replenishment from above tables would have been sufficient even with rainfall deficits (GKW Consult, 2009, parag. 2.5.6.2). The GKW study also warned that if superficial tables were most vulnerable to pollution, because of the hydraulic continuity, in the long run deeper tables will be contaminated. Even non-exploited tables (between Bambey and Louga) are threatened by pollution from the Littoral Nord tables.

Thus, the water sector increased the exploitation of underground resources oblivious to potential impacts. In 1996, the PSE impact study hoped a long-term investment project would

allow reducing the overexploitation of underground tables. With the PLT, reductions took place at boreholes where water quality was a problem for supply. But overexploitation continued for all tables, and salinization progressed. Recent studies confirmed the un-sustainability of the exploitation of underground water since 1996, "numbers are worrisome today and will become alarming" (GKW Consult, 2009, parag. 2.5.5).

Increasing the exploitation of limited and non-renewable resources, the water sector's management of underground resources is not sustainable. The sector paid no attention to "the obvious fact of very limited underground water resources in the Littoral Nord area" (GKW Consult, 2009, parag. 4.1.2), and to the non-renewable nature of other resources.

B. Protecting underground resources.

Very little was invested in resource protection. The water sector adopted extremely limited protection measures and hardly implemented them. The DGPRE, which was responsible for implementing protection measures related to the PSE and PLT has insufficient resources and no authority over the use of water resources. Progress toward controlling draw-offs and improving knowledge and monitoring is very slow, and the little information gathered is not used to guide exploitation and management decisions.

1. Controlling private draw-offs.

Progress toward controlling private draw-offs in underground tables is slow and difficult. The volumes of draw-offs for agriculture and industrial activities are important, particularly in the Niayes region, but not clearly known (DGPRE, 2009a).[85]

Recommended regulations for checking draw offs require resources and equipment that are not available (Lauras & Pigeon, 1995; World Bank, 2009). An inventory of private wells and their intakes began in 2007, and shows that most users do not respect extraction regulations (meter, tax, etc.) and escape control (Faye, 2008). In 2011, the inventory was still ongoing.

[85] In 2009, 64% of large producers and 20% of small ones used hose irrigation systems, the most wasteful irrigation practice.

2. Improving knowledge and monitoring.

Since the reform, financing for underground water studies and monitoring equipment have been very limited. Reformers and management plans considered strengthening the DGPRE's monitoring capacities, but serious monitoring remains impossible. The purpose of monitoring underground water tables is to observe the evolution of their volume and quality and determine their management so as to react in case of drifting and lowering quality, thus avoiding depletion and contamination. But monitoring requires adequate equipment, resources and staff.

The PSE included a monitoring plan, but did not provide for new piezometers (measurement instruments) to implement it. The PSE impact study and the PLT Environmental Management Plan recommended to establish a monitoring reference framework, density the piezometric network in the Dakar region, and capacity-building measures for the DGPRE (Lauras & Pigeon, 1995);(World Bank, 2009). But needed data, resources and equipment were not available. The DGPRE produced a few reports, which were not transferred to water sector officials, making any adjustment unlikely.

Though with the GKW Hydro-geological studies, knowledge on the Dakar region and Littoral Nord tables improved, and monitoring ability slightly increased, equipment, resources and knowledge are still painfully lacking. The PLT financed the GKW studies but did not budget the new piezometers they required. After additional funding was provided in 2008, 5 new piezometers were installed and 2 were rehabilitated, when 21 had been recommended in 1995 (Lauras & Pigeon, 1995). The GKW study noted the insufficient density of the monitoring network and its inadequate repartition (GKW Consult, 2009). The Dakar region is equipped with about 20 piezometers. For a proper monitoring of the infra-basaltic table alone (head of the peninsula), the study estimated that 12 additional piezometers were needed.

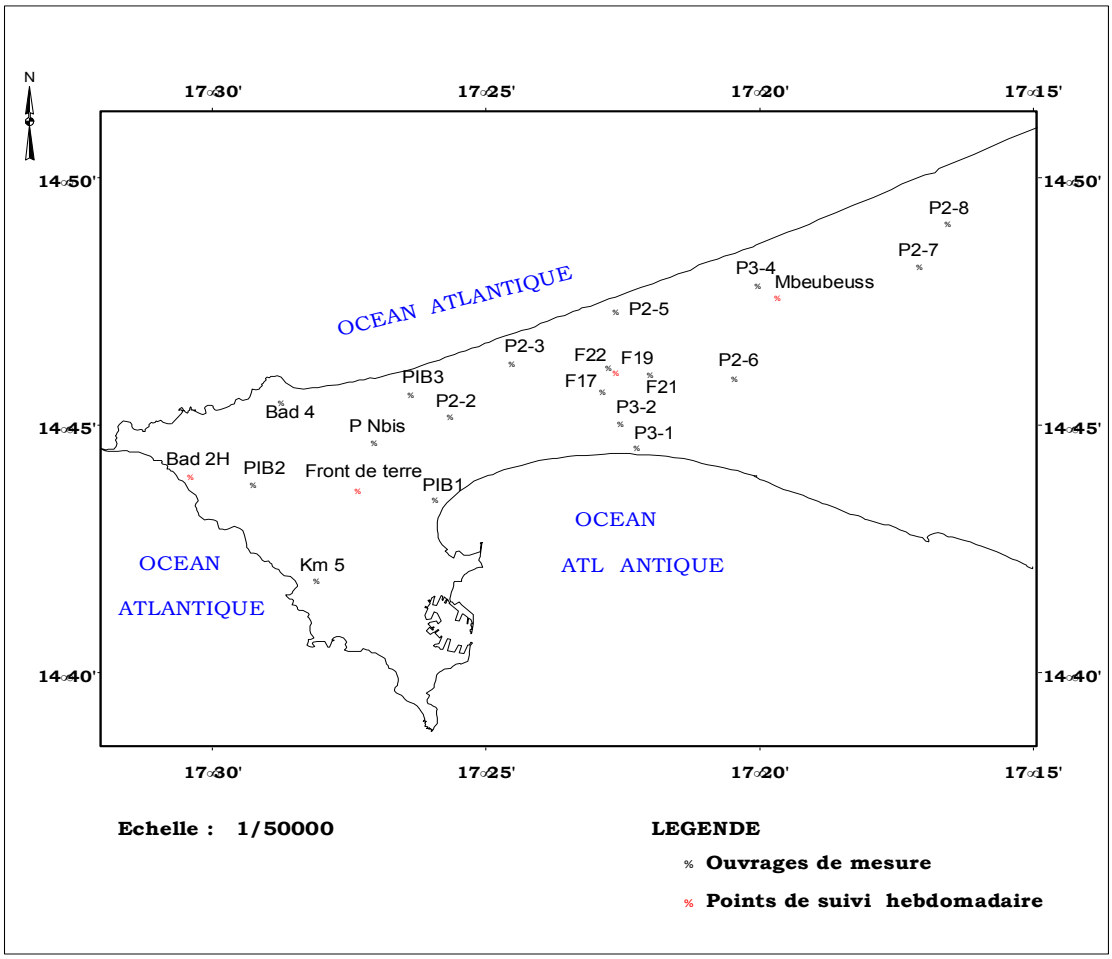

Figure 10: Underground aquifer monitoring network (with the 4 pollution monitoring points)
(Tandia et al., 2004)

With insufficient equipment and resources, surveillance is minimal. Physical measurements are irregular and qualitative monitoring nonexistent. A DGPRE manager explains:

> "Physical parameters are regularly analyzed, but we cannot do chemical analyses. It's too expensive. In the industrial area, there are heavy metals with the ICS [Senegal Chemical Industries], but we don't do these analyses. The hydrometric databank is blank from 1994 through 1998. Between 2004 and 2008, few measures were done. Prevention is difficult without data" (DGPRE manager; Dakar, Feb. 5, 2006).

Strengthening the piezometric network, improving resource knowledge, and reinforcing

DGPRE capacities remain the asserted goals of water development projects. The Millennium Water Supply and Sanitation Project (PEPAM), for example, includes resource monitoring:

> "Each PEPAM project has a 'water resource monitoring' component. Because they impact on resources, they have to be responsible for their management" (DGPRE manager; Dakar, May 26, 2006).

Concretely, this has meant each project finances a piezometer or two in the area it covers.

The lack of authority of the DGPRE and the lack of coordination between urban development and water resource management are also responsible for the inadequacy of the monitoring network. The administration authorizing housing construction shows no concern for water resource equipment, leading to the destruction of piezometers.

The DGPRE is unable to protect its own infrastructures. Piezometers were originally installed on public lands, which are engulfed by speculation and sold off. As a result, piezometers disappear under new constructions. A manager explains:

> "It's an urbanization problem. Constructions are authorized on top of piezometers. We try to raise awareness to keep protection perimeters around piezometers; to keep these lands public. We're supposed to rehabilitate some piezometers, but we cannot find them. We renovated three towards Thiaroye. But we lost the one in Cambérène. First it was damaged, then I saw a building there. We also have to get back one near the airport" (DGPRE manager; Dakar, Feb. 5, 2006).

Researchers experienced this situation firsthand. A PhD candidate at the University of Dakar explains:

> "I'm trying to regularly sample water for analysis at various piezometers in the region. One day, in Ouakam near the airport, a house was built on top of a piezometer. I found it in the middle of the house. Three piezometers where I used to sample water no longer exist—the SAMU well, the airport near the Corniche, and Bad2H" (Dakar, May 3, 2006).

A biologist saw new piezometers disappear:

> "In Mbeubeuss, a piezometer was recently installed, but before the end of the year, an authorization was given for a sand quarry and the piezometer was gone" (biologist, researcher; Dakar, Feb. 6, 2010).

Thus, measures to protect underground water resources were minimal and far from addressing the overexploitation and pollution of underground tables. The exact volumes drawn from these tables remain unknown. Since 1996, recommendations to "carefully monitor" tables were frequently reiterated, but no capacity for such monitoring was provided for. Though capacity-building was a component of the reform's projects, financial resources devolved to that purpose were sparse. Technical, human, financial and institutional weaknesses for monitoring and studying underground water resources are daunting. The lack of monitoring capacity and of procedures to take what little information exists into account shows the little importance reformers and water sector officials gave to water resource protection. Without proper monitoring and knowledge, management decisions cannot be guided by sustainability concerns.

C. A non-integrated management.

The water sector's management of underground water resources since the 1996 reform is neither integrated nor sustainable. It ignored the particular vulnerability of these resources and the impacts of sanitation, trash, agriculture and industrial activities, and urban development, which contribute to their pollution and depletion. Thus, the narrow scope of underground water management added contamination and destruction to the depletion and salinization caused by overexploitation.

1. Natural characteristics.

The characteristics of the natural environment in the Dakar and Niayes regions make water tables particularly vulnerable. Tables are low lying and open, often appearing on the ground surface. Shallow sandy niayes soils provide no filtration, and the risk of groundwater pollution from contaminated infiltrations and soils is very high. Rain, atmospheric dust, domestic wastewater, trash, and industrial and agriculture effluents easily affect water tables. Furthermore, their proximity to the ocean makes these tables vulnerable to the intrusion of salt and polluted seawater (Diouf, Gomis, & Tchani, 1997).

The map below shows the areas where underground water is at risk of pollution and

pollution sources.

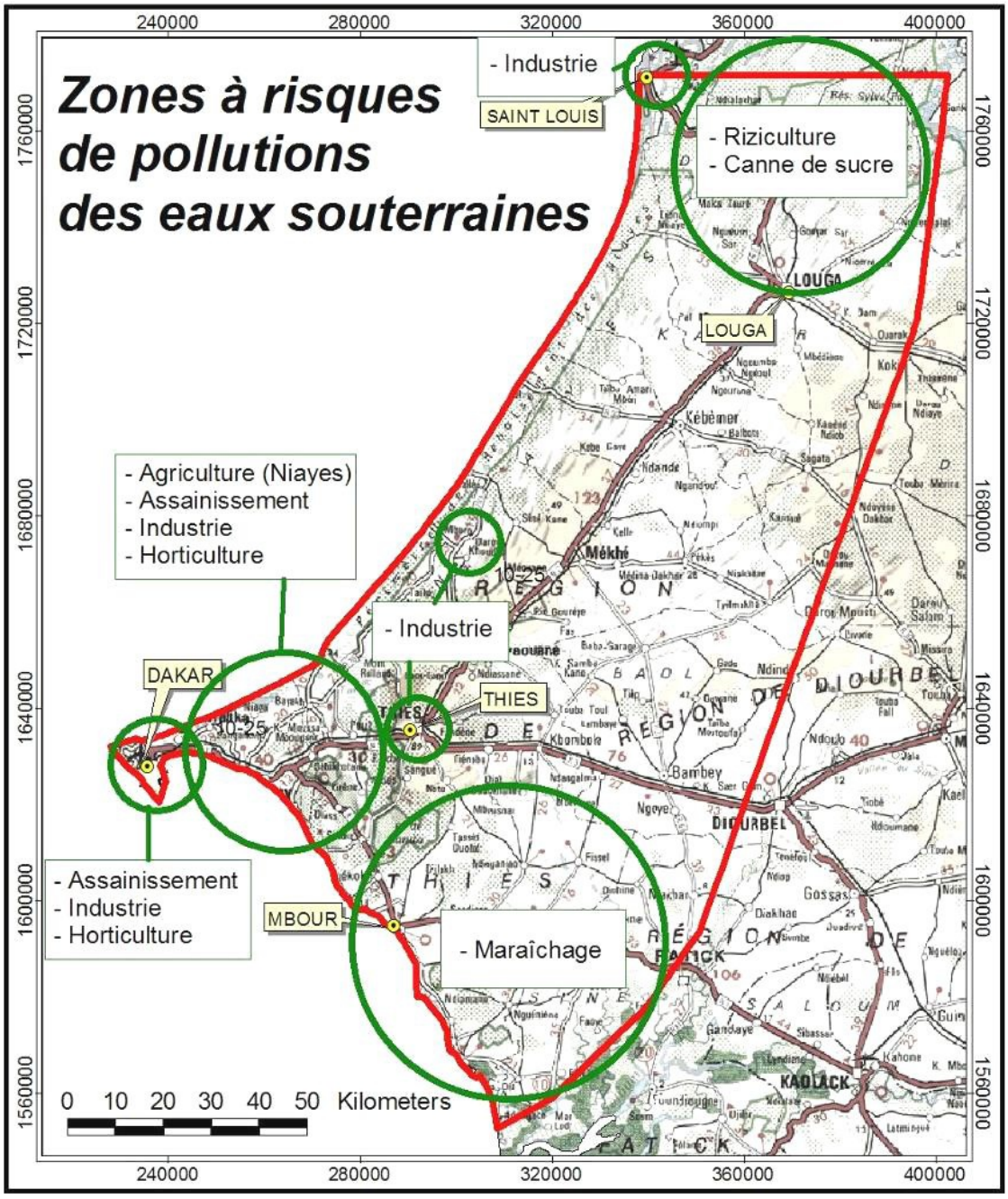

Figure 11: Areas where underground water is at risk of pollution
(GKW Consult, 2009)

In the Dakar region, the destruction of the ecosystem (soil erosion, destroyed vegetation cover, embankments and fill-ins of the niayes, contaminated coastal waters, intensive agriculture, urban sprawls, commercial and industrial developments) adds to these vulnerabilities and contributes to the degradation of underground tables.

Areas where the Dakar aquifer is most vulnerable correspond to the suburbs and industrial areas which have no sanitation systems, no trash collection, where the region's unique landfill is located, where the poorly functioning treatment plant spills untreated effluents, where intensive agriculture uses illegal chemicals, and where underground water recharge areas are filled-in with trash and constructed. The entire region is surrounded by the ocean, making underground tables vulnerable to seawater contamination.

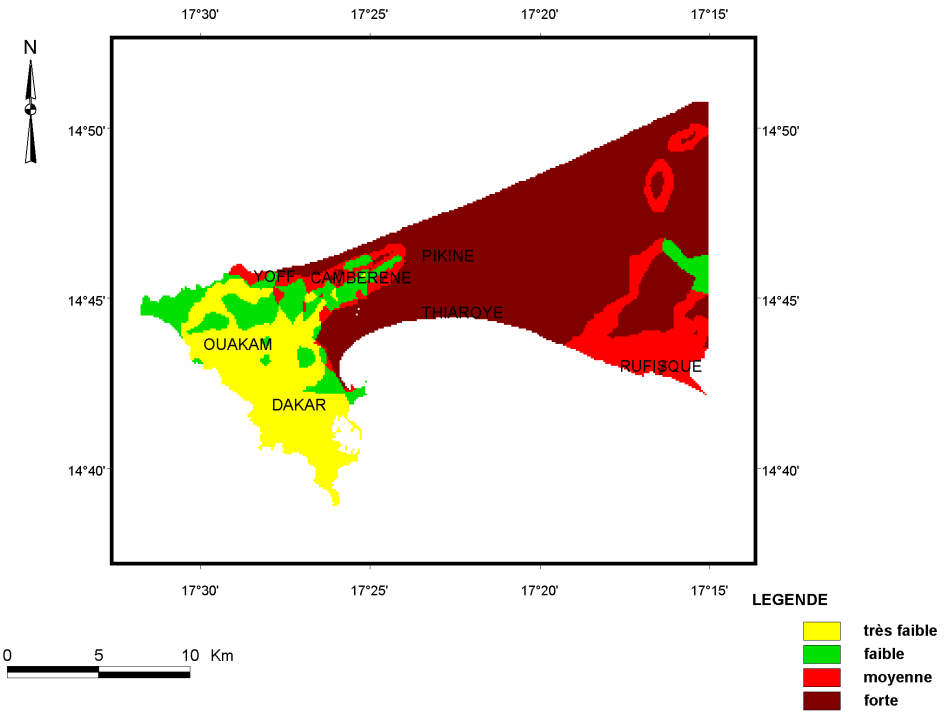

Figure 12: Dakar aquifer vulnerability map
(Tandia, 2002)

2. Ocean pollution.

If seawater intrusion into underground tables provokes their salinization, the pollution of coastal waters transfers to underground water as well. Thus, the dumping of untreated liquid and solid domestic, industrial and hospital waste around the Cape Verde peninsula contributes to the contamination of water tables. The water sector is partly responsible for this pollution, because of its lagging development of sanitation services. Infrastructures are insufficient, poorly functioning, and discharge untreated wastewater in coastal waters. Industrial sanitation is non-existent.

No data on the quality of coastal waters around the peninsula is available. A scientist from Dakar University explains:

> "In 1991, local scientists studied the impact of domestic and industrial effluents on the contamination of fish. They found fish were contaminated with bacteria and high concentrations of heavy metals. Lead, mercury and chlorine found in fish are discharged by textile dyeing, tanning, slaughterhouses, or food processing industries. Chemical contamination can be very dangerous because elements that may not be toxic individually become toxic when they combine under the effect of heat. The purpose of this study was to alarm the authorities and spur long-term in-depth research. But they manifested no real interest and we have no really valuable data" (hydro-geographer, professor; Dakar, May 27, 2006).

Since then, continued industrial pollution and increased volume of wastewater discharged in the ocean, the seriousness of pollution can only have intensified.

From collective sanitation infrastructures.

Collective sanitation infrastructures discharge raw or poorly treated domestic and industrial wastewater in the ocean. The largest sewer network (Hann-Fann) and rainwater canals draining domestic and industrial wastewater drain wastewater directly on beaches and close to the shore. [86] On the west coast, ocean currents carry off pollution if it is released at least

[86] The Hann-Fann network drains both rainwater and wastewater to the Pointe de Fann, the beach of Coussoum, the Gorée pier near the harbor. Rainwater canals discharge on the Corniche Ouest and in the Baie de Hann.

300m from the shore. Officially, the biggest outfall (Pointe de Fann) is 250m long. Local fishermen and divers, however, assert that its actual length is 50m maximum, directly polluting coastal waters. This is aggravated during the rainy season (May-August) as ocean currents are oriented westward and bring wastewater back to the shore. Even if the Cambérène plant released adequately treated effluents, its location facilitates coastal contamination. A university professor living in the Village explains:

> "An old study showed that because of currents, the north of the peninsula is the worst place to discharge wastewater, as oppose to the west where currents carry things off. Where plant is located, the outfall would have to be 2km long for pollution not to come back. But nobody paid attention to this. And you don't have to be a scientist to see that the swell and tides bring things back" (chemist, professor; Dakar, May 13, 2006).

Since the reform, water consumption increased without a parallel development of wastewater treatment, thus increasing ocean pollution. The PSE environmental impact study dismissed the impact of increased water consumption and subsequent wastewater discharge on ocean pollution, arguing that dumping would simply became less concentrated (Lauras & Pigeon, 1995). Increased water consumption, however, tends to modify households' lifestyle and their production of polluting matter. More water induces the use of more cleaning products and detergents, for example. As for industries, more available water allows increased production, thus using and disposing of more polluting agents.

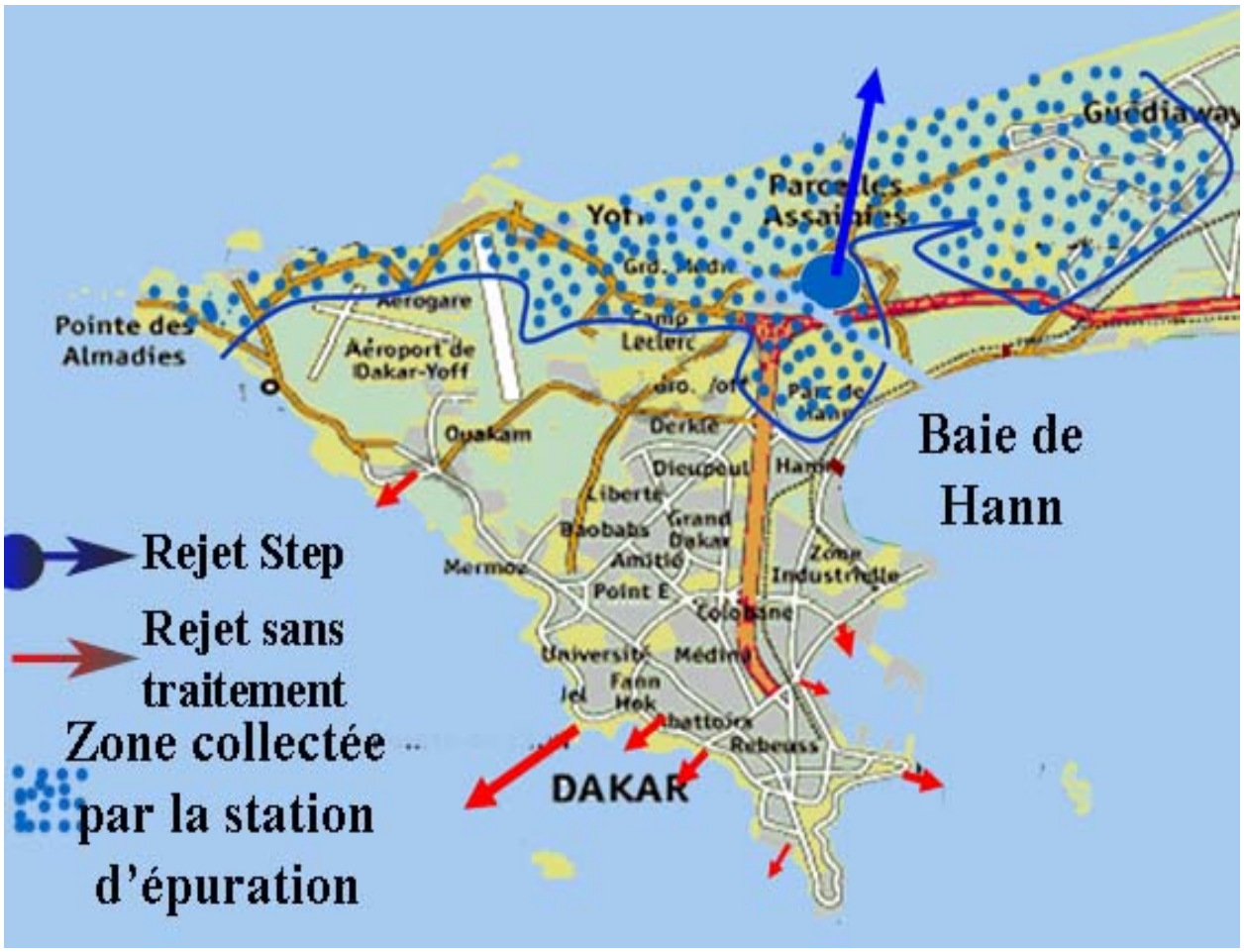

Figure 13: Collective sewers effluent discharge into the ocean
(DEEC, 2007)
Areas covered by the treatment plant (blue dots) and its effluent discharge (blue arrow) untreated discharge (red arrow)

From lack of industrial sanitation.

The total absence of industrial sanitation adds to coastal water pollution.[87] Industries discharge in the Baie de Hann, the harbor, and rainwater canals effluents contaminated with heavy metals (cadmium, zinc, lead, mercury, chromium), synthetic organic compounds that are not or hardly biodegradable (solvent, ammonia), and acids and greases.

In Bel Air, industrial outlets are connected to the rainwater Canal 6 crossing the area and

[87] Industries include food processing, textile, chemicals, timber, paper, slaughterhouses, tanning, fisheries, tobacco, and soft drinks. Industrial wastewater amounted to 12,914m^3/d in 1994 (JICA, 1994)

ending in the bay. The canal also receives engine oil from Colobane mechanics and domestic wastewater and excreta materials. With these various pollutions, what the canal discharges on the beach near Yarax is a thick oily and extremely toxic muck. Industrial effluents discharged in the harbor represent 50% of the organic pollution discharged into the bay (DEEC, 2004). Some companies use seawater for engine cleaning and return it to the ocean loaded with chloramines, acids and detergents. Each year, the African Oil Refining Company (Société Africaine de Raffinage) releases 1.4 million cubic meters of such effluents.

Promising projects?

Ocean pollution and its impact on underground water may be reduced if the Baie de Hann and the Corniche sanitation projects implemented infrastructures that adequately treated industrial and domestic wastewater. Both projects, however, are guided by cost-recovery and economic efficiency criteria for building and operating the kind of infrastructures that proved inadequate to the local context. The new infrastructures may therefore face operation problems and be ineffective at reducing coastal pollution, and continued pollution may be expected.

The bay project depends on polluters' willingness to pay and was elaborated without environmental data. Requirements for the bay's environmental sustainability remain totally unknown. Based on the operating cost of infrastructures providing insufficient treatment, and not including contaminated seawater used for industrial cleanup, the polluter-pays principle cannot meaningfully reduce pollution. The tradeoff between charges, taxes and industrialists' environment-friendly investments may not lead to substantial de-pollution, as financial tools do not cover all the environmental externalities borne by the bay. A hydrologist explains:

> "The price of pollution is determined by how much people accept to pay for a product. They consider that if 1kg of pollution load is more than 180 francs, industrialists won't be able to support production costs. I'd rather say: you pollute, you buy and operate the treatment plant that will render effluents harmless; that's the real cost. Also we only determine the organic pollution load, but everything else, like industrial chemicals, we

> don't know. Industrialists have to treat water so that it regains the characteristics it had before they used it" (hydrologist, professor; Dakar, Oct. 6, 2006).

Industrialists resist the application of the polluter-pays principle. A DEEC manager explains:

> "The DEEC developed a strategy for implementing the effluent discharge norms [SN05-61] adopted in 2001, and began dialogue with the industries union (SPIDS). A program to monitor the effluents of the 50 most polluting industries was set up in 2005. Between 2005 and 2008, pollution sources were identified for 157 factories. But industries challenged this study and a new one was undertaken. Pollution controls began in 2006 and the pollution tax on industries discharging water-polluting effluents [Environment Code, 2001], is levied since 2007. But the five biggest industries producing 75% of pollution do not pay the tax" (DEEC manager; Dakar, Jan. 20, 2010).[88]

The DEEC supervises the Baie project, but has no enforcement power. The same manager continues:

> "Nobody can force industries to pre-treat their effluents. The DEEC negotiates but has no power. Pollutions are identified. Effluent norms were adopted in 2001 and an implementation decree was issued. But the private sector works with the government and negotiates to buy time to make their application of the norms depend on their financial resources. The DEEC does not have the means to control" (DEEC manager; Dakar, Jan. 20, 2010).

Initially, the Baie project considered including trash collection around the bay but did not follow through. The lack of trash collection adds to the bay's pollution. In Thiaroye sur Mer, for example, accumulated trash combines with wastewater and excreta and decomposes on the shore. Irregular settlements around the bay do not allow for trash pickup. Trucks can only run on the national road and collect trash from nearby residents. Elsewhere, people fill buckets with trash and wastewater and empty them on the beach or in the ocean. A land restructuring project to allow trash collection was recently approved by the Dakar city authorities. But it involves relocating 40,000 people and funds have yet to be found.

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[88] These are agro-processing (SONACOS), slaughterhouse, brewery (SOBOA), tannery (Senta), fish cannery (SNCDS) industries.

Thus, as seawater invades overexploited tables, the pollution of coastal waters by collective sewers, the malfunctioning treatment plant, and industries discharging raw effluents near the shores is a source of underground water contamination. The sanitation projects currently under study to treat these effluents are likely, if implemented, to develop infrastructures that will be ineffective at reducing coastal water pollution, because of inadequate technology and a pollution management strategy based on financial principles rather than environmental requirements.

3. Direct sources of underground water destruction.

The water sector did not integrate its management of water resources with sectors and activities directly impacting these resources, including activities under its own responsibility. The sector did not endeavor to develop sanitation to match the growing production of wastewater and sludge, and installed sanitation facilities that pollute underground water. Beyond the water sector, poor trash management, agriculture and industrial activities, and urbanization are destroying water tables. The GKW was the first study to allude to the importance of pollution sources other than salinization, but the water sector took so far no action to address them (GKW Consult, 2009).

Sanitation development.

Despite the water sector's claim that sanitation development would contribute to preserving water resources, the scope, technology and strategy of sanitation projects ran counter to this objective (ONAS, 1998). In the Dakar region's environment, the absence and inadequacy of sanitation systems signify the automatic transfer of wastewater, excreta materials, and industrial chemicals to underground water. Tables are contaminated with nitrogen (ammonium, nitrates, nitrites) and all sorts of chemicals carried by wastewaters. Particularly dangerous industrial chemicals contaminate areas of the Thiaroye table.

PSE investments brought an additional 100,000m^3 of water daily to Dakar, but no plans were made for the parallel development of sanitation. Increased volumes of wastewater would

find their way out of industries and people's homes into the environment without raising much concern. The PSE impact study recognized that increased water consumption would facilitate wastewater infiltration and accelerate the transfer of pollutants towards underlying aquifers (Lauras & Pigeon, 1995, p. 32). The study also noted that with increasing population and no sanitation infrastructures, nitrate pollution was liable to increase in the Thiaroye table. [89] Concerned with water supply, however, the study made no recommendation for avoiding this pollution. It recommended maintaining the dilution of water drawn from the Thiaroye table before distribution, monitoring quality, and reducing draw-offs when better sources of supply would be available. The pollution of the Thiaroye table was an unfortunate fait-accompli to be palliated by increasing the exploitation of other water sources, but the urgency of developing sanitation was not mentioned.

Collective sanitation infrastructures, which are insufficient and malfunctioning, contribute to underground water pollution. Numerous sewer spills in unpaved neighborhoods and wastewater overflow at the Cambérène plant contaminate underground tables. But collective infrastructures concern a tiny fraction of wastewater produced in the region.

In the suburbs, households have no or non-watertight sanitation facilities. Wastewater and excreta therefore accumulate in the ground and infiltrate underground tables. In 1996, 95% of used water was poured on concessions grounds, in the streets or the ocean and 5% in dug holes (Enda-Rup, 1996). Most individual facilities are not watertight and do not degrade pollution. Pits, which receive wastewater from lost wells, sumps, washbasins and latrines are dug holes consolidated with piled tires, barrels or bricks. Pits are not emptied but rebuilt elsewhere every couple of years. With traditional latrines, liquids sip through bricks and sand and end up in side streets. Septic tanks are rare; as for "watertight," it is a fancy word for a very loose notion. Most tanks are unpaved, often on purpose because, as a "septic tank specialist" from Guediawaye explains:

[89] Nitrate pollution results from the mineralization of excessive organic matter disposed of in the environment.

> "Otherwise tanks fill up too quickly. Without pavement, you need to empty them less frequently" (April 19, 2006)

Tanks' emptying is unevenly performed (Enda-Rup, 1996; Merklen, 2000). In 1994, as much as 45% of tanks were never emptied (JICA, 1994). Tanks are also filled up by underground water, and if underground water penetrates tanks, tanks' content passes as easily into the water table. Thus, these facilities' content continually flows into the ground and the water table.

Water sector officials asserted that with the Sanitation Project for Dakar Peri-Urban Neighborhoods, the PAQPUD, "official," good autonomous sanitation facilities would replace informal low quality equipment, thus reducing pollution (Ly, 1999); (World Bank, 2009). But driven by effective demand and for the PAQPUD to reach its objectives, cheap non-watertight facilities were promoted in areas where the aquifer is most vulnerable. No prior studies anticipated the environmental consequences of the PAQPUD, but the potential damage of the project's facilities to underground water was obvious and known. The proximity of the water table and its rising during the rainy season is a major concern with on-site sanitation.

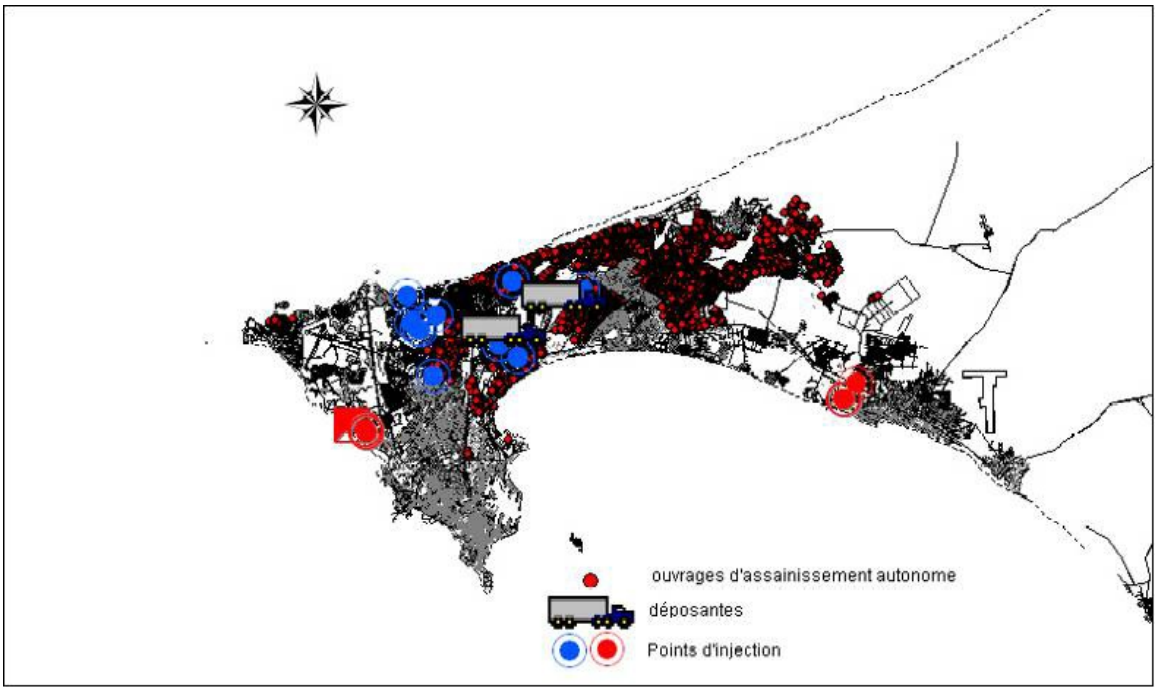

Figure 14: PAQPUD realizations
(ONAS, 2006b)
Autonomous on-site sanitation facilities (red dot), sludge collecting points (truck) and drainage into the Cambérène network (blue circle) or the ocean (red circle)

Since the early 1990s, NGOs and local scientists warned against the polluting effect of individual sanitation systems on the underground table. In peri-urban areas, shallow sandy soils, which allow quick infiltration without abating pollution, forbid the installation of latrines, non-waterproof equipment, or any type of systems based on ground filtration (Enda-Rup, 1996; Merklen, 2000). With the proximity of the water table, even well built septic tanks are inadequate as they do not perform tertiary treatment and no purification through ground filtration takes place. Seeking to adapt sanitation technologies to local socioeconomic and natural conditions, Enda suggested the installation of common watertight tanks for groups of houses or small diameter networks with treatment units (Enda-Rup, 1996; Niang & Gueye, 2002). A biologist explains:

> "The only effluent that is harmless for water tables is clean water, and no treatment system is 100% effective. Reaching 80 or 90% pollution reduction is very good, but with an underground table brushing the ground surface, releasing a 90% pollution reduced

> wastewater is polluting. And the more people adopt these systems, the more the table gets polluted. Only where the water table is 20 or 50 meters deep, these equipments are acceptable. Installing individual systems, it's like using the water table as direct receptacle. In terms of pollution, small networks protect underground water resources much better as effluents from in-house systems are not released on site. But small networks have received little attention so far" (biologist, researcher; Dakar, Nov. 19, 2006).

None of these actors were involved in the elaboration of the PAQPUD, and their warnings were ignored.

The project's "catalog of technologies" was realized without any study of the facilities' environmental impact, while its demand-driven strategy induced households to get the cheaper equipment, thus contributing to continued underground water pollution. Sump-washbasins and latrines were disproportionately chosen over watertight tanks. People were also more concerned with the disposal of wastewater, as many already had some kind of tanks or pits for excreta disposal.

The ONAS asserts that the PAQPUD largely contributed to increasing treatment and de-pollution rates (68% and 57% respectively) as wastewater collected by individual facilities is treated *in situ* and pollution load (BOD_5) is reduced by 80% (PAQPUD, 2009). When asked about the polluting impact of on-site sanitation facilities, ONAS managers emphasize that:

> "Sanitary improvements are visible in neighborhoods where equipments were installed. And the equipments filter wastewater sufficiently so that it is harmless to the water table. Effluents are environmentally acceptable" (ONAS manager; Dakar, Nov. 22, 2006).

However, far from all wastewater collected is treated *in situ*. When it is, the 80% pollution reduction takes place only in the case of some rare well-functioning watertight tanks, and 80% reduction is inadequate in the local environment. Furthermore, this does not take into account the impact of sludge produced by these facilities.

In 2008, when a study confirmed the negative impact of PAQPUD facilities, it was kept secret and the strategy for meeting the MDGs for sanitation was not modified (Faye, 2006b;

H20, 2008).[90] The study found that the pollution abatement performances of the best equipment were insufficient for nitrogen, nitrates and fecal coliforms. Even if 75-90% of Suspended Solids and 75-82% of Chemical Oxygen Demand were abated, the quality of effluents remained insufficient due to the high pollution concentrations of wastewater, and did not conform to Senegalese effluent norms. The study underlined that septic tanks and lost wells are not treatment systems, but are used respectively for the pre-treatment of raw wastewater and for infiltrating effluents after treatment. Thus, the best facilities have no treatment system per se in areas where the ground cannot perform this function. Moreover most lost wells or tanks sank directly into the water table.

When reminded of the H2O study's conclusions, a manager from ONAS argues that:

> "It is hard to say that in the local context equipments such as sumps or tanks do not pollute. The impact on the water table was known before the implementation of the project! But pollution was already there from previous equipments. So, it is difficult to measure the impact of 60,000 facilities when similar equipments have been used for 30 to 40 years. The precise impact cannot be determined" (ONAS manager, individual sanitation division; Dakar, Feb. 5, 2010).

In addition to polluting effluents, individual sanitation systems produce sludge matter that is hardly collected and treated. With 70% of the population in the Dakar region not connected to collective sewers, huge amounts of excreta materials are discharged in the environment, inducing serious microbiological and chemical pollutions. Households and professionals dump sludge in holes, niayes, improvised dumpsites, rainwater canals, sewer canalizations, or the ocean.

The PLT financed the construction of three sludge stations that collect an insignificant volume of sludge (220m^3/d) compared to the volume produced (172,445m^3) daily (Ndiaye, 2007). Furthermore, if residues from these stations are officially brought to the Mbeubeuss

[90] This study was contracted out for the ONAS by the AGETIP to H2O Engineering, a Senegalese consulting firm specialized in water and environmental issues. Impact studies are usually made available to the public. But fearing the repercussions of the negative conclusions of the H2O study, the ONAS kept it secret. It was by accident or stroke of luck that I laid a hand on it.

landfill, they do not always reach their destination, as trucks get rid of their load before reaching the landfill. The operation of dumping sites is also a source of pollution as water used for their maintenance is discharged in the environment (Faye, 2008).

Thus, overall sanitation development since the reform contributed to polluting rather than protecting water resources. The operation of collective infrastructures has little improved. The water sector promoted the installation of sanitation facilities despite warnings against their water polluting impact. Despite this now documented fact, the sector did not modify its sanitation development strategy. Investments barely addressed the urgent need for sludge management, which remain secondary among ONAS activities. Meanwhile, local initiatives to develop economically and environmentally adapted technologies, such as small networks and natural treatment units, are marginalized. Official sanitation strategies turn to these alternatives reluctantly, when running out of options and after huge amounts of money were spent and pollution had intensified.

No trash management.

In the natural environment of the Dakar region, any trash that is not properly handled contributes to water pollution. In the region, however, no trash is properly handled. The entire urban area suffers from lack of trash collection, specifically peri-urban areas, and none of the collected trash is treated or even adequately disposed of. Without public collection and increasing volumes of trash, anarchic landfills are spreading. The situation is all the more alarming that these sites receive domestic as well as industrial and medical wastes. Most industrial waste is sent without treatment to the Mbeubeuss landfill, but some industries bury or burn their waste on site. Environmental management norms for waste and hazardous materials are not respected. [91]

Mbeubeuss, the only authorized waste disposal site in the entire region is sitting on top of the water table. The landfill receives about 475,000 tons of domestic, industrial and hospital

[91] The most recent norms on industrial waste include NS 05-061 from March 2002 for wastewaters, and NS 05-062 on atmospheric polluting waste from October 2003.

waste every year (IAGU, CRDI, & IFAN, 2008). The enormous landfill located in Malika (Pikine) occupies 70ha of a 250ha partially dried lake, a resurgence of the underground water table.

Mbeubeuss is an extremely dangerous source of pollution: soils, air, surface and underground water are contaminated with heavy metals and microbiological organisms with concentrations beyond recommended standards (IAGU et al., 2008, p. 19).[92] The air is heavy with dust, decomposing gases and smoke from spontaneous fires. People living from trash recycling established villages on top of the landfill. The landfill spreads in an agricultural and pastoral area where people live, cultivate and raise animals, and where more than half the population has no access to distributed water. Exposed to toxic and infectious products, riparian populations suffer from health disorders such as congenital malformation, breathing difficulties, skin diseases, or reduced fertility—34% of women have gynecological and obstetrical problems (with 73% miscarriage and 22.5% stillbirths) (IAGU et al., 2008, p. 38).

[92] In 2006, as part of its Urban Poverty and the Environment Program (PURE), the International Development Research Center financed a research project on the impact of the landfill. The IFAN was responsible for analyzing the environmental impact of the landfill in Diamalaye and Malika, the poorest neighborhoods in the area.

Figure 15: Trash at the Mbeubeuss "Lake"
(GKW Consult, 2009)

Closing down Mbeubeuss has been the object of numerous official announcements—the latest indicated May 2010 as closing date. Closing the landfill is now seriously on the agenda because of the Dakar-Diamniadio expressway project financed by the World Bank (ADM, 2009). The expressway will cross areas of Pikine whose residents have to be resettled, and the chosen resettlement site, Tivaoune Peul, is near the landfill. The World Bank conditioned relocation to the prior closing of Mbeubeuss and the rehabilitation of the area. A scientist explains:

> "The World Bank said it was impossible to transfer these people near an active landfill. We have to stabilize and cover it. It will be covered with a layer of inert sand to prevent spontaneous fires, and made impermeable with wells for gas exhaust" (biologist, professor; Dakar, Feb. 6, 2010).

Decontamination will take decades and re-settlement for the expressway will not wait

that long. The contamination of the area will not disappear the day the landfill is closed. Closing it and rehabilitating the area will reduce dangers but will not eliminate them. The effects of the landfill pollution will therefore affect more people over time. Meanwhile, housing constructions are spreading near the landfill with the authorities' silent consent, weakening the Bank's condition of closing and rehabilitation as a pre-requisite for resettlement. Furthermore, no clear plan has so far been elaborated for handling Dakar's trash once Mbeubeuss is closed.

Without dramatic plans to improve collection in the entire region, trash will continue to contaminate underground water and the overall environment. In 2002, 53% of households in Dakar and regular Pikine benefited from trash collection services, with trucks picking up trash once, twice or three times a week (Diallo, 2007). In peripheral areas, service is irregular and limited to main paved roads. No public trash collection exists within neighborhoods. Private horse-drawn carriages sometimes pass through and pick up trash for a small fee. In Guediawaye, a resident explains:

> "The neighborhood got organized. Households pay CFAF 300 per month for someone with a carriage to come pick up trash. They bring it to the niayes where they burn it" (resident; Guediawaye, Nov. 11, 2006).

In Pikine Nord:

> "Someone with a horse drawn carriage picks up the trash at your house for CFAF 25, 50 or 100 depending on the size of your family" (communal employee; Pikine, Nov. 15, 2006).

With insufficient collection, people deal with their trash as they can. They dump it in the ocean, rainwater canals or the niayes, or bury it, burn it, or leave it in the streets. These practices pollute the ocean, the ground, underground water, and the atmosphere. Even near the city center, trash is burnt on sidewalks and along the expressway (Medina, Sapeurs Pompiers). In areas of Pikine:

> "We don't have space to burn trash, and so much trash is buried that when you dig you unearth old trash. It's getting very hard to bury it" (local resident; Pikine, Nov. 15, 2006).

Trash dumped in the niayes directly contaminates the water table. Trash spreads along the Grande Niaye of Pikine. On top of certain niayes, accumulated trash forms a thick decomposing layer. Swamp areas are filled with trash and used for housing construction.

Without adequate management, domestic wastewater and trash pollutes water tables directly or indirectly through ground contamination. In many parts of the suburbs, the ground is saturated with accumulated excreta and wastewater. These materials soaked and polluted the ground to the point of changing its nature. In Guediawaye, the ground, which was once a white fine sand, hardened from constant humidity and nitrification. Bacterial ground contamination is extensive in Pikine and Yeumbeul (Tandia, 2002). Organic matter from trash and wastewater was found 2.2m deep in the ground. Fecal Streptococcus (FS) were found up to 1m deep, with concentrations declining with depth.[93] Fecal Coliform contaminations followed the same pattern.

In the same areas, well water was contaminated with 200-50,000 FC per 100ml (WHO standard for potable water is 0 bacteria per 100ml). A 1996 study had found no fecal coliform in that area, showing the rapid evolution of this contamination. Nitrate concentrations reached 300mg/l in 1994 (WHO standard for drinking water is 50mg/l). In 2000, concentration levels were up to 500mg/l in the suburbs (Tandia, 2002). University students sampling water in 2006 found between 400 and 600mg of nitrates per liter of water at various boreholes (F17, F22, F19, F21) depending on the season.[94]

[93] 7,500 FS/g of dirt were found on the ground surface; 6,300 FS at 0.5m; 20 FS at 1m; nil below 1.5m.
[94] Nitrate concentrations depend on the thickness of the ground layer above the water table, and rise during the rainy season when the rising water table is contaminated by soils and sanitation pits.

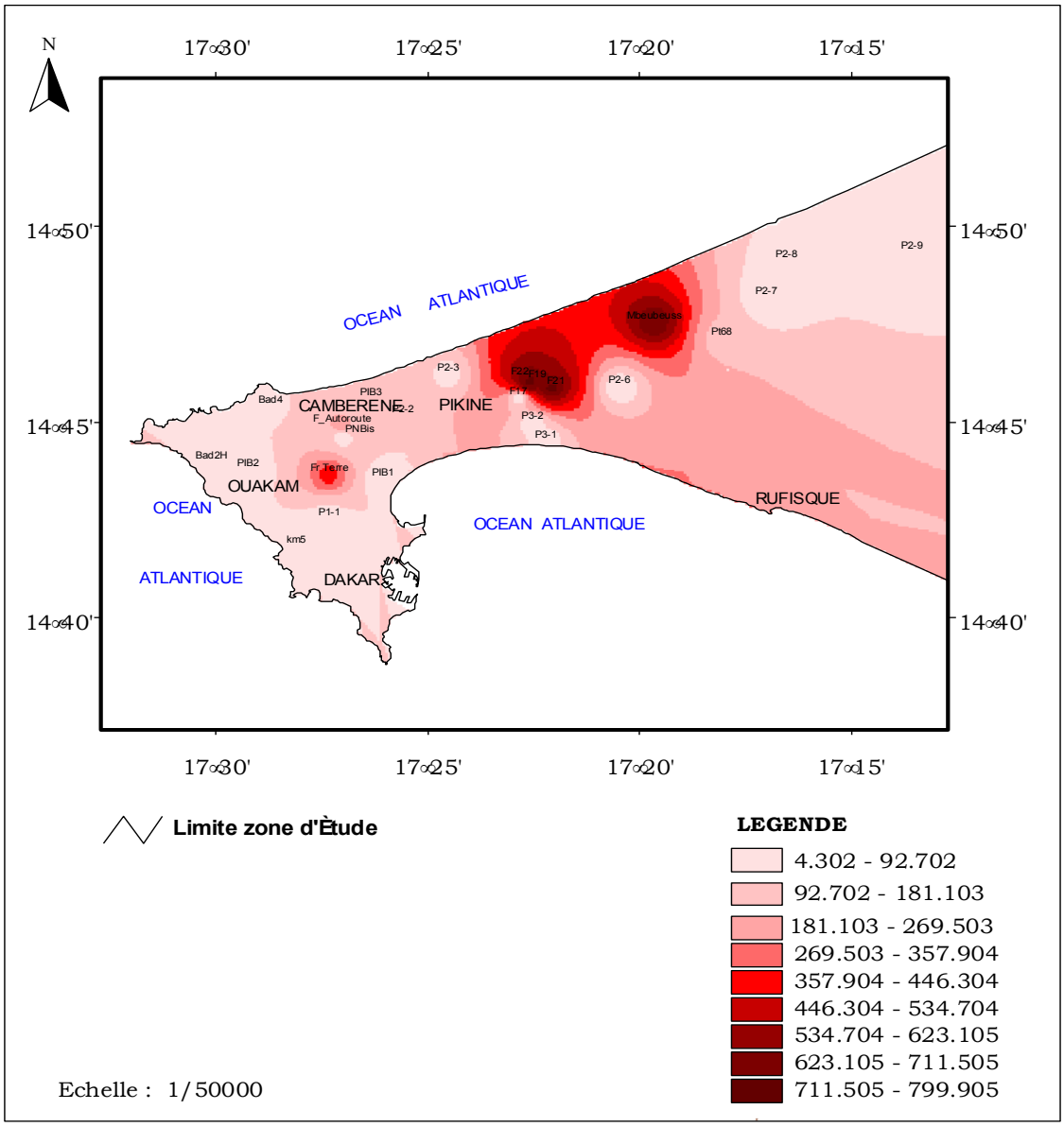

Figure 16: Nitrate concentrations (mg/l) in the Dakar aquifer
(Tandia et al., 2004)

Industrial and agriculture activities.

Water management does not address the polluting impact of industrial and agriculture activities on water tables. Agriculture pollution in Dakar and the Niayes region are a real threat to underground water, growers and residents. Agricultural practices, environmental

vulnerability and the superficial nature of water tables increase contamination risks (De Bon, Parrot, & Moustier, 2010).

Agriculture activities discharge organic and chemical fertilizers, herbicides and pesticides containing micro-pollutants and persistent organic pollutants (POPs) such as organo-chlorinated compounds. POPs are highly toxic, persist in the environment, travel thousands of miles away from their spraying point, accumulate in food chains, and their health consequences are serious (neurological deficiency, reproductive organs' anomalies) (I. Cisse, 2006; IAGU et al., 2008). Residues harmful to human and animal health accumulate in porous soils and contaminate water tables.

In the urban area, the use of organo-chlorine pesticides is extensive and out of control. The intensification of agriculture, the illegal trade of some of these products and the trade liberalization of others are mainly responsible for this anarchic use. This is compounded by over-dosing, the inability of growers to distinguish between pesticides, and the inability of soils to retain their molecules. In total mid-2000s, 57 different fungicides, pesticides and herbicides were used in Pikine and Guediawaye (Gueye-Girardet, 2010).[95] Among them, many are illegal and some are concerned by the Rotterdam Convention that Senegal ratified.[96]

Agriculture also considerably intensified in the Niayes region, and because of the continuous system of aquifers between the Niayes and Dakar, pollution affects overall underground water. But knowledge, resources, regulations and enforcement capabilities are lacking to address the impact of agriculture on water tables. More than one hundred different products are used irrationally and without legal control, many pesticides are illegal (DGPRE, 2009b).

In 2001, six different types of organo-chlorine pesticides residues were found in underground water sampled in Pikine, Guediawaye, and Rufisque, where groundwater is used

[95] Some of these products were identified by Anne Gueye during her doctoral field research (Gueye-Girardet, 2010).
[96] Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade, adopted in 1998, ratified by Senegal in 2001, and in force from 2004.

for drinking (I. Cisse, 2006).[97] Active matters were found in water sampled 8 meters deep, indicating that the whole table is polluted. In the Niayes region where the aquifer prolongs the Thiaroye table, all water and soil sampled were contaminated by organo-chlorine pesticides, with average levels largely exceeding WHO norms.[98] As intensive agriculture is performed in underground water recharge areas, water replenishing the tables is polluted and in the long run will contaminate the entire aquifer.

In the industrial area, factories discharge in their surrounding waste and effluents containing heavy metals, toxic chemicals, chlorinated solvents, hydrocarbons, and organic compounds, which contaminate the ground and underground water.

High concentrations of cobalt, nickel, and zinc (80-120µg/l) were found in céanes at Mbao near the Senegal Chemical Industries (ICS) (World Bank, 2008). Industrial pollution increased water acidity (pH3.9 at Mbao and pH4.9 at Yeumbeul; WHO recommendation for drinking water is pH6.5). Considering that the presence of wastewater and saline groundwater reduce acidity, this represents a strong impact.

Urbanization and land use.

Disconnected from water resource management, urban development ignores water protection requirements and proceeds with inadequate drainage and wastewater systems. Rapid and uncontrolled urbanization contributes pollution to underground water tables and reduced their recharge.

Non-treated urban run-offs contaminated by waste, hydrocarbons and other chemicals end up in water tables. As seen above, urbanization also affects water tables by hindering the proper operation of sanitation infrastructures and by reducing natural rainwater drainage and tables' replenishments.

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[97] The total amount of these residues varied between 7.52µg/l and 1,099.05µg/l when the norm for total concentration is 0.5µg/l.

[98] WHO norms for potable water are 0.1µg/l of distinct active matter and 0.5µg/l of total active matter

Recharge areas are not protected from urban development and existing regulations are not respected. Land impermeabilization restricts rainwater infiltration and flood regulation. Construction in wetland zones was banned by the 1967 Dakar Urban Master Plan, which was never enforced or updated. Agricultural areas disappear at the cost of infiltration. Lands that officially served rainwater infiltration and agricultural purposes (valleys, low grounds, wetlands) are appropriated and plots are sold to the best buyer for whatever use.

Beyond urbanization, overall land use is negatively affecting water resources in the Dakar region: agriculture; industries concentrated in one vulnerable area; the Mbeubeuss landfill sinking in the water table; constructions on wetlands; speculative use of shorelines that increases erosion and salt water intrusion in underground tables (World Bank, 2008).[99]

Thus, the overexploitation of underground water resources and their non-integrated management sped up their degradation, while the reversibility of this process is growing unlikely. In the Dakar region, seawater intrusion, domestic wastewater, excreta, trash, industrial and agriculture activities pollute the ground and the underground water with organic, biological, chemical and micro-pollutants. The Thiaroye table is lost, contaminated with salt, nitrates, persistent organic pollutants, heavy metals, bacteria, and parasites.

A hydrologist explains that in the current situation, the reversibility of underground water pollution is unlikely:

> "To stop or reverse the salt bezel, we would need a volume of freshwater such as to repel it. With sufficient freshwater, reversal could take place maybe within a decade. But with shrinking and polluted recharge areas and continued overexploitation… But to clean nitrate pollutions, I am skeptical. As for other kinds of pollution…" (hydrologist, professor; Dakar, Oct. 6, 2006).

The Thiaroye table is now a "lost resource." The same hydrologist continues:

> "We lost the resources of the Thiaroye table. It is contaminated by nitrates and other stuff. And we will have to add to this loss other tables, which are being rapidly polluted.

[99] The cliffs of Dakar, the Baie de Hann, Cambérène-Yoff and the Mbeubeuss quarry areas are most affected.

> The Thiaroye table was a resource of quality. Now we have to go 250km away to get water of a quality whose future is uncertain" (hydrologist, *ibid*).

Thus, if the Thiaroye table is lost, current trends are making sure that other tables will face similar consequences, and because of hydraulic continuity between aquifer systems, all tables are at risk.

Restricted to water distribution, the water sector's management of underground resources ignores factors and activities affecting water resource sustainability: natural characteristics, ocean pollution, coastal erosion, sanitation and trash, industries, agriculture, urbanization and land use. Even activities under the water sector's mandate (rainwater drainage and wastewater management) and affecting water supply are addressed as separate issues. Indeed the sector's management of sanitation and rainwater drainage is destroying water resources.

An overall integration of water resource management requires the involvement of public authorities beyond the water sector. The protection of water resources requires regulating overall land use and concerns all sectors. Not any activity can be located anywhere and performed in whatever fashion. A sustainable management of water resources has to spell out the kind of land use adapted to the requirements of water resources' renewal, so that these resources and the ecosystem ensuring their sustainability are not destroyed.

D. Certain destruction.

This section showed the water sector's management of underground water resources is destructive and non-integrated. The sector's management consisted in increasing exploitation to ensure Dakar supply. Exploitation decisions were made despite pre-existing overexploitation and known negative consequences. No study to improve resource knowledge and determine exploitation consequences was undertaken beforehand.

The water sector's concern for resources degradation was restricted to the immediate consequences of its exploitation, i.e. salinization induced by level drops. Environmental impact

studies anticipated further drops and salinization as a result of infrastructure investments, but considered them acceptable for the time being. The studies recommended monitoring tables and increasing the exploitation of other sources so that draw-offs could be reduced. Small reductions took place, but were insufficient to reverse degradations, and with the looming water deficit in Dakar, exploitation will increase anew.

Measures to protect underground resources fell short of addressing their overexploitation and pollution. Little was invested in capacity building for resource knowledge and monitoring. Monitoring capabilities remain derisory, and progress toward controlling private draw-offs is very slow. A few studies, undertaken after investments were realized, did not serve to inform management decisions. The complexity of the various aquifer systems and their hydraulic functioning are still known with insufficient precision.

The sector's management of underground resources did not take into account the natural characteristics of the local environment and the vulnerability of underground tables. The sector ignored the need to develop sanitation and rainwater drainage in relation to water resource sustainability. On the contrary, its sanitation activities and development projects negatively affected underground resources.

There is no management addressing various sectors' impacts on underground resources. As a result, uncontrolled polluting activities (trash, agriculture, industry) take place on highly porous soils, leading to high levels of pollution concentrations in the little deep tables. Meanwhile, urbanization speeds up tables' depletion by hindering their replenishment. Without addressing these factors and coordinating management with relevant institutions, the management of underground water resources is neither integrated nor sustainable.

III. Commercial Management, Resource Protection, and Political Will

With the 1996 reform, the water sector fully endorsed the commercial management of water supply. The purpose of this management is to supply demand for profit, inducing the overexploitation of water resources and the adoption of inadequate protection measures. Water

waste and pollution are addressed when they constitute a cost for distribution, and protection measures seek to reduce financial losses, not to ensure resource sustainability. The environmental impact studies that accompanied infrastructure investments did not contribute to protecting resources. Rather, they provided a "sustainable development" legitimacy to projects pertaining to an unsustainable neoliberal development process.

Furthermore, the commercial water management of water resources takes place in a context in which the political will to protect water resources is lacking. No national water policy exists; protection regulations are inadequate and not implemented; and responsible institutions are very weak. Unhindered by regulations and political will, the commercial management of water resources caters to the unsustainable demands of profitmaking and economic growth.

A. Commercial management.

Seeking to satisfy profitable water demands in the short-term, the commercial management of water resources creates their long-term destruction. Concerned by profit, the water sector considers resource preservation as a financial issue, and addresses it through cost-benefit calculations, technical measures, disconnections and restricted supply.

1. Satisfying effective demand.

The purpose of the water sector is to ensure sufficient water is available to satisfy demand. Within this perspective, resource planning is about finding sources of supply, not determining sustainable exploitation rates and adjusting demand to these rates. Investment projects thus increase the exploitation of water resources to respond to an increasing demand.

Furthermore, with the involvement of a private operator and the sector's self-financing objective, supplying demand had to be profitable. Guided by profitability considerations, the management of water resources is short-term and ignores the timeframe of resource sustainability. Infrastructure investments were a "long-term" solution to water demand based on ten year anticipated demand and financial requirements, and on the need to replace degraded water sources by better quality ones. Within this timeframe, accessible resources were

sufficient. A hydrologist explains the inadequacy between this management and water resource sustainability:

> "Water projects look at 10 years as the long-term. The PLT sought to ensure supply until 2012. Now the horizon is 2025. Projects are based on the long-term of financial institutions and financial sustainability. It's not the long-term of resources or even supply needs. From the standpoint of water resources' sustainability, the long-term has by definition no time limit. Resources are continuously renewed, which is possible if their uses do not destroy their renewing capabilities" (hydrologist, consultant; Dakar, Feb. 8, 2010).

Thus, to ensure supply for ten years, investment projects further destroyed underground resources and ignored the long-term implications of increasing the exploitation of the Lake of Guiers.

2. *Protecting resources.*

The water sector adopted no effective measure to protect water resources, and environmental impact studies did not encourage resource protection, but legitimized projects contributing to their destruction.

Environmental impact studies.

The environmental impact studies and management plans that accompanied investments to increase the exploitation of water resources did not contribute to protecting these resources. Their main function was to legitimize investment projects. The studies were made after investment decisions, and were of poor quality. They were not seriously elaborated or implemented. When recommended measures were implemented, they were unable to slow down or arrest the degradation of water resources.

International financial institutions require environmental studies, but not to inform investment decisions. Studies are limited to individual projects; they do not address a sector's overall development strategy. Financial institutions also limit the potential impact of studies by imposing conditionalities such as resorting to particular contracting companies, technologies or

designs. An environmentalist concludes that impact studies serve no other purpose that adding legitimacy to programs and investment projects:

> "Impact studies are required by financial institutions. But there are no prior studies to determine possible options. Impact studies address only projects and programs. They don't address overall strategies and policies, that projects are designed to implement. These studies serve only to preserve programs, to be in conformity with the World Bank." (environmentalist, consultant; Dakar, April 29, 2006).

Some observers consider that environmental studies are part of a corrupt political game for the government to get international funding and for public officials to get side incomes. Another environmentalist explains:

> "Environmental studies and management plans are formalities to validate investments and get funding. International funding is obtained and infrastructures are built. That's good for the government. And these projects are always sources of benefits for high-ranking civil servants. They get commissions from contracts or they have a stake in the companies that get the contracts" (environmentalist, project coordinator; Dakar, April 30, 2006).

Public participation in the elaboration of impact studies was more a parody than an effort to integrate public concerns. Investment projects were not broadly publicized, and when consultations took place, the terms of participation were not defined:

> "There is no information, consultation, and effective public participation upstream of the impact study, when there is maximum potential to influence the project at least cost. Information is the purview of the promoter, … [who] deliberately limited distribution of information on projects … Hearings are chaired by the ministry whose activities are being evaluated, … conflict of interest can harm consultation outcomes" (World Bank, 2008, p. 63).

The environmental studies were more concerned with the water sector's objectives than with the sustainability of water resources. The studies produced unreliable environmental assessments based on insufficient knowledge. They were done over periods of time too short for any in-depth evaluation, and by foreign consultants, local specialists with limited means, or

private companies building the infrastructure being assessed. The results were, as an environmentalist explains:

> "The impacts of projects were poorly quantified. And they put emphasis on the construction phase of infrastructures rather than their operation, which is when most problems occur. Cumulative effects are never assessed. They don't think about the ecosystem that sustains resources and which is disrupted. The environment is the weak link" (environmentalist, consultant; Dakar, April 29, 2006).

Recommended measures and plans were not systematically implemented (Faye, 2008; World Bank, 2008). No implementation framework was set up for the PLT Environment Management Plan. As a result, actions were isolated and relevant actors were not involved. Implemented measures were not seriously evaluated. A World Bank mission to verify the PLT conformity with its Environment Management Plan, for example, did not consider the project's impacts on underground water or on public health (Faye, 2008).

Thus, the real function of environmental studies was to obtain funding and to serve as ideological tool for the water sector's neoliberal development. Stamping investment projects as "environmentally safe," the studies gave them and the sector's orientations legitimacy. They at the same time supported the World Bank's pro-environment image, and the idea of clean and environmentally sustainable economic growth.

Protection measures.

For the water sector, protecting water resources is necessary when and to the extent their degradation increases the cost of treatment and supply. But this is usually too late and insufficient from the standpoint of resource sustainability. As financial concern, resource protection is addressed with economic instruments and technical measures. Economic instruments, however, do not reflect environmental requirements and are therefore ineffective for reducing pollution and waste. A hydrologist explains that economic mechanisms solve the economic problems of environmental destruction, not environmental problems:

> "Economic mechanisms are short-term. They determine equilibrium between supply and demand based on what people are ready to pay, but no price can be put on natural processes and what they mean for the future. According to the laws of economics, the nature of profit is to constantly change object. When a resource becomes too polluted and thus no longer profitable, it is abandoned for a better one. That's what they're doing with the lake, using it to replace polluted tables. And the polluter-pays principle encourages those who can pay to continue polluting. From the precautionary principle standpoint, it is not acceptable. When we don't know the long-term impact of pollution, we cannot allow it. And who benefits from the profit made from pollution taxes and fees? Neighbors [of polluting sources] fall ill and pay out of their pocket to see the doctor. The government does not cure them. For sustainable development, we need different instruments: laws, training, technologies" (hydrologist, consultant; Dakar, Feb. 8, 2010).

Faced with increasing water pollution, the sector sought to abandon degraded tables, replacing them by increasing the exploitation of good quality tables and of the Lake of Guiers. But the exigency of satisfying demand implies that poor quality water was, and will be, distributed, luckily somewhat diluted before distribution.

Anti-waste measures were limited to reducing un- or low paid distributed supply. To curb wastage, the water sector adopted a demand-management strategy with commercial and technical measures. These measures reduced financial losses. If these measures had an impact on the exploitation of water resources, it was a minimal side effect as the criterion for waste was financial, unrelated to the overexploitation of resources or to basic needs.

At the time of the reform, unaccounted for water (UfW) and unpaid bills represented a high cost for the sector (see note 67). Improving network output, billing and bill collection were performance targets assigned to the SdE. The efficiency of the supply network had to improve so that more of the water fed into the network was delivered or metered (accounted for). To reduce water losses and unpaid consumption, the SdE installed meters and repaired leaks. To reduce unpaid bills and low-priced consumptions, the SdE implemented disconnections and encouraged the application of agriculture quotas.

In the economic logic, "adequate" water prices and disconnection for non-payment were

incentives for reducing unpaid bills and "wasteful" consumption. With high enough prices, households would not consume beyond their needs. This logic assumes that effective demand represents needs, and that unpaid consumption was useless. What people cannot afford is what they don't need: bills were too high because water was wasted. This is a questionable assumption when it comes to poor consumers whose basic water needs are not satisfied. Furthermore, contrary to the pervasive idea that the poor are careless and wasteful, wealthy households appear to waste water more. A UN-Habitat project coordinator reports:

> "We intervened in a number of buildings, and we saw that when households can pay they tend to waste water. Wasting water increases with income levels: the more income, the more waste" (UN-Habitat project coordinator; Dakar, May 16, 2006).

But the water sector does not see this consumption as waste because it is paid for. Only the demand of those who cannot afford prices when water is distributed for profit has to be managed. When water is paid for, even if its uses are wasteful from the standpoint of limited resources and basic needs—swimming pools, golf course, green loans, sodas production, or tomatoes cultivation for winter consumption in Europe—there is no need for water saving. Most industries in the Dakar region use drinking water for activities requiring lower quality water, but they pay the high water price charged commercial consumers.

The demand management strategy applied different measures to different types of consumers. All public taps where free water was still available were privatized. Disconnection for non-payment was implemented for households, local districts, schools and other small institutions. But the meters of central administrative agencies or the university, which ran huge unpaid bills, could not be turned off. Their consumptions therefore had to be reduced.

In many public buildings, lost or broken meters, decrepit networks and water installations were responsible for important losses. The PSE financed network renovations and the installation of water meters and retrofitting devices in a number of buildings. To help in this effort to reduce public water consumption, the World Bank approached UN-Habitat water-

demand management program, Managing Water for African Cities (MAWAC), which accompanied on-going water sector reforms in Africa.[100]

A WAC project was set up to accompany the renovation of the university's water network (UN-Habitat, 2006). The University had a high water consumption and unpaid bills, but supply could not be cut without provoking strikes and unrest. A diagnosis of the campus network and water equipment identified leaks, unknown sections, and clandestine uses (banana orchard on campus), and installed water saving devices (push taps, toilet flush). After the project's completion, the university's water consumption had declined by more than half (from 1,000m^3/d to 435m^3/d) and bills could be paid. Following this success, the SONES requested UN-Habitat to do similar interventions in other public buildings.

Attempts at reducing low-paid agriculture water consumption were less successful. The government's attitude toward agriculture supply has been ambiguous, as inadequate supply could jeopardize the economic importance of an activity central to its development plans. Furthermore, landowners in the Niayes who are top officials (deputies, ministers) constitute a powerful lobby. Measures to reduce agriculture consumption were therefore unevenly implemented. The SdE was left with restricting supply, interrupting distribution during the day so that more water reached Dakar.

Disconnecting plantations from the supply network was not seriously considered, and quotas were not always enforced. In 2001, the Wade government decided to grant new quotas to cultivators before reaffirming its commitment to controlling agricultural water consumption. The 2nd Water Sector Policy Letter (Min. de l'Hydraulique, 2001) formulated a plan to provide producers with alternative sources of supply (underground water, treated effluents), but so far,

[100] MAWAC, later called Water for African Cities and then Water for Cities, was initiated in 1999 following the 1997 Cape Town Declaration adopted by African ministers to address the need to improve water resources' management in African cities. Through pilot interventions, the program showed the effectiveness of small, targeted policies over large projects.

only technical and financial studies were done. [101] Plantations cannot afford the sole use of lower quality water, as export norms require irrigation with good quality water.

Despite official commitments, the water sector is not actively promoting alternative sources of supply for activities requiring lower quality water (ONAS, 1998). Cost-benefit calculations hinder this development. Wastewater reuse is constrained by cost and limited effective demand. As seen above, the industrial consumption of drinking water is not considered waste, and the use of alternative sources of supply by industries was never considered. The possibility of using rainwater has so far captured no interest, despite potential benefits. A hydrologist explains:

> "The solution is not only to transfer water from distant sources. Rainwater is a local resource we can use. We let rainwater flood, or we drain it to the ocean. We'd rather use it. This could help reduce flooding and people's water bills. Poor households in the suburbs use rainwater. But it's marginal and not done safely. Rainwater roof supply systems are developed in other countries. That could be done here too" (hydrologist, consultant; Dakar, May 10, 2006).

Thus, the purpose of the water sector was not to preserve water resources, but to achieve its financial objectives. Environmental impact studies contributed to these objectives by validating projects for the sector's development, despite these projects' negative impacts on resources. Addressed pollution and waste to the extent of their costs, the sector adopted no effective anti-pollution or water saving measures, and neglected developing alternative sources of supply. The purpose was to find adequate water sources to supply demand, and to reduce unpaid or low paid consumptions and losses of distributed supply.

B. Political will, water policy and institutions.

The water sector reform concurred with the lack of political will to protect water resources in Senegal. Political and economic interests and international pressures hinder the

[101] The Action Plan included disconnecting boreholes in the Dakar region from the supply network and handing them to growers. Bringing treated wastewater from the Cambérène treatment plant and water retention basins were also considered. Once alternative water sources would be available, growers still using drinking water would be charged higher prices.

development of such political will, and thwarted efforts at public control over water resources. No national water policy was developed; decision-makers neglect local research on water resources; institutions responsible for water resource protection have no capacity and no authority; and existing regulations are inadequate and not implemented.

1. Political interests.

Concerned with foreign aid, investments and growth, politicians do not advocate water resource protection, and no environmental movement able to exert pressure exists in Senegal. Politics tends to interfere with efforts to elaborate plans, strategies and projects promoting water resources protection.

Politicians ignore environmental protection, which can discourage foreign investments and hinder economic growth. The dependence of the country on international lenders fosters the lack of political will to protect natural resources. Development projects attract international funding and contribute to GDP growth. The World Bank *Senegal Country Environmental Analysis* (2008) noted that:

> "… political decisions favor growth over the environment … The lack of regulatory supervision over certain resource consumption trends reflects a lack of political will to protect natural resources upon which a large portion of the population depends" (World Bank, 2008, p. 64).

The environment department of the World Bank deplores this state of affairs while World Bank loans to the water sector were conditioned to the implementation of a reform promoting the exploitation of water resources for profit in support of economic growth but unsustainable for these resources. Putting the blame for favoring growth over the environment and lacking political will on the national level seems a denial of the Bank's own responsibility. International actors still have to prove themselves favoring the environment over growth. So far, through conditionality and trade regimes, they "forcefully" maintain developing countries in a position of seeking growth above all and of supporting rich countries' growth at the expense of

their environment. The Bank's environmental concerns translate more into ineffective tools than challenging protection measures.

Furthermore, environmental protection is a long-term concern with no immediate impact that does not serve politicians' interest. A sociology professor explains:

> "Environmental management is distorted by politics: they care only about what's visible. The OMVS [Senegal River Basin Development Authority], for example, was set up for hydro-energy without any thoughts about sustainability. The salty flow up the river was a problem for rice cultivation so they built the Diama dam, but with the dam bilharzias worsened. And anti-salt dams don't work anyway because salt goes around in the ground. Politicians are interested by technical mastery, by extravagant projects. They want results without worrying about consequences. Large infrastructure projects (expressway, international airport) are realized no matter what, when basic infrastructures for sanitation and trash management still don't exist!" (sociologist, Environment Sciences Institute; Dakar, May 4, 2006).

Considering the political climate, a water specialist concludes:

> "We need a strategy that allows the emergence of new national actors who have interest in the long-term, who are not pressured by short-term considerations, who can think about new solutions. Politicians' deadlines are their mandates; they cannot consider water in the long-term" (water specialist, consultant; Dakar, Oct. 19, 2006).

Finally, environmental movements in Senegal are unable to put pressure on politicians:

> "As for citizens' participation, social movements are more political than technical. They lack knowledge and can provide no warning. NGOs or consumer associations have no technicians; they get the information one wants to give them. They react to accidents, to what is visible, but they don't have a sustainable management approach and cannot take any preventive action" (environment lawyer; Dakar, May 6, 2006).

Thus, local politics, the search for economic growth and the dependence on international funding combine to hindering the development of a national political will to protect natural resources.

2. ***No national water policy.***

Without political will and satisfied with water investment projects, public officials do not

see the need for a coherent long-term national water policy and for scientific knowledge as basis for policy decisions. A hydrologist explains:

> "Water sector policy letters and investment projects are presented as water resource management tools, but they do not constitute a coherent policy. For some, the PEPAM, the MDGs, that's the water policy; for others it is the Grand Projects of the president. But these projects don't emanate from any coherent strategy. They are determined by interests and funding. Plans, programs and projects should derive from a national policy, not the other way around" (hydrologist, consultant; Dakar, Feb. 8, 2010).

Efforts at developing a national water policy were to no avail. The same hydrologist who was involved in the elaboration of the Action Plan for the Integrated Management of Water Resources (PAGIRE) explains:

> "The Senegal Water Vision and the PAGIRE contained some orientations for a national water policy and a Water Code. But the document is sleeping in a drawer, waiting for another government, or president, to come. There is no political will" (hydrologist *ibid*).

Local research and successful experiments that could inform policy decisions are ignored. Water specialists involved in water studies and projects explain:

> "We are doing studies, but when a government changes, the new guys think everything that was done before is bad and we start the studies over. We have some good projects, but in Senegal, we always remain at the pilot phase; everything is pilot, … To move to generalization, to amplification, to become part of an overall strategy, it's always a problem. Either lenders don't follow and there is no resources or politicians …. for other reasons" (hydrologist, professor; Dakar, Oct. 6, 2006).

> "There is no articulation between research and development. Politicians don't listen to local researchers. They sign contracts with European consulting firms who come here and copy what our students did. In 2002-03, the government set up the centers for research and testing, to articulate knowledge and politics that was promising. But this quickly lost its purpose. When we changed minister, he turned them into cyberspaces!" (hydrologist, consultant; Dakar, May 10, 2006).

Thus, water development is not informed by knowledge about water resources or a coherent overall strategy.

3. Weak institutions and inadequate regulations.

Continued institutional and regulatory weaknesses reflect the lack of political will to protect water resources. Public institutions responsible for water resource planning and protection have limited mandates, and suffer from insufficient resources and capacity, fragmentation, and political interference. Despite official claims, capacity-building efforts were minimum since the reform. This, however, appears consistent with the reform's orientations: public control over water resources runs counter to private interests, when the main institutional achievement of the reform was to introduce a private operator for distributing water.

Institutions mandated to protect water resource are legally confined to monitor them, and have insufficient resources, capabilities and power to do so. These institutions have no authority over the use of water resources. They cannot monitor resources, strengthen and implement regulations, or influence actors that could mitigate negative impacts on water resources.

The DEEC, Direction of the Environment and Landmarks (Ministry of the Environment), is responsible for natural resources, but its responsibilities for resource protection are restricted. The World Bank noted that:

> "Not recognizing natural resource protection responsibilities is particularly evident for water [...] waste management, and water purification" (World Bank, 2008, p. 55).

Responsible for resource monitoring, the DEEC has none of its own budget for this task. Its involvement in programs and projects depends on the duration of financing from international aid and other ad hoc sources.

The DGPRE, Direction for the Management and Planning of Water Resources (Ministry

of Hydraulics), is also confined to monitoring water resources without the capacity to do so.[102] Though strengthening the DGPRE was an official goal of the water sector, it was a minimal component of its capacity-building efforts. Since the reform, its improved status from a Service within the Ministry of Hydraulics to a Direction did not increase its resources or capabilities. DGPRE managers explain:

> "We have no technical capability for measures and analyses. The [piezometric] network is too limited and obsolete. How can we protect resources? The OMVS [in charge of only one river] has more resources than the DGPRE [in charge of water resources for the entire territory]! But they don't think about this" (DGPRE manager; Dakar, Feb. 5, 2006).

> "At the time of the reform, we talked about the need for capacity-building, for increasing DGPRE's resources, for studies, for equipment, for data … More than ten studies were done about the DGPRE. Institutionally we moved up from a Service to a Direction, which can manage its own budget. But financial problems and technical and institutional weaknesses persist" (DGPRE manager; Dakar, May 26, 2006).

DGPRE resources come from unreliable and irregular sources, and are dependent on the good will of the private water distributor and the ministry's officials. A manager explains:

> "The DGPRE is financed through the state budget. But this budget barely allows operation. Any investment comes from external resources. Large projects are only possible with international funding" (DGPRE manager; Dakar, May 5, 2006).[103]

A water intake tax is officially levied on private boreholes to finance resource monitoring. But the DGPRE has no control over the collection and allocation of this money (Faye, 2008). The SdE is responsible for collecting and transferring the tax to the Ministry of Hydraulics. A few years later, the same manager continues:

> "Resource monitoring is financed by the Water Intake Fund which is made up of taxes on boreholes for commercial activities other than drinking water supply. The SdE collects the tax, or not, or only a small portion. Collection has improved recently, but its basis is

[102] The DGPRE is responsible for studying and monitoring water resources, following the country's hydrometric (rain) and piezometric (underground water) networks, and feeding a water resource databank.
[103] For example, the 2000-05 UNESCO study on the pollution and vulnerability of urban underground water tables (Tandia, 2002).

> getting smaller and smaller, people don't pay. The SdE takes 10-20%, of the money and transfers the rest to the Ministry. But the Ministry uses it for other things, for political purposes. Only a small portion of what the SdE gives to the Ministry is transferred to the DGPRE. And each time the Minister changes, we have to fight. In 2008, we got no money at all. With the new Minister, Omar Sarr, we're getting a bigger portion, and we manage to do our campaigns—monitoring 150 piezometers nationwide" (DGPRE manager; Dakar, Jan. 21, 2010).

The PSE impact study and the PLT Environmental Management Plan recommended capacity-building measures for the DGPRE (Lauras & Pigeon, 1995);(World Bank, 2009). But no resource or equipment was provided. A DGPRE manager explains that capacity-building:

> "[…] came down to educating a few employees on computer modeling and on IDA procedures, and getting 3 or 4 cars, but no environmental management training was provided. The PSE upgraded the Geographic Information System, that's great, but you need to feed data to the GIS" (DGPRE manager; Dakar, Jan. 21, 2010). [104]

One of the stated purposes of the PLT Hydro-geological studies was to "provide the DGPRE with a solid basis for water resource analysis, management and planning" (GKW Consult, 2009parag. 0.9). This translated in the installation of a couple of piezometers, but the network remains too restricted for serious monitoring.

Beyond monitoring, water institutions have no power over other actors. Limited protection regulations and the inability of institutions to see to their implementation, arbitrate between actors, and influence their impact on water resources impede any real protection and control over resource use. A DEEC manager explains:

> "The 2001 Environment Code does not emphasize regulations for monitoring pollution sources or outline penalties for those causing environmental damage. And we have no capacity to control and sanction. The 1981 Water Code was never implemented. Resource management tools require institutional mechanisms" (DEEC officer; Dakar, June 2, 2006). [105]

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[104] GIS is a tool to analyze location data by merging cartography, statistical analysis, and database.
[105] Loi n° 81-13 of 4 March 1981 « Code de l'Eau ».

The DEEC or the DGPRE have no authority over the use of water resources or the sectoral policies or programs of other ministries, water sector institutions, or the private sector. The DGPRE has no influence over water exploitation or sanitation decisions. The World Bank's *Country Environmental Analysis* concluded that with few resources, no legal mechanisms to implement regulations, and lack of influence on other institutions' policies, the DEEC was unable to reduce pressure on natural resources and control pollution sources (World Bank, 2008, p. 56).

There are no suitable litigation services. The DEEC has no legal services, which limits its ability to prosecute violators of environmental regulations, and no capacity to arbitrate. Arbitration requires knowledge and equipment, which are unavailable:

> "Resource monitoring is necessary to arbitrate among users. We need hydrological stations and piezometric networks for groundwater and rivers. We need to know the hydrological system to evaluate demands" (DGPRE manager; Dakar, April 29, 2006).

Institutions are left with attempting to raise awareness and organize consultations to encourage "the responsible use of water" (GKW Consult, 2009). As seen with the Lake of Guiers and the Baie de Hann project, however, consultations and dialogue, though inducing some behavior change, have their limits. Mediation, conciliation and information leave ample space for power struggles and bribery as conflict resolution methods.

The separation between exploitation and monitoring functions and lack of power of institutions with monitoring responsibilities make the protection of water resources and the development of an integrated management impossible. This is compounded by institutional and political instability and lack of coordination among water institutions (World Bank, 2008, p. xxii). A civil servant from the Ministry of the Environment explains that:

> "The Ministry of Hydraulics is pulled apart by various political stakes. Departments and responsibilities change all the time. Water resource management was under the hydraulics department, then the minister's cabinet, then the DGPRE. No long-term

> vision can develop. And frequent changes of ministers pushing different agendas add on top of this" (DGPRE manager; Dakar, May 26, 2006).

There is no synergy among institutions (Faye, 2008). Within the Ministry of Hydraulics, the SONES and the DGPRE pursue their activities independently, even when involved in the same projects. The DGPRE was responsible for implementing the PSE and PLT environment management plans, but no feedback mechanisms were set up, and water resource studies were not transferred to officials responsible for water supply and sanitation projects. The lack of coordination between institutions can be appreciated by incoherent data (GKW Consult, 2009). A DGPRE manager explains:

> "Piezometric data gathered by the SONES and the DGPRE differ. Information is not integrated. We ignore aspects dealt with by other actors. We are generalists; we can be detailed only in some areas. Other actors, such as the university, can get deeper into other areas. So data have to be integrated and harmonized" (DGPRE manager; Dakar, May 26, 2006).

Against this debilitated management, water specialists have advocated the creation of a strong institution in charge of water resources:

> "Everything is handled separately: floods, wastewater, water supply, monitoring, etc. Urban and rural hydraulics are separated. This is a problem: water is a crosscutting resource. We need a real agency for water management with power and authority, like they did with APIX [Agency for the Promotion of Investments and Major Projects]. In the PAGIRE, we expressed the need for all water actors to be regrouped in one ministry or agency in charge of all water and sanitation issues. This could avoid scattered investments and integrate management. Everything depends on water. But they only address problems to promote political figures. They did this for floods and it failed. They established an agency and staffed it with incompetent people. Hiring is based on political considerations. But politics is not going to feed Senegal. The political will has to change" (hydrologist, DGPRE; Dakar, May 10, 2006).

As the Bank recognizes, to be effective, any regulatory structure would need:

> "… a mandate with sufficient authority to supervise the activities of ministries more powerful than the Environment Ministry … [and] … necessary financial independence to confront operators with deep pocket" (World Bank, 2008, p. xvii).

But such an evolution is unlikely, as it would run counter to country's neoliberal orientations promoted, among other policies, by the water sector reform. The Bank, which deplores the lack of protection responsibilities for water, wastewater and trash management, has been pushing these activities in the hands of the private sector, and commends the government's efforts to make the private sector:

> "[…] a partner of the government in the provision of environmental services […], especially for water supplies, waste management, and water purification" (World Bank, 2008, p. 76).

Strengthening public control over water resources and protection responsibilities for water and sanitation activities would go against the push for privatization, restricting the private sector's benefits from these activities.

Thus, no political will to preserve water resources exists in Senegal. Local politics, the search for international funding and economic growth contributed to hinder the development of such will and interfered with efforts to promote water resources protection. This concurred with the water sector reform's neoliberal achievements: establishing the commercial management of water supply and privatizing distribution. Despite claims of concern for water resource sustainability, reformers and public officials did not provide the technical, financial and institutional support needed for the elaboration of a coherent national water policy, adequate protection regulations, and institutions able to implement them and to integrate water management. As a result, public control over water resources has all but improved since the reform.

C. Catering to growth.

With no political will and institutional capacity to protect water resources, these resources are being exploited to satisfy the needs of economic sectors under the pressure of a

growth-oriented development. Because the development process determines the uses of water resources, their sustainability depends on this process. If economic development entails the unsustainable use of water resources, no water resource management attending such development will ever ensure water resource protection.

The accelerated growth strategy of the government of Senegal cannot be pursued with a sustainable use of water resources. Economic growth relies heavily on intensive agriculture in the Niayes region, and commercial and industrial development in the Dakar region—development that increases water demand and destruction in that area and affects distant resources.

This development strategy pushes rural populations to migrate to urban areas, primarily Dakar, as their means of subsistence in the countryside disappear. Peanut cash crop agriculture, phosphate mining and intensive agriculture along the Senegal River and in the Niayes negatively impacted subsistence farming, fishing and husbandry, while not compensating for these activities' decline. Along the Senegal River, for example, irrigated farming developed at the expense of flood recession farming, fishing and husbandry, inducing employment exodus. Meanwhile, irrigated farming itself declined, reducing local employment further.

In the Dakar region, the disparity between available water resources and the water needs required by high population density and economic activities reflects an unsustainable development process, which has long stretched beyond the carrying capacity of the local environment. Activities and population outgrew the resource base that sustained them, and now require an increasing amount of other natural and chemical resources, thus pursuing local destruction and transferring environmental degradation elsewhere.

The water sector reform contributed to this development process, bringing more water to the rapidly growing urban area and growth inducing activities. Current water management caters to this unsustainable development process. As nothing indicates that trends may be reversed, more and more water will have to be brought to Dakar, depleting and polluting

underground water further and increasing the exploitation of the Lake of Guiers with no regard for consequences. The continued degradation of local and distant water resources will make people's lives, hard as they already are, even harder.

This section showed that since the reform the water sector implemented a commercial management of water supply geared to profitmaking, indifferent to the impact on these resource. Despite official claims to the contrary, preserving water resources was the goal of neither water sector reformers nor Senegalese politicians.

The commercial management of water resources has a short-term horizon based on profitability, which is incompatible with the long-term sustainability requirements of water resources. The water sector addressed water waste and pollution to the extent of their financial costs with technical and economic measures that can solve financial problems but are unable to meaningfully reduce pollution and overexploitation. Water-saving measures aimed at reducing lost and unpaid distributed supply, not wasteful consumption from the standpoint of basic needs and limited water resources. Reducing low-paid agriculture water consumption was more difficult as it ran counter to the country's development objectives and the interests of powerful civil servants. The industrial consumption of drinking water is not a concern as industries pay high water prices. Financial considerations also led to neglecting the development of alternative sources of water supply.

The environmental impact studies and management plans that accompanied investment projects did not contribute to protect water resources. They validated investments and international funding, and serve as ideological tools to promote the water sector's development as sustainable. Studies and plans did not influence investment decisions or management strategies. They provided poor assessment and recommended inadequate measures often not implemented.

The lack of political will to preserve water resources concurred with their privatized commercialization for profit by the water sector. Seeking immediate results, foreign aid and

economic growth, and under no social pressures, politicians set aside environmental protection. The Senegalese government hindered the elaboration and implementation of effective water protection strategies and regulations. Institutions responsible for protecting these resources remained as powerless as before the reform.

International Financial Institutions and other lenders share some responsibility in Senegal's lack of political will to preserve water resources. The World Bank loan conditionalities imposed a reform that privatized and increased the exploitation of water resources, which goes against strengthening public protection and control over these resources. Beyond the water sector, the search for economic growth and Senegal's dependence on international funding ran counter to water resource preservation. Unhindered by regulations, the management of water resources caters to the unsustainable demands of a growth process. The 1996 reform contributed to supporting this process, assuredly leading to the destruction of water resources.

IV. Conclusion

This chapter showed that since the 1996 reform and despite official claims, the water sector implemented a non-integrated and unsustainable management of water resources. Preserving water resources was not the goal of water sector reformers, Senegalese politicians, or international financial institutions. The water sector commercialized water supply for profit, increased the exploitation of underground and surface resources to satisfy Dakar demand, and addressed the financial costs of water pollution and waste through cost-benefit calculations. If this contributed to sustain the country's economic growth, it accelerated the destruction of water resources.

As the exploitation of the Lake of Guiers intensified, its numerous users and pollution sources called for the elaboration of a strategy to manage potential conflicts and protect water quality. Managing the lake raises important stakes for powerful actors and economic activities central to the country's development. The Office for the Lake of Guiers, which will be responsible for its management, is, however, unlikely to have enough power to impose

protection measures and arbitrate among users. Decisions about the lake's management therefore rest on the balance of power between strong interests, as increasing needs for Dakar water supply compete with agriculture and industrial development around the lake. Powerful actors using its water will *de facto* continue to manage the lake and determine its future.

The strategy adopted for managing the lake ensured the water needs of powerful companies were satisfied, but left local populations with reduced access to the lake and farming possibilities, and no drinking water. Controlling pollution sources would strongly constrain large plantations and industries, and require authority over development projects and land use that calls for substantial power and resources which consultations and the future Lake Office are unlikely to garner. Thus, without political will to enforce protection measures, pollution reduction depends on polluters' good will.

Management decisions were made with little knowledge about the lake's hydrology and sustainability mechanisms, or the implications for the Senegal River that feeds it. Furthermore, management only concerns activities around the lake, when pollution sources extend far beyond its surroundings. All activities affecting the watershed of the Senegal River and the lake have to be sustainable for the lake's water to be protected. But relevant political, economic and environmental factors are beyond the scope of the current "integrated" management of the lake and the authority of the Lake Office.

The water sector's management of underground water resources is not integrated to preserve these resources. The sector increased the exploitation of underground tables despite pre-existing overexploitation and known negative consequences. It implemented ineffective protection measures, its own activities contribute to polluting these resources, and it ignores other sectors' destructive impacts. Persisting overexploitation and pollution will lead to the destruction of all tables. Aquifers are not being replenished, their levels are dropping, and water quality is degraded. In the Dakar region, contamination is beyond prescribed norms in all respects. The superficial table under the suburbs is lost. In the Niayes region, contamination is

progressing and fossil resources are exploited. Because of hydraulic continuity between aquifer systems, pollution is transferred to all tables, including non-exploited ones, and deeper layers are recharged by emptying upper ones. Their proximity to the ocean puts all lowering aquifers are at risk of salinization, and thus of destruction as freshwater sources.

The measures adopted to protect underground resources were far from addressing overexploitation and pollution. Little was invested for improving resource knowledge and monitoring. Water pollution was addressed by diluting poor quality water, and by increasing draw-offs in good quality sources so that the exploitation of tables whose quality is a problem for distribution could be reduced.

The water sector ignored numerous factors contributing to underground water pollution and depletion, including the vulnerability of exploited tables. This added more destruction to that caused by overexploitation. The lack of integration between water supply, sanitation and rainwater drainage hinders the effectiveness of these activities, and with it resource sustainability. The activities of other sectors aggravate this situation and proceed oblivious of their own destructive impacts. Land development, economic activities and urbanization are polluting tables and hindering their renewal. This combination speeds up degradation, and makes its reversibility further unlikely.

Water tables in the Dakar and Niayes regions are particularly vulnerable: close to the ocean, they are invaded by seawater; lying one yard below sandy soils, no ground purification takes place and tables are direct receptacles for excreta, trash, and any chemical pollution. Thus, polluted ocean water, inadequate sanitation, agriculture, industrial activities, and urbanization are sources of underground water contamination. Coastal waters, contaminated by untreated domestic and industrial effluents intrude lowering tables. Planned sanitation projects are unlikely to adequately treat these effluents and reduce pollution around the peninsula. Meanwhile, shoreline developments accelerate coastal erosion, speeding up seawater invasion.

Though the water sector increased the volume of water available for consumption in Dakar, and knowing this would facilitate wastewater infiltration and pollution transfer to underlying aquifers, it did not develop sanitation to match that increase. Furthermore, guided by financial criteria, sanitation development projects led to the installation of environmentally unsafe facilities in areas where the aquifer is most vulnerable. When a study officially confirmed the inadequacy of these systems, it was kept secret and the sector did not modify its strategy for reaching the Millennium Development Goals for sanitation.

The water sector barely addressed the urgent need for sludge collection and treatment, leaving intact the polluting impact of an increasing amount of excreta materials anarchically disposed of. Meanwhile, the sector marginalized alternative treatment technologies responding to both sanitation and irrigation needs and adapted to the social, economic and natural context. Official strategies turned to these alternatives reluctantly and in small increments when running out of options.

Beyond the water sector, trash is an important source of underground water contamination. The entire Dakar area suffers from a serious lack of trash collection, and none of the collected trash is treated or even adequately disposed of. Trash is buried or burnt everywhere. Anarchic dumpsites are spreading, receiving domestic as well as industrial and medical wastes. The unique official, and humongous, landfill sits on top of the water table. Even if the landfill is shut down, contamination will persist for decades, affecting more people if the resettlement imposing its closure takes place. With no clear plan for handling trash after the landfill is closed and improving collection, trash will continue to contaminate underground water.

The country's industries are concentrated in one vulnerable area. No industrial sanitation exists, and factories discharge in their surroundings toxic wastes and effluents that infiltrate underground water. Intensive agriculture in the Dakar and Niayes regions contaminates water tables with herbicides, pesticides and fertilizers, including illegal organo-

chlorinated products. Urban development takes place without regulations to protect water resources. Contaminated run-offs end up in water tables. Niayes and water table recharge areas are filled-in for construction. Urbanization hinders the functioning of sanitation infrastructures and natural rainwater drainage. All this contributes to the pollution and depletion of underground resources.

The commercial management of water supply did not promote the preservation of water resources, but caters to the unsustainable demands of profitmaking and economic growth. Its short-term perspective is incompatible with water sustainability requirements. It addresses water waste and pollution to the extent of their financial costs. The sector implemented a demand-management strategy to reduce financial losses from unpaid and lost supply, not luxury or unnecessary consumption and overexploitation. Commercial and technical measures reduced network losses and unpaid domestic and public water bills. But reducing low-paid agriculture water consumption was more difficult as it runs counter to the country's development objectives and the interests of powerful civil servants. Financial considerations led the sector to ignore the industrial consumption of distributed supply, of unnecessarily high quality but charged high prices, and to neglect the development of alternative sources of supply.

The environmental impact studies and management plans that accompanied investment projects served to validate these projects and obtain international funding. They attested to the sustainability of the sector's development but did not help protect water resources. Studies and plans did not influence investment decisions or management strategies. They provided poor assessments and made inadequate recommendations often not implemented.

Local politics, the search for economic growth and international pressures hindered the development of a political will to protect water resources. This lack of political will concurred with the water sector's ineffective protection measures, and the reform's neoliberal orientations. The reform's main achievement was to improve the sector's profitability and introduce a private operator. Strengthening public control over water resources goes against privatization interests,

restricting the private sector's potential benefits from water services. Effective resource would also be unfavorable to the rapid economic growth strategy endorsed by the Senegalese government and encouraged by Senegal financial and economic partners. Thus, water reformers and government officials did not provide the technical, financial and institutional support needed for elaborating a coherent national water policy and adequate regulations, and for enabling institutions to effectively protect water resources. On the contrary, the government interfered with such efforts.

Without political will to protect resources, the commercial management of water supply caters unhindered to the demands of economic sectors under the pressure of a growth-oriented development process. The water sector reform contributed to sustain this process, bringing more water to the rapidly growing urban area and its growth-inducing activities. As this process is pursued, more and more water will have to be brought to Dakar, causing the irreversible destruction of local and distant resources.

Thus, the Senegalese water reform privatizing water supply, the lack of political will to preserve water resources, and international water development policies were coherent in promoting the exploitation of water resources for profit and economic growth, while disregarding their sustainability requirement. But the politics of water successfully hid this disregard and the contradiction between increased exploitation and resource protection behind the conciliatory power of the neoliberal notion of sustainable development.

Part II

Ideas, Interests and Policymaking

Chapter 5

The Urban Water Sector Reform in Senegal: Implementing a Neoliberal Sustainable Development Reform

This chapter will show that the adoption of the 1996 urban water sector reform in Senegal resulted from a mix of coercion and consensus, in which ideology played a critical role. The water reform was part of an on-going economic liberalization process imposed by the International Financial Institutions on the country. This process and the changing ideological climate in the country pertained to the evolution of Senegalese politics since independence from African Socialism to full-fledged liberalism with President Wade after 2000. This evolution reflected the rise of neoliberalism as hegemonic culture among Senegalese elites, with sustainable development as one of its pillars. The Senegalese reform illustrates Robert Cox's theory about the consensual form of power prevalent in a hegemonic world order, with ideas facilitating "adjustments by subordinate actors to dominant interests."

This chapter analyzes the process that led to the adoption of the 1996 reform and its specific features, within the evolving Senegalese political economic and ideological context. It identifies the actors involved in the process, their objectives and resources, and the different stages of that process in order to explain the decisions that were made.

The main features of the reform were the transfer of water supply delivery to a private company, the creation of a public asset-holding company owning water infrastructures and responsible for the sector's development, and the establishment of a separate public agency in charge of sanitation services.

The water sector reform was a continuation of the International Financial Institutions' (IFIs) efforts to liberalize the country's economy since the late 1970s. The reform was not an independent decision of the Senegalese government but a conditionality to any further lending. The IFIs' purpose for targeting the water sector in particular was to speed up the liberalization

process by making an exemplary reform that would encourage further privatizations. The water sector was an obvious choice because, rather strong and well managed, it could be easily transferred to the private sector. The reform also coincided with the World Bank and the international business sector pushing neoliberal reforms on "environmental urban services:" making basic services and water resources available for profit and economic growth through their commodification and privatization.

The economic liberalization process in Senegal was accompanied by the spread of neoliberal economic ideas, which the Socialist government in power officially endorsed in the 1980s and which took hold among Senegalese elites, including water sector professionals. During the period preceding the reform, "sustainable development" made its way into the development discourse, and contributed to undermine the legitimacy of public services with ideas such as: there are no free goods; the public sector is inherently corrupt, inefficient and wasteful; rationality and efficiency are needed in the management of basic services.

By the early 1990s, the country's dominant ideology had changed, making the acceptance of privatization and neoliberal measures in the water sector easier. Though total divestiture of water assets to the private sector was opposed, neoliberal values justified the need for reform and circumscribed opposition. Adhering to these values, the managers of the public water utility actively participated in the elaboration of the reform. The neoliberal ideology also worked its way among the sector unions, more concerned by safeguarding their interests than maintaining public water services and a socially oriented economy.

By the time of the reform, the neoliberal understanding of sustainable development was pervasive. Its meaning and application to water management were therefore not an issue. The reform was a "sustainable development" reform, and its neoliberal measures were common sense policies that served the interests of all. The reform implemented the main IWRM features, supported by beliefs carried by sustainable development. Sustainability was primarily a financial objective. Participation aimed at building consensus and gathering support for decisions that

were not open for discussion. The efficient, i.e. commercial, management of water services would lead to waste reduction and resource preservation. The reform was necessary to increase water distribution and ensure the sector's future. Meanwhile, the impact of the reform and related investments on water resources and people's lives were not factored in the reform's decisions. Once in place, the new institutional setup was consolidated, and liberalization proceeded supported by the sustainable development and Integrated Water Resources Management discourse.

I. The Economic Liberalization Process

The water sector reform was part of an on-going process to liberalize Senegal's economy imposed by the International Financial Institutions (IFIs). After independence, the African Socialism of president Senghor did not modify the country's role and vulnerability as producer of primary commodities within the global economy. Its indebtedness in the late 1970s led to the adoption of Structural Adjustment Programmes (SAPs) that imposed the privatization of many public enterprises and introduced other liberalization measures, including the commercialization of water services. These measures were accompanied by the spread of neoliberal economic ideas. This constituted a preparatory phase for the 1996 water sector reform, which the IFIs undertook to make an example of a successful reform that would encourage further liberalization.

A. African Socialism.

After independence from France in 1960, as part of the African Socialism policy promoted by president Leopold Sedar Senghor, the Senegalese government nationalized the water sector (Senghor, 1990).[106] The National Company for the Exploitation of Senegal's Waters (SONEES) was created in 1971 to replace the Compagnie Générale des Eaux du Sénégal (CGES; a subsidiary of the French Compagnie Générale des Eaux) in charge of water and sanitation

[106] African Socialism based the country's development on state-controlled and planned economy and rested on the nationalization of strategic sectors, which had remained under the control of private French companies, while leaving room for foreign capital and the private sector. Nationalizations, or "Senegalization," took place until the late 1970s.

service. The state took responsibility for investments in the sector. After its creation, the SONEES had ongoing contractual relations with SAUR (Societe d'Amenagement Urbain et Rural), a subsidiary of Bouygues, another French multinational, for technical assistance.

Senghor's politics did not stop the country's dependence on peanut trade nor its neocolonial relationship with France (Gellar, 1995).[107] As peanuts fared poorly on the global market in the mid-1970s, large amounts of foreign aid and loans were taken to diversify the economy. Senegal became highly indebted and debt services tripled in a few years. At the end of the decade, lowering prices of primary commodities made external debt service impossible, and ballooning oil bills further deepened external deficits. Negotiations with lender groups (Club of Paris, Club of London) encouraged Senegal to adopt stabilization and structural adjustment programs with International Financial Institutions (IFIs). According to the World Bank, the risk of Senegal defaulting on its loan payments required to deregulate and privatize the economy (Van de Walle, 2001). The Senegalese government adopted its first Short-Term Stabilization Programme in 1979 (1979-80). IFIs' objective to privatize the water sector dated back from this time.

B. Neoliberal economic measures and ideological incursions.

During the decade that preceded the water sector reform, the liberalization of the Senegalese economy began along with the spread of neoliberal ideology. The administration endorsed neoliberal ideas, wowing them in the policy discourse. In the water sector, the influence of the government was reduced; the commercialization of water supply was established. Water had to be paid for and available for economic growth. Autonomy, efficiency and rationality became management criteria for the water company. These were the first steps to make the sector attractive to private companies.

[107] Almost 80% of foreign trade was with France, which subsidized exports and whose investors owned most capital-intensive industries.

1. The neoliberal assault begins.

In 1980, Abdou Diouf, prime minister at the time, launched a five year Economic and Financial Recovery Plan (1980-85) and signed a three year Extended Fund Facility (EFF) with the International Monetary Fund the following year. Policy conditions were similar to all stabilization and structural adjustment models: limiting credit and government spending, reducing the public sector, promoting exports and privatization. This heralded the hegemony of economic over social and political considerations, and the dismantling of the country's public services and "socialist" protective policies. In 1981, Senghor stepped down and handed the presidency to Abdou Diouf.

For the World Bank, however, progress was too slow and the EFF was cancelled. After the 1983 elections, once Diouf had his own political mandate, several structural adjustments credits were agreed upon, prompting policies to liberalize agriculture marketing and trade, deregulate the labor market, and rationalize the management of public enterprises. In the water sector, all assets and debt service obligations were transferred to the SONEES, which officially became a national water utility with managerial autonomy (Law 83-73 of 5 July 1983).

2. Autonomy, efficiency and commercialization.

Systematic privatizations of productive sectors began in 1984 (Medium and Long-Term Structural Adjustment Programme) and were implemented through Bank loans until 1992 (Gellar, 1995). In 1987, a privatization law established a list of enterprises to be privatized (Law 87-23 of 18 August 1987). To increase flexibility, the Labor Code was modified and facilities were introduced in free zones (zona franca). By 1993, out of the 87 public enterprises existing in 1986, 21 were liquidated and 27 partially privatized.

To improve efficiency and reduce political interference in public enterprises, the IFIs encouraged the government to negotiate performance contracts (*contrats plans*) with its para-

statals.[108] In 1988, the SONEES was one of the first public enterprises to sign such a contract. The contract granted the SONEES primary responsibility for operating the urban water supply system, while the government was responsible for reviewing water tariffs according to a pre-determined formula, and ensuring that central administrations and local districts paid their water bills. The Diouf administration, however, did not increase tariffs according to the pricing formula, failed to curb non-payment from public administrations, and maintained control over most investment decisions. A law then enforced the autonomy of public enterprises and established a system of *posteriori* controls (Law 90-07 of 26 June 1990).

Despite the slow implementation of liberalization measures, the Socialist government officially endorsed neoliberal policies and ideology. In the 1980s, president Diouf launched the slogan "moins d'état, mieux d'état" – "less state, better state." During the same period, the neoliberal concept of sustainable development was elaborated and imbued the international development discourse in favor of efficiency and privatization for growth. In Senegal, the political discourse embraced sustainable development strategies with their benevolent claims, and stressed that obstacles to their implementation called for more resources and more supportive institutions (M. C. Diop, 2004; Rep. du Senegal, 2002).

International water policy guidelines reflecting lending agencies' and the business sector's concerns for institutional restructuring and cost-recovery prices focused on financial sustainability and the introduction of the private sector in water management. In Senegal, the SONEES enforced water commercialization by implementing a disconnection policy for domestic households not paying their bills (Ernst & Young, 1992). The SONEES opposed the practice of selling water to neighbors. In 1991, the management of public water standposts was privatized. Standposts had until then provided free water to numerous Dakar residents

[108] A 1987 study by the International Labor Organization documented the extent of political and clientelist interference in Senegalese public enterprises. Interviews revealed that a senior official was at the helm in 32 out of 56 public companies, including the major utilities, SONEES and SENELEC (electricity). Their boards of directors were made up of senior officials, often poorly informed and intent more on defending the interests of their ministries than those of the enterprise (Dzakpasu, 1998).

improving supply and reducing the use of polluted well water. Concerned with the SONEES' financial situation, a utility manager condemns the provision of free water:

> "Local districts were responsible for standpost bills but were unable to pay them. They owed huge arrears to the SONEES (CFAF 6 billions) and the financial situation of the company was worsening. It was an incentive for waste: water was let running; contractors diverted water to construction sites and residents to their gardens; vendors fetched water to sell it" (SONES manager; Dakar, May 27, 2006).

The provision of free water constituted a disincentive for residents to connect to the network in neighborhoods. Another manager of the ex-SONEES explains:

> "Getting rid of standposts to force inhabitants to connect to the network was a strong temptation, but it would have provoked unrest; putting a price on standpost water was a compromise to keep both supply sources" (ex-SONEES manager; Dakar, Oct. 23, 2006).

Thus, standpost operators began charging water to users, and paid bills to the SONEES. Operators were financially and legally accountable. The need to reduce local districts' inability to pay their water bills justified this move. In addition to getting people used to paying for water, this measure prepared the way for privatization. No private company would have accepted to take over distribution if water was free at standposts.

Water consumption at standposts declined after their privatization, as did municipalities' water bills (- 40 to 60%). But no study was ever made of the impact of ending free water access on users: had all the cubic meters of water now saved (7,9000m^3/d) been wasted when water was free? How had this volume been used? What were people who had "wasted" water now doing? How was their consumption affected? What alternative source of supply did they resort to? "Waste" was a financial notion, but is water wasted when it is used for growing food and building shelter in a context of extreme poverty?

The SONEES used the savings thus made to partly finance a program of social connections to the supply network.[109] In addition to stimulating water sales, this program was

[109] The SONEES had initiated a social connection program in 1978, requiring households to cover 50% of costs. This contribution was progressively reduced and eliminated in 1988.

meant to compensate for the privatization of standposts. But these did not affect the same people as many standposts were located in neighborhoods where the distribution system was little developed and therefore where social connections were not an option. Furthermore, poor management at standposts led the SONEES to disconnect many of them (15% within two years). As the SONEES implemented social connection programs while eliminating standposts, public toilets where water was still available became a source of supply.

The overall negative impact of adjustment policies affected rural and urban areas. Urban areas—especially Dakar—were plagued by reduced social services and a growing influx of impoverished people from the countryside (Knight, 1994). But waves of strikes in national companies and universities did not stop budget cuts or privatizations. The deterioration of the political situation and growing unrest reflected worsening social and economic conditions. If Diouf had been favorably elected in 1983, by 1988 the political climate was not so auspicious. The opposition challenged Diouf's party with economic failure, and the 1988 post-election period was marked by allegations of fraud and protests (M. C. Diop, 1993). The 1993 elections took place in a similar but even more violent context.

3. Making an example of the water sector.

Despite economic liberalization throughout the 1980s, the IFIs frequently limited or canceled loans to Senegal because of slow implementation. If in 1988, the World Bank described Senegal as achieving "adjustment with growth," the early 1990s saw rising deficits, arrears on foreign and domestic debts, and capital outflow. The Diouf administration would have implemented reforms only to the extent needed to obtain more funding (Gellar, 1995). Though there had been some state divestiture, not a single major public enterprise had been privatized, and government subsidies to these companies had risen. The IFIs withheld aid until the government agreed to more structural adjustments: further cuts in public sector salaries, continued privatizations, and the devaluation of the CFA franc (Dembele, 2003).

Thus: "Reform was urgently needed, and a high-profile and successful privatization transaction was required to break the impasse" (Brocklehurst & Janssens, 2004, p. 2). The water utility was a relatively well-run company, which made it well-suited to private sector participation, and therefore a likely candidate for a successful reform that would open the way for other privatizations.

According to a World Bank team member involved in the Senegalese reform:

> "Privatization would solve the SONEES' lack of autonomy, which made it unable to exercise full control over planning, tariffs, and bill collection, specifically from public sector clients such as government agencies, local districts, and public companies. Public administrations, which accounted for 30% of water consumption, did not pay their bills. Water was never shut down in the case of high-ranking civil servants. Because of low tariffs and uncollected accounts the SONEES was unable to settle its arrears with its suppliers, such as the national electricity company (SENELEC), and it lacked funds for investments. Private sector involvement was essential to ensure operational autonomy, to put pressure on public authorities to reduce their water consumption and pay their bills, and to generate resources for investments" (World Bank Team member; Dakar, May 29, 2006).

While the IFIs sought to achieve these objectives, the government of Senegal needed international assistance to further its hydraulics policy. The administration had elaborated three monumental projects: the revitalization of fossil valleys in the Ferlo region; irrigation works along the Senegal River; and the Cayor Canal, a multipurpose canal that would bring more water from the Lake of Guiers to Dakar, while supplying water for irrigation along its course.

Dakar obtained an important volume of its water from the Lake of Guiers (250km north-east of the capital) through a transmission pipe and from coastal aquifers of limited capacity producing water of relatively poor quality. The need to increase water supply and extend the supply system in the capital was becoming pressing.[110] In 1987, the government established the Mission for the Study and Development of the Cayor Canal. A study showed technical feasibility

[110] Water shortage, calculated from estimated population, industrial needs and the actual volume distributed, was estimated to be 4% in 1984 and above 30% since 1991, reaching 100,000m^3 per day in 1995.

of the project, and anticipated no environmental problems (BCEOM, 1987; BETURE SETAM, 1987).

But the project required international financing. Neither the state nor the SONEES could carry out this large investment, and private capital was difficult to obtain: no local capital market existed and the SONEES did not have a credit rating. The need for project financing was the leverage the IFIs used to impose privatization in the water sector.

This section showed how, during the decade preceding the adoption of the water sector reform, economic liberalization was undertaken and the policy discourse progressively spread neoliberal beliefs. Though the Socialist government did not have much choice but to proceed with reforms in order to obtain loans from the IFIs, it endorsed the neoliberal ideology. The need to commercialize natural resources and basic services, to increase efficiency and involve the private sector in service management now dominated the way of thinking about public services. These ideas took hold among the Senegalese elites and facilitated the liberalization process. The next section will show that this was particularly true of water sector professionals and the role they played in the reform process.

II. Reforming the Water Sector

When the water reform process began, privatization was challenged politically on the ground that strategic sectors should remain under national control, and because it threatened parochial interests. But, the ideological climate in Senegal had changed in favor of neoliberal ideas, which continued to spread during the reform process, ultimately facilitating the acceptance of the reform. The Senegalese government took the lead in the process, progressively incorporating all "relevant" actors and integrating their inputs toward a "successful" reform. The resulting reform satisfied the main requests of the World Bank, as well as some of the government's demands, and was collectively endorsed.

A. The takeoff.

1. Actors and objectives.

By the early 1990s, plans for the Cayor Canal project to increase water supply in the Dakar region were well underway. But, when the Senegalese government approached the IFIs for funding, they argued a lack of institutional capacity to carry out such a project and were unfavorable to the Cayor Canal project. They were prepared to finance an interim project to ensure water supply until 2010, the Water Sector Project (PSE), before considering a long-term project for supply until 2030. The PSE would increase production capacity at the Lake of Guiers and install a second water transmission pipe to Dakar.[111]

Meanwhile, the IFIs required the adoption of an institutional reform prior to considering any investment or financing needed for infrastructure development. The objectives of the IFIs and bilateral lenders were to introduce private participation in the water sector, achieve "financial equilibrium," end state subsidies, and increase water supply in Dakar to boost the economy. In 1992, the French Development Agency (AFD), Senegal's main bilateral lender, was first to request the privatization of the SONEES in its terms of reference for loans to the water sector.

During the same period, events promoting international sustainable development guidelines were held in Senegal. The African-American Institute, for example, organized a conference on Governance, Development and Participation in Dakar (April 1992) as part of its African Training for Leadership and Advanced Skills (ATLAS) program:

> " [...] designed to address Africa's lack of trained human capital in order to create an enabling environment for sustainable growth [and] improve the performance of African

[111] The project included increasing production capacity at the Ngnith water treatment plant on the Lake of Guiers (+65,000m^3/d), doubling the pipeline bringing water to Dakar, ten new boreholes in the Littoral Nord region (+35,000m^3/d), a 25,000m^3 reservoir at Mamelles in Dakar, rehabilitating the city supply network to reduce water loss (+25,000m^3/d), and undertaking various studies. The Bank was ready to provide a US$230 million credit out of the US$290 million for the cost of the project.

institutions to plan and promote sustainable development" (African-American Institute, 2002, p. 4).[112]

These forums promoted the ideas that commercializing water resources, involving the private sector in their management, and achieving financial sustainability would ensure people's needs and water resource preservation.

Rather than economists set on conducting reforms based on financial considerations alone, the World Bank team supervising the reform process in Senegal was headed by a water specialist and made of engineers and water professionals (Janssens, Locusol) who emphasized the specificities and needs of the water sector and introduced their expert logic into reform considerations. This made for a more professionally oriented reform than if actors guided by economic concerns alone had dominated the process (Kerf & Smith, 1996). The team's orientations made it easier to work with Senegalese water sector professionals and consultants.

International consultants, whose studies informed reform decisions, were in line with IFIs' tenets, but occasionally recommended options that departed from IFIs' usual practices. They proposed solutions that accommodated technical requirements, specific circumstances and local objectives. The involvement also played an ideological role: consultants promoted privatization, water commodification and a capitalist-type development for the sector, but their "neutral" or "independent" expert knowledge encouraged these developments as "professional" improvements.

The Diouf administration was caught between its own political and development agenda, a need for loans, pressures from the IFIs, and opposition to privatization from political circles, as well as SONEES managers and employees. After the IFIs had been withholding aid to Senegal in the early 1990s, ensuring continued lending was necessary, and the need to reduce water shortage in Dakar was urgent. Entrepreneurs in Senegal demanded more and better services to step up efficiency in an increasingly competitive international market (Brocklehurst & Janssens,

[112] The ATLAS projects of the African-American Institute were funded by USAID and began in 1992 in Senegal.

2004). Industrial companies requiring important volumes of water lobbied with their ministry for improved water supply.

After the AFD put privatization in its terms of reference for loans to the water sector, the government accepted that some form of privatization was unavoidable. The administration had to demonstrate its political will to undertake the requested reforms. But it was politically perilous and ideologically still delicate to privatize wholesale the water sector.

Entrusting water infrastructure operation and development to the private sector meant the state would lose control over the sector, and water prices would increase dramatically. There were pressures from within and without the Socialist party to preserve the country's national assets in public hands, and to maintain government's control over a strategic sector. Against the full divestiture of water assets to the private sector under a long-term concession, the administration favored transferring only infrastructure operation, through a lease or affermage with a private company, and establishing a public asset holding company owning the sector's assets, responsible for investment planning and financing, and for monitoring the private company's activities. The administration also sought an institutional setup that would have the lowest possible impact on water prices. Setting up a public asset holding company would also help rally SONEES managers to the reform, and was a way of maintaining jobs in the sector.

For the IFIs, however, a lease scheme was only a first step for private involvement. Once cost-recovery tariffs would be implemented in the sector, the next move would be to transfer all investment responsibilities to the private operator (Kerf & World Bank, 2000). This would improve the sector's growth, ensuring coordination between operation and investment and the maintenance of adequate tariffs in the long run. The full participation of the private sector in both service operation and investment funding was the ultimate goal.

When the reform was initiated, 90% of SONEES managers, including its General Director, Abdoulaye Makhtar Diop, opposed privatization arguing the strength of the company

and encouraging an internal restructuring. For some, privatization endangered their status and role in the sector; for others, the sector ought to remain within public hands. But all agreed that:

> " We had done a good job, the sector was not in perdition, the SONEES had adequately fulfilled its mission and, therefore, privatization was unjustified. Improvements were needed, but did not require privatization. An internal reorganization could address constraints impeding the sector's development, improve managerial, commercial and technical efficiency, achieve financial equilibrium and realize investments" (ex-SONEES manager; Dakar, Oct. 23, 2006).

SONEES managers shared much of the IFIs' analysis and objectives for the sector. Geared toward improving the utility's efficiency and financial viability, they resented political interference:

> "Achieving profitability required increased commercial, managerial and technical efficiency. Incentives for improving billing, revenue collection, and reducing Unaccounted for Water (UfW) had to be introduced. [113] Paying for water had to be enforced, and the volumes of water wasted in decayed networks (which amounting to 30% of production) made curbing water shortage more difficult and had to be reduced" (ex-SONEES manager, *ibid*).

SONEES managers constituted a balancing force between the government and the IFIs. Their objection to privatization supported the government's desire to keep control over the sector's assets, while their call for efficiency and financial improvements coincided with IFIs' arguments for reform. As sector professionals, managers' search for autonomy from politicians was a source of legitimacy for the reform. The weight of SONEES managers was further strengthened as the company's employees gave managers the mandate to represent them in a common opposition to privatization.

Institutional reforms with the privatization of water services usually included the establishment of an independent regulatory body to supervise the sector's activity, and oversee the operating company and contracts' implementation. The Bank, following its standard

[113] UfW is calculated by dividing the volume of water billed by the volume produced. UfW incorporates all losses from leaks, misread meters, unpaid water or theft, etc.

procedure, suggested the establishment of such an organ. But the Diouf administration, worrying about continued state control, opposed the idea of a foreign regulator. This refusal was reinforced by SONEES managers opposing the creation of an independent regulatory body. In case water services were transferred to a private operator, the national water structure ought to remain close to production and distribution operations.

At the time, furthermore, a new approach to regulation was emerging among international water sector reformers. This approach supported setting up regulatory "systems" rather than regulatory "authorities" (Brown, Stern, Tenenbaum, & Gencer, 2006). Regulatory bodies were based on financial regulations assuming the existence of a market, which for most developing countries' water sector did not exist. In which case, a contractual arrangement using non-financial techniques was a better alternative. A contractual system establishing obligations, performance, costs, remunerations, and an income sharing implementation scheme acceptable to all parties bound private and public actors. The World Bank conceded to this approach in the Senegalese case, and loan conditions to the country did not require the reform to include an independent regulatory body. All agreed on establishing a contractual regulatory system.

Achieving the sector's "financial equilibrium" (sustained accumulated cash surplus) was necessary for involving the private sector in water distribution. The water sector had to generate resources to finance capital expenditures, ensure debt servicing and profitability, and in the long-run for the private sector to finance an increasing part of investments (Sorel, 1999). Financial equilibrium required implementing cost-recovery prices for water services, and "unbundling" the sector, i.e. infrastructure development and unprofitable sanitation services had to be separated from profitable urban water supply.

Cost-recovery prices were central to achieving financial equilibrium. A World Bank team member explains:

> "The sustainable development of the sector [would] remains very fragile as long as cost-covering tariffs [were] not implemented. But the Senegalese government was weary of

> high water price increases triggering popular unrest. Low price increases and a subsidized 'social' tariff to maintain a social dimension in water supply were important. Water prices had to be socially and politically acceptable" (World Bank Team member; Dakar, May 29, 2006).

The uncertainty over water pricing within the World Bank before 1995 worked to the advantage of the Senegalese government. This made it possible to maintain a rising block tariff system with a cross-subsidized "social" price, as opposed to implementing full cost-recovery prices. Furthermore, with infrastructure development under state's responsibility, public loans would be made for investments and water prices could increase gradually toward financial equilibrium.

Agriculture water supply was a sensitive issue with regard to water prices. Large plantations producing for exports located along the water transmission pipe between the Lake of Guiers and Dakar irrigated their crops with drinking water they bought at subsidized prices. Water quotas had been set in an attempt to limit growers' consumption, but were not implemented. The World Bank encouraged raising agriculture water prices and disconnecting farmers from the network. SONEES managers shared this position. But the government had an ambiguous attitude, and was unable or unwilling to enforce any decision. A water specialist aware of the stakes in the matter explains that:

> "Big planters constitute a strong lobby. They are businessmen operating abroad, or high ranking officials and landowners who opposed discussing any disconnection. This lobby is represented within the Ministry of Hydraulics" (hydrologist, professor; Dakar, Oct. 6, 2006).

The situation remained unsettled, government decisions shifting with political circumstances.

The fate of sanitation services was easily solved. The IFIs and the government agreed that sanitation was too burdensome to be included into the private sector's responsibilities, and decided to entrust these activities to an independent public agency. SONEES water and

sanitation managers also agreed, though for different reasons, that sanitation services should be separated from water operations. SONEES "water" managers considered that:

> "We advocated the separation of sanitation from water services for financial reasons. The SONEES had spent for sanitation activities, which were not part of our mission. The SONEES would save money if a separate sanitation structure with independent financing mechanisms was created. This would take the burden of sanitation activities off from SONEES' budget" (ex-SONEES manager; Dakar, Oct. 23, 2006).

For their part, sanitation managers complained that the sub-sector was of secondary concern after water supply and had no strategy of its own. Separating sanitation from water could solve these problems:

> "As long as sanitation was drowned in drinking water, it would not be a priority for the government. Water supply, with its visibility and strong lobbies, would always take precedence. Within the SONEES, sanitation was left aside. Separation would help better focus on sanitation. The sector needed more autonomy and resources to develop. A separate institution would give sanitation more visibility and ease the search for funding" (ex-sanitation manager; Dakar, Oct. 12, 2006).

Thus, the Senegalese government's concerns were taken into account during the reform process and contributed to shaping the new institutional design. From the World Bank's perspective, Senegal wad a stable and democratic country in West Africa, and despite the ups and downs of SAPs implementation, was considered a "good pupil." The World Bank appreciated the risk of pushing too harsh a privatization scheme on the country. SAPs had caused unrest, which could resurface, and the risk of the country becoming unstable and more radical existed, as did the risk of defaulting on its debts. The Bank was furthermore ready to compromise for the sake of making the water sector reform a privatization success.

2. Reform orientations and expert knowledge.

The Diouf administration objected that privatization of the water sector could not be opted for without first identifying problems and possible solutions. The World Bank agreed that a sector diagnosis investigates contractual arrangements other than concession. The AFD signed

a contract with Ernst & Young, a multinational consulting firm, to undertake a study of the sector, including institutional and technical options and debt servicing capabilities.

The study concurred with the IFIs' analysis of the water sector and applied pro-privatization arguments (Ernst & Young, 1992). The SONEES, though performing well and well managed, had reached its limits and, to be competitive, its institutional framework had to be revised. Private sector participation would improve technical and commercial results and debt servicing ability, achieve financial equilibrium and solve problems of governance and lack of autonomy. With efficiency gains, the study claimed, a private operator would limit tariff increases required for financial self-sufficiency.

E&Y elaborated three possible scenarios for the new institutional framework and a financial model to evaluate them (Ernst & Young, 1992). World Bank loans were available only in the case of private sector involvement and concerned investments defined in the PSE. Restructuring the utility, as requested by SONEES managers, was rejected: it would not achieve financial equilibrium soon enough as required by the IFIs, and would not sufficiently address water shortages as IFIs loans were not available under this option. A concession was too risky for the private sector: knowledge of infrastructural conditions and of investments needed was poor. But the private sector would clearly have to provide substantial investments and transfer costs onto consumer prices.

A lease or affermage scheme transferring operations to the private sector was the only way to achieve financial equilibrium in a reasonable amount of time with limited price increases. This option concurred with the goal of privatization and the general opposition against concession in Senegal. Furthermore, concessional loans were available and the public asset holding company could borrow investment funds at lower cost. An asset holding would also have easier access to commercial loans, which might be necessary if tariffs were for a time insufficient to cover the operator's remuneration, investment needs, and debt service.

This scenario predicted reaching financial equilibrium by 2003 if network efficiency was improved and consumer tariffs were increased at a maximum 3% per year. A financially autonomous asset holding, relying for part of its financing on revenues collected by the private operator, rather than governmental subsidies, would have incentives to lobby the government to progressively raise tariffs to cost-covering levels, and to be accountable in carrying out investments.

For the sector's regulation, the study recommended establishing a web of contracts binding the state, the asset holding and the private operator, that would make all parties accountable for reaching financial equilibrium and developing the sector. The financial model complemented these contracts by making all parties accountable for the sector's cash flow. Regulatory responsibilities would be shared by the government and the asset-holding.

3. Devaluation and continued liberalization.

While the water sector reform was underway, continued economic liberalization proceeded. In 1993, the IMF and the World Bank conditioned any further support to the devaluation of the CFA franc (Creevey, Vengroff, & Gaye, 1995; Gellar, 1995). The IFIs argued that devaluation would promote the country's "successful integration" in the world economy.

After prolonged resistance, a 50% devaluation took place on January 12, 1994. After the devaluation, public officials, the president, intellectuals, and IFIs representatives wrote numerous press articles praising privatization, structural adjustments and their benefits (see the two national daily newspapers, *Le Soleil* and *Sud Quotidien*).

The devaluation, however, immediately doubled the foreign debt (from about US$3.5 to US$7 billions) canceling out previous debt reductions. Consumer price inflation rose some 36% in 1994 with no corresponding rise in salaries. The cost of food, electricity, and transportation jumped up. Water prices rose by 30%. Local entrepreneurs found it difficult to buy equipment, fuel, or inventory, and under increased fiscal pressures, many small and medium private companies moved into the informal sector. The devaluation sped up the process of

impoverishment started in the 1980s. The riots of February 1994 indicated the seriousness of socioeconomic problems.

Tight macroeconomic policies and far-reaching structural measures backed the devaluation. The IMF set up a comprehensive adjustment program (1994-97), which included a two-third-debt reduction. The World Bank disbursed non-project assistance money in 1994, and France cancelled Senegal's public debt. In 1995, the IMF approved a series of annual loans under the Enhanced Structural Adjustment Facility (ESAF), provided the programs were implemented satisfactorily.

The 1994-97 Programme called for the restructuring of 22 (out of 54) public establishments, among which the national water company. After the devaluation, the focus of privatization turned to strategic sectors and basic services such as water, electricity and telecommunications. A law established a second list of enterprises to be privatized expanding state withdrawal to water, telecommunications, transportation and electricity infrastructures (Law 95-05 of 5 January 1995). The Labor Code was eased further, increasing the flexibility introduced during the 1980s.

B. The government takes the lead.

1. Steering Committee and Aquanet report.

In 1994, expressing its will to proceed with the water sector reform, the government set up a Steering Committee made of key government officials and water sector representatives to conduct the reform.[114] The Steering Committee commissioned studies, organized consultations, and accompanied the elaboration of the sector's contracts, search for a private operator, and negotiations with financial institutions.

The Ministry of Industrial Development was represented in the Committee, suggesting that industries' concerns for water shortage was taken seriously. Agricultural water needs were

[114] The State Accounts Unit of the Ministry of Finances chaired the Committee.[114] Members were officials from the Ministry of Agriculture and Hydraulics, the Ministry of Industrial Development, the SONEES, the Prime Minister's Office, the President's Office, the IFIs and their experts.

defended by the Ministry of Hydraulics, which was also the Ministry of Agriculture. SONEES managers were included in the Committee. No reform was possible without their support. Only them could manage the utility. Their inclusion was both a necessity and a way to counter their opposition and ensuring their role in the future institutional structure.

The Steering Committee commissioned a study comparing the water sectors' of neighboring countries where private operators managed water services through contractual arrangements similar to the one envisioned in Senegal (Aquanet, 1994). The Aquanet report concurred with the reform's orientations, and reflected managers' insistence on introducing performance constraints for the private operator. To prevent water loss and improve commercial efficiency, the report proposed setting performance targets (network efficiency, billing and collection) and linking the operator's remuneration to these targets.

The report addressed potential conflicts between the asset holding and the private operator over infrastructure maintenance and renewal. Lack of maintenance by the operating company induced more renewals for which the asset-holding was responsible, while insufficient renewals increased maintenance costs. To avoid conflicts, Aquanet recommended that the operator contribute to capital expenditures through network and equipment renewal obligations, and own operating equipment.

The Aquanet report favored an institutional framework not overly regulated. The operating company needed independence to manage and "bring the advantages of professional private management to the utility (Aquanet, 1994, p. 15). The report proposed that the public asset-holding be endowed with sufficient autonomy, financial and professional resources for overseeing the operating company.

2. Ideological promotion.

As the water reform was proceeding, the media and special events publicized the benefits of privatization and the efficient management of public services. The 7th Congress of the African Union of Water Suppliers (Dakar, Jan. 1994) promoted public-private partnerships in water

distribution. Water suppliers declared their readiness to contribute to the Senegalese government's goal of using water resources to boost the national economy through projects such as the Cayor Canal and the revitalization of Fossil Valleys. A series of awareness-raising seminars on water service management followed the congress (Office International de l'Eau, 1994).

Press articles underlined the importance of water infrastructures for other economic sectors, and commended privatization for the sake of economic rationality and profitmaking (APS, 1994d, 1995a).

In March, a presentation seminar for the 1994 World Bank's World Development Report, entitled *Infrastructure for Development* (World Bank., 1994), was held in Dakar and widely publicized. The press reported that infrastructures had to be managed like commercial enterprises in a competitive environment and with the financial participation of users; contracts with the private sector would increase the performance of public enterprises; and appropriate prices would allow ending subsidies that most benefited the rich *(APS, 1994b)*. A consultant involved in the reform argued that in the water sector:

> "Because of unpaid public bills, poor management and political interference, water price increases to reduce the sector's deficit amounted to consumers subsidizing the government" (consultant; Paris, Dec. 4, 2006).

Publicity around neoliberal policies and their benefits underlined the efforts to involve all relevant actors in the reform process, overcome opposition, and create consensus.

C. Participation and collective endorsement.

From 1994, a "participatory" process was initiated to bring relevant actors on board the reform and gain their support. SONEES managers' opposition turned into an active involvement in the reform's implementation. Workers' opposition was curbed by guaranteeing them continued employment and benefits. Investments' decisions for the sector's development were

made, and a law re-organized the sector. The decision process was participatory and the reform was collectively endorsed.

1. National Workshop.

In July 1994, the Steering Committee organized a national workshop on the reform under the auspices of the World Bank. Among the participants, SONEES employees and sector unions' representatives were the only new actors. The workshop was part of the Bank's efforts to build consensus, inform on the reform's objectives, and gain support from labor unions and SONEES employees. The workshop initiated the Bank's "participatory approach," and was presented as a crucial reform moment when major decisions would be made collectively. Major decisions, however, had already been made and were not open for discussion. *Le Soleil* published a few lines on the holding of the workshop (APS, 1994a). This was the first mention of the reform in the press since 1992.

The workshop officially validated the privatization scheme: a public asset-holding responsible for infrastructure development under a Concession contract with the state, which retained infrastructure ownership and control over the sector's policy orientations (Rep. du Senegal, 1994). The operation of water services and routine maintenance of assets were transferred to a private company under a ten-year Affermage contract. The private operator would own at least 51% of the company's shares; Senegalese investors (public and private) would acquire remaining shares.

Participants endorsed the financial principles established for the sector. The only support from the state would be on-lending of lenders' financing, rather than ongoing operating subsidies. Financial equilibrium would be achieved over a seven-year period through improved billing and bill collection, and prices covering the costs of investments and operations, and a "fair" return to the private operator. Price increases would be limited to maximum 3% annually. Finally, the workshop set up team to elaborate the Affermage and Performance contracts binding the asset-holding and the private operator.

At the time of the workshop, entrusting sanitation activities to a separate public organ was a done deal. All involved favored the creation of an independent sanitation agency, but the extent of the sub-sector's weaknesses was unknown. An ex-sanitation manager explains:

> "The idea of separating sanitation from water was in the air. But the situation of sanitation needed to be better known. Assets had to be evaluated and weaknesses studied" (ex-sanitation manager; Dakar, Oct. 12, 2006).

After the Workshop, the government commissioned a diagnosis of the sub-sector and an institutional study for a sanitation structure.[115]

2. Managers: from opposition to contribution.

Despite the presence of SONEES managers and sector unions' representatives, no opposition to the reform was voiced during the National Workshop. After the Workshop, however, SONEES top managers elaborated, through the Association of Water Companies' Executives (ACASE), an alternative proposal to privatization. The document asserted the viability of the SONEES and addressed the sector's development, proposing a smaller investment program to increase water production and supply, alternative sources of funding, and measures to improve technical, administrative and financial management.

Managers argued that:

> "Needed loans did not justify privatization. The PSE was not going to resolve the sector's investments funding difficulties. If financial partners' contribution to these investments was conditioned to the privatization of the SONEES, privatization only set aside future funding problems. Furthermore, the company had the ability to borrow, and with state support it could undertake investments and develop the sector" (ex-SONEES manager; May 19, 2006).

Managers' alternative investment project was based on a better use of existing equipment, renewals and new infrastructures. Like the PSE, investments consisted in doubling

[115] The World Bank financed both studies. The Japanese Cooperation Agency (JICA) undertook the diagnosis (JICA, 1994), while IDEA (Ingenierie, Developpement, Eau et Assainissement), a Tunisian consulting firm, elaborated a possible sanitation structure (IDEA, 1995). Fadhel Ghariani, head of IDEA, was a sanitation expert often used by the World Bank. AQUAFIN, a Belgium para-public sanitation company, VAMAS, and Cabinet Barry collaborated in the organizational study. SONEES sanitation executives and the World Bank team leader, Janssens, also contributed to it. The study was finalized in December 1995.

the transmission pipe from the Lake of Guiers to Dakar. Increasing technical efficiency would reduce shortage and waste. This included increasing production to nominal capacity; improving the transit system; better regulating connections at the Lake of Guiers; accelerating network renewals; faster response to breaks, and other technical and organizational measures. Managers also recommended disconnecting towns that could be supplied by their own borehole from the Guiers transmission pipe.

SONEES executives wanted a strong, more autonomous national company:

> "To improve management, the company needed more autonomy from the government. Political and clientelist influences resulted in erratic top executives' replacements for reasons unrelated to the operation of the company. This thwarted continuity. Commitments were not respected and decisions not implemented. The Administrative Board could not exercise its control mission. Relieved from political interference, management would be more efficient and managers would be able to properly implement needed changes and achieve the sector's objectives. The company also needed the authority to directly negotiate with lenders and benefit from debts cancellation and rescheduling, as well as from loans ceded by the state under lenders' conditions rather than with higher interest rates" (ex-SONEES manager; *ibid*).

Toward financial equilibrium, managers suggested not only to increase water prices and bill collection and implement coercive measures in case of non-payment, but also to end social connections to the distribution network for the poor and to reduce subsidies to growers and disconnect them from the network.

In October 1994, SONEES managers presented their alternative document to the authorities:

> "With the support of union representatives, the ACASE presented its alternative proposal for the sector to the authorities. We pleaded with politicians, union leaders and religious authorities, explaining the validity of our solutions" (ex-SONEES manager; Dakar, May 19, 2006).

Le Soleil reported the opposition of SONEES executives and their alternative proposal only once, months later (APS, 1995e).

Privatization, however, was well under way and would not be reversed. Rather than continue opposing privatization, executives went along with the reform and endeavored to influence decisions so that their objectives for the sector would be integrated into the reform design:

> "When we realized privatization was not negotiable, we decided to fight for a good privatization. We transformed our original proposals into elements to be integrated in the privatization scheme and make for a better reform. We wanted to make sure the future public asset holding would have a strong position in the sector, and that the private operator would perform better than the public sector had. Network efficiency improvement, for example, would not necessarily follow from privatization. So we developed performance objectives for network output, water quality and commercial management that the private operator would have to achieve" (SdE manager; Dakar, May 19, 2006).

These objectives coincided with World Bank's demands for increased technical and commercial efficiency. The General Director of the SONEES, however, who was an influential politician, continued opposing the reform. Since 1993, SONEES employees had been instructed to withhold information on the company's assets from auditors. Until 1995, the companies' doors remained shut to consultants who were unable to meet with employees or establish the list of assets to be ceded.

3. Sector investments.

Though the World Bank's loans were conditioned on the implementation of the PSE, disagreement over investments persisted. In 1994, the Bank commissioned an environmental impact study for the PSE (Lauras & Pigeon, 1995), while the Operations Director of the SONEES declared that the Cayor Canal would be achieved in 1995 to ensure Dakar's water supply until 2030 (APS, 1994c). Government officials argued that a second water transmission pipe from the Lake of Guiers to Dakar was not a solution, as the same saturation problem would re-emerge within 10 years. Thus, they continued promoting the Cayor project.

The Minister of Hydraulics, Mamadou Faye, stressed the Cayor Canal project was crucial for the development of Senegal. In January 1995, congratulating the Cayor Canal Mission for its work and the first kilometer of the canal that would soon be realized, the Minister deplored that the exigencies of international finances were slowing down progress (APS, 1995a). But in March 1995, the Ministers of the Economy and of Hydraulics addressed a Water Sector Policy Letter to the president of the World Bank setting the new orientations for the sector and introducing the PSE (World Bank, 2001). The PSE environment impact study was published the same month. The study was favorable to the project, but stressed that the PSE was an interim phase and that a long-term solution should address the overexploitation of certain underground water tables (Lauras & Pigeon, 1995).

The Cayor Canal project remained on the government's agenda as the long-term solution. Progress was regularly reported. As the PSE was adopted, the first construction works (a dike and a sluice at Keur Momar Sarr on the Lake of Guiers) were announced. An institutional setup for the canal's construction and operation envisioned the establishment a company with state and private participation. A Build-Operate-Transfer arrangement with a private firm was being explored. Early April 1995, a financial and organizational study of the project was officially launched. The study was commissioned to Aquanet by the Canal Mission and realized with concessional financing (60%) and World Bank lending (40%) (Aquanet & Hamilton, 1996). The government also commissioned an environmental impact study to SNC-Lavallon-BCEOM (Lavalin & BCEOM, 1996).[116]

4. Voting Law 95-10.

In January 1995, a new law added water to the list of public enterprises open for privatization (Law 95-05 of 5 January 1995). The reorganization of the urban water sector required the adoption of a law establishing new public institutions and allowing the

[116] The CFAF 2 billion study was financed by the Senegalese Treasury (18.5%), the African Development Fund of the BAD (49%), and the Kuwaiti Fund (39.5%).

participation of the private sector. A law project was elaborated establishing the public asset holding company, the National Company of Senegal's Waters (SONES), to which the state transferred infrastructures under a Concession contract. The national company was relieved from operation activities, which were transferred to a private operator under an Affermage contract. A public sanitation organ would be created out of the dissolved SONEES to manage urban sanitation.

Most media coverage on the reform occurred as the new sector law was to be presented in Parliament and as SONEES workers manifested their opposition to the reform. Press articles described the main features of the reform and its justifications: water shortages, the need for financial equilibrium, and efficient management called for institutional changes. Turning things on their heads, the government presented IFIs financing for the PSE as the condition for implementing the reform. The press emphasized the importance of the project and described in details planned investments. The project was an important development effort, most beneficial to the country, which legitimized the institutional reform.[117]

The Parliament's Inter-commission on rural development, finances, and laws adopted the water sector law project after a debate that lasted eight hours and a half (March 22, 1995). During the debate, parliamentarians raised questions about what justified privatization, the way it was undertaken, and the social dimension of the reform (unpublished summary records). In a strange alignment, the debate split between those, mainly from opposition parties dominated by neoliberals, arguing that strategic sectors ought to remain within the public domain, and those, led by the Socialist party in power, promoting competition and privatization in the water sector.

The Minister of Hydraulics insisted that: "The concept of privatization was exaggerated … [the point was] to create a better managed and more competitive company," and that the capital of the operating company would be mixed (unpublished Summary Records). The Minister stressed the SONEES was "incapable, technically and from the standpoint of

[117] See the two national newspapers, *Le Soleil, Sud Quotidien,* between March and May 1995.

commercial management and bill collection, of carrying out the reform," and assured that the solution adopted avoided the over-exploitation of underground water tables. Other Socialist deputies underlined that the social dimension of the reform had been carefully studied and developed in consultation with sector workers, taking their alternative proposal into account.

Main opposition parties—the Senegalese Democratic Party (PDS), the Democratic League/Labor Movement (LD-MPT), the Independence and Labor Party (PIT)—voted against the reorganization law (APS, 1995d). They objected to the government's propensity to privatize everything. They argued that privatizing infrastructures hindered any integrated development strategy, increased prices of basic services, and reduced the activities of local enterprises. They insisted that other solutions existed (APS, 1995b).

The position of the main opposition party, the PDS, toward the water reform was somewhat ambiguous. The PDS, which would take power in 2000, favored economic liberalism and did not oppose privatization per se but the way reforms were conducted. The PDS strongly opposed state monopoly, seeking to promote the Senegalese private sector. Abdoulaye Wade, the party leader and president of Senegal after 2000, claimed that privatizations had been undertaken in ways detrimental to the national economy, and that strategic sectors should not be privatized (APS, 1995c). Good management, according to Wade, was possible with some re-organizing, by which he meant ending state monopolies to allow private participation in smaller companies at regional, departmental or municipal levels, owned at least in half by Senegalese investors, and in partnership with foreign firms for technological quality. In 2010, Wade would make the unilateral decision to implement a concession scheme regrouping water and sanitation services.

National Assembly's debates over the sector's reorganization law were scheduled to take place in plenary session on March 24. But Socialist parliamentarians requested the postponement of the debates. There were dissensions within the party over the reform, and they needed time to harmonize the positions of their members, in particular those depending on the

National Union of Senegalese Workers (CNTS)—the dominant union in the water sector which opposed the reform. Meanwhile, mobilized against the reform, SONEES workers were holding a sit-in in front of the Parliament House and began a water strike the following day. CNTS deputies finally agreed on supporting the reform law if the government guaranteed no SONEES employee would be laid off. Deputies from other parties remained unfavorable. Deliberations took place on March 25th during a special session that lasted four hours. After 38 interventions, Law 95-10 was adopted.

5. Dealing with employees' opposition.

Until early 1995, SONEES employees had relied on managers to oppose privatization, thinking managers were better equipped to negotiate and defend their interests. But, a union representative recalls:

> "When it became clear that managers were not going to influence the decision to privatize, and that the reform was proceeding without our concerns being heard, we began mobilizing. But we had no direct interlocutor to present our grievances to and who could provide us with proper information. We were told that once the law on privatization was passed, the government would consider what to do with the private company. What did that mean? That would be too late. We decided to put pressure on the government to secure our future" (union leader; Dakar, May 22, 2006).

Two trade unions were represented in the SONEES: the Senegal Water Workers Union (SUTES) and the Independent Workers' Union of Senegal (UTIS). The SUTES, affiliated with the CNTS, dominated the sector. It held moderate positions and opposed privatization "in defense of the moral and material interests of workers, as well as national assets" (union leader). But since the 1994 workshop on the reform, SUTES leaders accepted the inevitability of privatization and focused on avoiding layoffs:

> "We called for employment and benefit guarantees in the new structures, and for the private operator to continue contracting with local firms—the public water company had generated an important peripheral economy with small and medium size local

> enterprises. A private operator could terminate these relationships and use its multinational for equipment and services" (union leader, *ibid*).

The UTIS, affiliated with the Senegal National Union of Autonomous Shops (UNSAS) was more radical and less representative. In the mid-1980s, autonomous unions appeared in Senegal in response to structural adjustments and resulting layoffs, companies' closing, lowering purchasing power, and increased labor flexibility. A union leader recalls:

> "UTIS was strongly opposed to SONEES privatization, arguing privatization meant water services and workers would become preys to international capital. At the time the reform law was being deliberated, we organized a sit-in in front of the Parliament House and we went on strike. Union managers, from both SUTES and UTIS, and employees supported the strike. SONEES managers supported workers' demands for all employments, benefits and wage levels to be maintained in the new institutional structures—private operator and new public asset holding. When the strike began early morning, everybody stopped working. Water was shut down at the Ngnith plant [on the Lake of Guiers], and no water reached Dakar. Even the Presidency did not have water. After two days without water, the Minister of Hydraulics met with unions' representatives to negotiate. But negotiations were suspended. We had to elaborate a memorandum spelling out our demands. That would serve as basis for negotiations. The negotiations were to take place with union leaders, SONEES managers, personnel representatives, the Minister of Hydraulics, the Minister of Labor, and deputies the unions had called upon. The CNTS drafted a memorandum and was ready to present it for negotiation without previously submitting it to SONEES employees. But UTIS remained opposed to privatization whatever the conditions, and the union's leaders refused to negotiate on the basis of a memorandum that was not co-signed" (ex-union leader; Dakar, May 27, 2006).

The Minister of Labor, Assane Diop, who was also a member of the CNTS Directorate, expressed his readiness to discuss with unions their reasons for opposing the reform, but that no discussion was possible with those against privatization for no reason (APS, 1995f). Negotiations were possible only within the context of privatization. A union leader explains:

> "When negotiations resumed on March 28th, UTIS leaders read a declaration stating their opposition to the reform and left the negotiation table refusing to bargain for

> employment and benefits. That evening, the negotiators reached an agreement and signed a Memorandum of Understanding" (union leader; Dakar, May 22, 2006).[118]

The government conceded to workers' demands for continued employment and benefits. All permanent positions would be maintained between the new public holding company, the private operator and the future sanitation agency. Other demands included technical and management performance requirements for the private operator, adequate social water prices, 51% maximum of the operating company's shares owned by foreign capital and 9% reserved to employees (Memorandum of Understanding). The bulk of the Memorandum would be integrated into the bidding documents and the Affermage contract with the private operator.

The SONEES strike and ensuing negotiations put pressure on the government to set some constraints on the private operator. Maintaining employment became a reform condition. But this did not entail much risk for the private operator. The SONEES was not overstaffed, employees were relatively qualified, and benefits were not exaggerated. The promise that the private company would take on all the employees not needed by the asset-holding company, and maintain existing wage levels, was decisive in circumscribing unrest, which the authorities feared could escalate. Unions were highly represented within the SONEES and had the power to paralyze the entire sector with complete water shutdown. The last such incident had occurred in 1992. In 1995, if the shutdown had lasted a few more hours, the electric power plant would have had to shut down as well, its cooling system depending on water supply. Privatization would definitely end the risk of water strike and the power of sector's workers.

All actors involved in the reform appeared satisfied with the passing of Law 95-10 and successful negotiations with SONEES employees. The Minister of Hydraulics reported in the press the positive aspects of the reform, including continued employment for the entire SONEES workforce, an option "equally shared by the government and lenders;" the possibility for

[118] Co-signatories were the Minister of Hydraulics, Mamadou FALL, the Minister of Employment and Labor, Assane DIOP, the SONEES General Director, Abdoulaye Makhtar DIOP, the Board President, Lamine DIAK, the CNTS General Secretary, Madia DIOP, and the SUTES General Secretary, Alioune DIAW.

employees to buy private company's shares; a public asset-holding, strong technically and in terms of human resources, and capable of controlling the private operator; and the operator's remuneration dependent on performance objectives (APS, 1995g). The Minister also assured there was nothing to worry about price increase.

For the IFIs, the passing of Law 95-10 was an important step. On March 26, an article in *Le Soleil* announced "The IMF is satisfied with Senegal," and on the 30th, the financial institutions met with the government to finalize financing for the PSE. SONEES executives considered that:

> "Being good 'republicans', we had to accept the Parliament's decision, and we focused on creating the conditions for a 'good privatization'" (ex-SONEES manager; Dakar, Oct. 23, 2006).

6. What about sanitation?

In 1996, *Le Soleil* announced the creation of the National Sanitation Agency of Senegal (ONAS) (APS, 1996b). Ten deputies took part in the debate before the law establishing the ONAS was voted (Law 96-02 of 5 February 1996). The public sanitation agency was in charge of infrastructure development and operations for wastewater and rainwater, developing individual sanitation systems, and commercializing treatment plants' by-products. ONAS' financial resources would come primarily from remittances from the private water operator based on a fixed portion of the price per cubic meter of water sold. ONAS activities and various local public funds, taxes, and institutions would provide other resources. But no procedure was established to collect financial resources devolved to the agency other than the sanitation tax on distributed water. Though institutionally disconnected, sanitation activities remained totally dependent on water distribution.

Sanitation executives would have favored the establishment of a national company:

> "A national company would have been more functional and adequate to the requirements of sanitation services. It would have allowed for more flexibility and diligence. We could get things done faster. But this solution faced a legal hurdle: a

national company directly borrows from financial partners and is responsible for debt servicing. Sanitation resources, however, barely covered operational costs, and would never be sufficient if amortizations and debt servicing were added. The new sanitation agency had to settle for an Industrial and Commercial Public Enterprise (EPIC) status. This implied much heavier and rigid procedures that make all our activities more difficult" (ONAS manager; Dakar, May 15, 2006).

D. Transition toward private takeover.

The reform process was not over with the passing of the sector's reorganization law. A number of steps remained for the new institutions to be put in place and to properly function and cooperate. After Law 95-10 was passed, the Steering Committee established a transition period to prepare the transfer of operation activities to the private operator. The Ministry of Hydraulics appointed the General-Director of the future SONES who would conduct the transition period. SONEES hiring was frozen (1594 employees). The transition lasted until April 1996 when the new entities of the sector and the government signed the various contracts.

To ensure the reform's success, consensus had to be built in an environment that had been rather hostile. Seminars were held to explain the reform and prepare the entry of a private operator. Funding for the PSE had to be secured. The project, which was crucial to attract private sector interest in Senegal's water services, was the basis for discussions with funding partners and private operators. A private operator had to be selected and a new company established. To facilitate the transition, the World Bank modified a number of its usual procedures and initiated new practices.

1. Building consensus.

From March 1995, "awareness-raising" workshops and capacity-building seminars were held under the auspices of the World Bank. The purpose of these seminars was to gather support and prevent potential problems between the future public and private companies. They addressed in particular the limits of the SONES monitoring role and appropriate regulatory procedures. Interpreting the Affermage contract in favor of one or the other entity or the

administration colluding with the asset holding against the operator were risks to be avoided. Seminars with SONEES employees aimed at maintaining performance levels until the private operator took over.

2. Securing funds.

Contrary to World Bank's practices, negotiations for the PSE credit began before the call for tenders was initiated. Instead of insisting that the contract with a private operator be awarded prior to loan negotiations, the Bank allowed the Senegalese government to proceed with the bidding process after the credit was in place. Bank management felt that the "champions" of the reform would not be able to continue if credit was delayed, and that it would be difficult to attract private operators if a source of financing to increase water supply was not available (Brocklehurst & Janssens, 2004). The US$100 million IDA credit was slated to go to the World Bank board in the summer of 1995, with credit effectiveness (funds could be disbursed) conditional on the establishment of a privately managed operating company "satisfactory" to the Bank (World Bank, 2001).

The World Bank's rules on borrowers' contributions to its financed projects required that the water sector, through the asset holding, funded about 10 percent of the IDA credit without recourse to lenders. The precarious situation of state finances did not allow the Senegalese Treasury financing to fulfill this requirement. The Bank agreed that the operator's contribution to capital investments paid for by the government through the operator's fee would meet this requirement (Brocklehurst & Janssens, 2004).

Experts expected a cash deficit in the implementation of the PSE during the initial years. E&Y suggested various options to minimize the deficit and finance the cash shortfall. Among these options, a commercial bank loan to the water utility was unheard of in sub-Saharan Africa at the time. But after negotiations between the government and the World Bank, the SONES was authorized to request a line of credit from Citibank. Structuring some financing as equity instead of loan would give investors a stake in the sector and there would be no debt service on this

capital. This was not a common practice, but 60% of World Bank and 50% of KfW financing were structured as equity. Finally, the operator would buy the moveable assets from the asset-holding. Debt re-scheduling was the only option that was rejected.

3. The bidding process.

Before launching the call for tenders, Steering Committee members visited various countries (France, the UK, Belgium, Germany, and the US) to reach potential partners. After calls for candidacy were publicized, only French companies expressed interest in Dakar water supply services: Générale des Eaux (now Veolia Environnement), Lyonnaise des Eaux (now Ondeo), CISE (then the environment subsidiary of Saint-Gobain; later bought by SAUR), and SAUR (Société d'Aménagement Urbain et Rural, a Bouygues subsidiary) in partnership with GTHE (Grands Travaux Hydrauliques et d'Equipement).

Since the nationalization of the water company in the early 1970s, SAUR had provided technical assistance to the SONEES. For reason of fair competition, Senegalese officials thought of eliminating the SAUR. But nothing in Senegalese law justified such elimination. SAUR canceled all contracts with the SONEES six months before the tendering process began. GTHE was a local engineering firm and a partner of SAUR, recently established by Senegalese companies and businessmen, and headed by an ex-Director of the SONEES.

The official call for tenders was launched in July 1995. The Lyonnaise des Eaux was eliminated during the first stage of the bidding process for non-compliance. Its technical proposal requested transforming the 10-year affermage into a longer-term concession. La Générale des Eaux was also eliminated as it committed to keep only 750 out of the 1300 SONEES employees. Proceeding to the second stage, SAUR and CISE submitted their financial tender on the operator's rate. In November 1995, SAUR-GTHE was declared the winning bidder with the lowest rate per cubic meter of water to take over the operational activities of the SONEES.

4. Finalizing the sector's contracts.

The various contracts of the sector were the basis of the regulatory system that would ensure increased water production, investments, efficiency, cost-recovery prices and financial equilibrium. The contracts determined actors' roles and relationships, and established financial incentives.

The Concession contract and its annex, the Sector Development contract were signed between the state and the SONEES. The Concession contract ensured the public sector carried out required investments. The asset-holding had the exclusive right to acquire, rehabilitate and build water assets for thirty years. It was responsible for investment planning, execution, and financing. The Sector Development contract included the PSE, defining investments for 1996-2001. Investments and debt services would be financed with resources from water sales transferred by the private operator, while the state, which had authority over consumer tariffs, committed to adjust tariffs. The asset-holding would make infrastructures available to the operator, control operations and monitor the operator's performance.

The Affermage contract structured the relationship between the asset-holding and the private operator. The asset-holding entrusted the operation of water infrastructures to the private firm for ten years, renewable every five years thereafter. The contract embedded a full cost recovery pricing system (prices covering investment financing, debt services, and generating profit) gradually achieved as consumer prices increased and investments were realized. Its annex, the Performance contract, set out their respective obligations.

The asset-holding was responsible for yearly price increases of maximum 3%. A rising block tariff system based on cross-subsidization was maintained to guarantee an affordable "vital" quantity of water with large consumers (supposedly the rich) paying for small ones (supposedly the poor). A "social" tariff was applied to the vital water consumption of 10 cubic meters per month per household (equivalent to 22.2l per person per day in a 15 person

household, an average in Dakar); a “full” price was applied to “comfort” consumptions (10-50m^3 per month); beyond 51m^3, a “dissuasive” price applied.

The dissuasive price was supposed to control consumption by the richest and discourage waste, leading to the efficient allocation of water resources and their preservation, while ensuring the satisfaction of basic needs. Consumption measured at each meter determined the block tariff to be applied. Consumption per meter, however, has often nothing to do with wealth but rather with poverty and crowding. The price structure was therefore inherently inadequate and would rather hinder the satisfaction of basic needs.

The Affermage contract determined the remunerations of the public and private companies, and introduced financial incentives for both to fulfill their responsibilities toward increasing water supply. The operator collected water bills based on a government-approved tariff per cubic meter, retained an agreed share, and remitted the difference to the asset-holding company and the sanitation agency. Thus, the remunerations were proportionate to the volume of water sold. The asset-holding and the operator shared risks related to available water quantities—an incentive to invest and reduce leaks. The asset-holding had to generate sufficient resources to finance investments and ensure the sector’s financial equilibrium.

The operator was insulated from the composition of demand, being paid the same rate per cubic meter sold whether consumers paid the social, full or dissuasive price. This was meant to induce the operator to reach new customers and increase coverage in low income neighborhoods, i.e. to accompany the social connection program financed by the asset-holding.

The Affermage contract established performance targets and made the private company commercially and technically accountable. The operator’s remuneration was partly dependent on reaching bill collection and network efficiency (reducing UfW) targets. A disconnection policy in case of non-payment accompanied the implementation of full cost covering prices and bill collection targets. The operator was also responsibility for maintaining and repairing infrastructures, and had minimal network investment obligations.

To complement the regulatory system, the financial model guided progress toward financial equilibrium, embedding actors' incentives and responsibilities. Each year, the model determined the financial variables to which actors were liable: non-respect of commitments affected the entire cash flow of the sector, its financial evolution and water prices. The model gave the operator an incentive to reduce operating costs by fixing leaks and maintaining equipment. If the government did not pay its bills on time, cash flow difficulties would result. The asset-holding had to implement scheduled investments so that financial progress could be realized as planned.

5. Establishing the new institutions.

In December 1995, after negotiations with the government, SAUR-GTHE accepted the performance objectives set in the Performance contract and established the new operating company as Sénégalese des Eaux (SdE, 26 December 1995). SAUR held 57.8% of the company's shares instead of the 51% agreed to in the Memorandum of Understanding; Senegalese investors held 32.2% instead of 39%; and the state of Senegal 5%. SdE employees obtained 5% of the company's shares, as opposed to 9%. But this shareholding never materialized, and SAUR, bearing these shares, ended up with 63% of the company's ownership. As shareholders, employees would not only receive yearly benefits, but would also attend Administrative Board meetings, be better informed on the company's situation, and have a voice in its administration.

In March 1996, the SONES constitutive assembly and first Administrative Board meeting was the occasion for officially launching the PSE. Abdoulaye Makhtar Diop, the General Director of the ex-SONEES, was General Director of the new SONES. All SONEES personnel with a long-term contract were transferred to one of the new structures. Executives held their position in one structure or the other.[119]

With the assurance that external financing was available, the parties signed the Affermage contract on April 23, 1996, and the SdE started operations. The Affermage contract

[119] The SdE hired 1394 staff members. The SONES retained 50, and ONAS 96.

was signed not only by the SONES and the SdE, but also by the Ministry of Hydraulics and the Ministry of the Economy, Finance and Planning before the Prime Minister approved it. The SONES alone could have signed the contract with the private operator, but there were concerns that the new SONES, made up of former SONEES staff who had opposed the restructuring, might cancel the contract to bring water distribution back into public management. Having the Ministry of Hydraulics sign the contract was an additional message about the government's commitment to the reform. This move was strongly supported by lenders.

This section covered the reform process from the imposition of privatization in the sector as loan conditionality to the establishment of the public asset-holding and the private operator. In this process the World Bank accommodated the Diouf administration's demands to maintain social and political stability, and innovated in its procedures to facilitate the reform's implementation. Making the reform a success called for some flexibility as long as the private sector's involvement and water services' profitability were ensured. The sector's development remained under state control, reducing risks for the private sector at the same time. But investments financed in exchange for the reform were not those the government had envisioned.

The utility's managers were crucial for the future of the reform. The sector could not do without them and their support gave legitimacy to the reform. Their involvement in the reform process, and their neoliberal orientations, countered their initial opposition. They contributed to ensure the new structures' efficiency before taking over their management. The sector's workers accepted the reform when they were guaranteed continued employment. Opposition to the reform did not seek to maintain public services or oppose capitalist development, but to make marginal adjustments and suit the interests of the sector's managers and employees.

Ideological propaganda and consensus-building efforts accompanied the entire process. Sustainable development qualified all liberalization measures. International consultants backed these measures with their expert knowledge. The national media relayed the benefits of the reform. Participatory gatherings and parliamentarian decisions rubber-stamped the reform and

integrated all relevant actors in the process, giving it the appearance of democratic and consensual endorsement.

The water reform took place within the web of relationships between influential actors, forming a neoliberal politics-business-knowledge alliance that existed in Senegal. This web including the IFIs, the French development agency and government, international consultants, the French-based multinational Bouygues and its water subsidiary, SAUR, and Senegalese politicians. In this tight network, E&Y got the contract financed by French bilateral aid for the reform's major study, and elaborated a privatization scheme. [120] SAUR, which had provided technical assistance to the Senegalese water company for twenty years and had relations with local actors (water sector official, SONEES managers and local politicians), was the winning bidder in this privatization. The Bouygues group was heavily involved in Senegal (construction), and some said the company had an influence on Senegalese politics.

III. The Water Sector Reform and Sustainable Development

The water reform was meant to achieve the sector's self-financing development with profit for the private operator, and ensure water supply for economic growth. Financial sustainability was the primary goal of the reform, determining the sector's investments and re-organization. Environmental sustainability was not a concern of reformers. Decisions were made without considerations for their environmental impacts. Environmental studies served an ideological purpose, window dressing the reform rather than attempting to preserve the environment and water resources.

Officially, the reform and investment projects implemented the Integrated Water Resource Management (IWRM) approach—the sustainable development strategy for water resource development defined by global water partnerships and widely promoted since the early 1990s (see Chapter 2). The reform introduced the main IWRM elements: pricing water services for cost recovery and demand management, involving the private sector in services delivery,

[120] In 2003, the Bouygues group appointed Ernst & Young Audit as statutory auditor, and senior auditors have held positions in both companies.

ending overall subsidies but maintaining targeted subsidies for the poor, and modifying legal and regulatory frameworks. According to the neoliberal sustainable development logic, these measures were conducive to the efficient allocation of water resources and therefore to their preservation. Finally, the decision process was "participatory," and the reform integrated the social and environmental dimensions required of sustainable development.

A. Sustainable development in the reform process.

1. Meaning sustainable development.

Sustainable development and its meaning for the water sector was not an issue during the reform process. Though privatization was resisted at first, neoliberal assumptions about adequate development and water management policies were accepted. The reform was as a matter of fact a "sustainable development" undertaking. Most reform actors had integrated the neoliberal sustainable development ideology, identifying their interests and those of the sector with efficiency, rationality, and financial "equilibrium." They understood sustainable development primarily as the need to establish financial equilibrium and to involve the private sector in service delivery.

The reform's objectives and underlying assumptions were taken for granted. When questioned on the significance and role of sustainable development in the reform and their evaluation of the reform from the standpoint of sustainable development, key actors had either no clue, or their answers were financially oriented and emphasized private sector's involvement. Actors aware of the social and environmental dimensions associated with sustainable development had a neoliberal understanding of their implementation. The sector's managers and reformers clearly expressed this approach:

> "Implementing long-term investments that will ensure water supply for some 10 years; that's sustainable development. It is a development that will last longer, that is perennial and ensures the perpetuation or continuation of the actions undertaken. There is continuity" (ex-SONEES manager; Dakar, Oct. 23, 2006).

> "Sustainable development is the perpetuation of activities; it's a development that will continue, that is lasting and durable. It is not hindered by financial constraints" (high-ranking civil servant, Ministry of Hydraulics; Dakar, May 15, 2006).
>
> "The water reform was a sustainable development reform because financial sustainability was achieved. The reform was congruent with main political stakes and contained social dimensions. So it was politically and socially sustainable. Environmental sustainability was addressed with impact studies and environment management plans. There were measures to protect the environment and monitor water resources" (World Bank team member; Dakar, May 29, 2006).
>
> "We [SdE] are doing sustainable development. We have a reforestation program and we have various social initiatives: we built a school near the Lake of Guiers, for example" (SdE manager; Dakar, Oct. 10, 2006).

They all equated sustainable development to good and efficient management by the private sector, considering private management was the solution for perpetuating activities:

> "Private sector involvement ensures sustainable development. Without financial equilibrium, there is no sustainable development. Sustainable development exists when the sector's financial equilibrium or self-financing is established" (SdE manager; Dakar, May 19, 2006).
>
> "If the resources needed to perpetuate activities, to continue operations and investments exist, then development is sustainable. The private sector is needed to ensure resources are available. Management becomes more efficient when water production and distribution are privatized. Then, you promote adequate prices and waste reduction. That's good management. You don't waste water resources, and you have sustainable development" (SONES manager; Dakar, May 27, 2006).

The sustainability of sanitation services was seen in their transfer to the private sector:

> "Local ownership of sanitation activities is needed for continuity. Local ownership means local communities, households and the private sector are involved. Once these actors have the necessary level of concern or awareness, they will get involved and development will be sustainable. We hope to transfer the management of new sanitation equipment to the private sector as soon as possible, so that operations will no longer depend on water bills. The dependence of sanitation on water bills—that is, on insufficient resources—entails a problem of continuity" (ONAS manager; May 15, 2006).

The requirements and implications of a "lasting" development were not considered beyond financial needs. No one questioned whether the activities to be perpetuated or the kind of development promoted were destroying water resources or creating social inequalities. Nobody wondered about the environmental or water resources sustainability dimension of the reform.

2. The environmental dimension of the reform.

The reform addressed environmental sustainability through environmental impact studies of investment projects. Water resources studies were projected to improve resource knowledge and better adjust supply to anticipated demand. Undertaken in 1995, the PSE impact study supported the investment project the World Bank was ready to finance. The study did not help determine investments or draw-offs appropriate for water resource sustainability or address the institutional reform from an environmental standpoint. The impacts on water resources of the new institutional framework, transferring water delivery to the private sector and separating water supply from sanitation services, were not considered.

The known negative impacts of projected investments on water resources were minimized or ignored, while the overall lack of knowledge about water resources and the environment made it impossible to fully anticipate the consequences of investments. The sustainability of water resources was a concern for reformers so far as the depletion and pollution of water sources were becoming obstacles to their exploitation (Lauras & Pigeon, 1995).

The reform embedded features contrary to water resources' conservation. By integrating incentives for the sector development (increasing water production for profit), the reform reinforced incentives for overexploiting water resources. Private management driven by profit-making was not conducive to the protection of water resources beyond what would be economically meaningful in the short-term. The private operator considered, for example, that if its treatment of the Lake of Guiers' water contributed to polluting that water, treatment cost would increase, and therefore established a treatment process that recycled chemicals and

treated waste. Abandoning the exploitation of certain underground tables was considered not to protect them from depletion and pollution, but because of induced costs.

The reform included "water saving" measures for agriculture consumption of drinking water and UfW in the distribution network and public buildings. The 1995 Water Sector Policy Letter stated the objective of reducing drinking water use for irrigation by 50% by 1999, and implementing a more rigorous management through quotas, rejecting new demands, and improving network performance and bill collection. [121] But these measures were inconsistently implemented.

Water-saving measures addressed low-paid and lost (unpaid) water to reduce shortage, not water resource preservation. The volumes of water saved were only a byproduct of financial gains. Effective demand determined resource exploitation, whatever its purpose. As economic good, water that is paid for is never wasted, specifically when it contributes to economic growth. Industrial water consumption was never questioned though industries consume huge volumes of unnecessarily high quality water. But industries pay the dissuasive price of water, contribute to the country's development, and bring in hard currencies.

The lack of attention to sanitation activities and their importance for water resources was a striking feature of the reform, showing its disconnection from sustainability concerns. The investment program that prompted the reform aimed at increasing water supply. But no parallel sanitation development was considered. The many more cubic meters of water brought to Dakar would be as many more domestic and industrial wastewater discharged into the environment, polluting groundwater and endangering the health of many. From an environmental standpoint, the separation of sanitation activities from drinking water supply denies the integrity of water resources and the fact that water passes through users, and what one does with them affects all others.

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[121] The goal was to reduce agriculture water consumption from 24,000m^3/d in 1995 to 14,000m^3/d in 1999, or 5% of total water consumption.

The interactions between water supply sources, draw offs, uses, disposal, and treatment, as well as land use and pollution sources were absent from reform considerations. Rather than making steps toward such integration, the reform moved the water sector further away from it. Rather than seeking to determine the sustainable limits of water resources' exploitation and priorities among uses, the reform established the commercial management of water resources. As long as profit-making and the ability to pay for water determine consumption and exploitation, however, resource sustainability will not be addressed.

B. Consolidation and continued liberalization.

The ideology of sustainable development contributed to the consolidation of the reform and to further liberalization. After 1996, the IFIs and the Senegalese government promoted the reform to a sustainable development success story, encouraging the pursuit of liberalization measures in the water sector and the overall economy. Sustainable development ideology served to justify the reform *a posteriori,* and to support demand-responsive strategies implemented through investment projects, as well as legislative and executive decisions for the sector's development.

1. A successful reform.

For the World Bank, the water sector reform was the first and successful example of private management of a former state-owned enterprise in the country—an encouragement to proceed with neoliberal reforms in Senegal and elsewhere:

> "This successful transaction set the stage for reform in other state enterprises (particularly public services such as electricity and telecommunications) and built up government's confidence to explore more private sector partnerships" (Brocklehurst & Janssens, 2004, p. 2).

The IFIs promoted the Senegalese case to a model of efficient delivery of water supply and sanitation services that contributed to poverty reduction. The Bank claimed that the considerable improvements and expansion of services was a measure of the reform's success (Blanc & Ghesquieres, 2006). The introduction of a public-private partnership (the Affermage

contract) had a significant impact on the quality of water services, and supported the government's objective of serving the poor, as previously unconnected poor customers now benefited from water services—an argument which not only mixes the impact of new investments and continued social programs with private participation, but also misrepresents reality.

For the World Bank, the social dimension of the reform, the lack of opposition, and the government's willingness to proceed with neoliberal measures made the water reform socially and politically "sustainable." The Senegalese reform avoided some of the features that triggered violent opposition and reversal in other countries by maintaining national ownership of the sector's assets, limiting water price increases, and preserving a social tariff and social connections to the water supply and sanitation networks. Major actors were successfully integrated in the new institutional setup, which after its implementation required only minor adjustments between the private operator and the public asset holding. In 2006, the contract with the SdE was renewed without the parties requiring a prior evaluation.

The Bank gave the Senegalese experience as example of its cutting-edge practices and a proof of the adequacy of its approach:

> "The need for sector reform to meet the challenge of the Millennium Development Goals in water supply and sanitation services is now widely accepted. The Senegal experience, which provides an example of how such reform can be implemented, supports us in our efforts to scale-up infrastructure provision and in reaching the poor" (Brocklehurst & Janssens, 2004, p. ii).[122]

2. *The sustainable development of the water sector.*

By 1996, environment and natural resources concerns imbued the Senegalese policy discourse. Environmental protection and sustainable development became official objectives. In 1996, the government adopted the country's IXth Development Plan (1996-2001) entitled

[122] Foreword by Jamal Saphir, Director, Energy and Water; Chairman, Water Supply and Sanitation Sector Board; World Bank.

"Competition and Sustainable Human Development." Embracing international mottos and reflecting the neoliberal discourse, the Plan sought the healthy management of natural resources for sustainable development through their rational use, satisfaction of priority needs, adequate technology, conservation, participation, and reduction of pollution and waste (MEFP, 1996). The Plan deplored that poverty and lack of capacity hindered the integration of environmental concerns into policies and concluded that these obstacles required improving the country's institutional framework and commitments from all development actors.

Privatizations were carried on and the new Labor Code confirmed deregulatory measures previously adopted (Law 97.17 of 1 December 1997). By the end of 1998, the privatization of 22 public enterprises was completed, including water, hotel, telecommunications, phosphate, and textile companies. These restructurings reduced the government's portfolio by 25 percent and generated CFAF 93 billion (3.5% of GDP) in 1997. But privatizations did not increase national savings, stimulate the local private sector or reduce public debt. Foreign investments and the conquest of external markets by Senegalese products remained to materialize as "vectors of growth" (Gulde & Tsangarides, 2008).

Decentralization laws were adopted in 1996 (Laws 96-06 and 96-07 of 22 March 1996).[123] The following year, after the Rio Summit, the National Action Plan for the Environment (PNAE) supported decentralization as a means for increasing funding and improving natural resources management (CONSERE, 1997). Through decentralization, local communities would be able to enter directly into agreements with international public or private development agencies or other communities and generate new resources to finance development and environmental management.

The Plan replicated neoliberal measures and sustainable development incoherence. The "Water" section of the PNAE emphasized the need for improving resource monitoring and

[123] The laws concerned the Code des collectivités locales [Local Districts' Code], and the Transfert de compétences aux régions, communes et communautés rurales [transfer of responsibilities to regions, communes and rural communities].

protection, and called for a better repartition of water resources between uses, and for setting a decision-making framework that would ensure coherent resource management (CONSERE, 1997, pp. 56-63). Meanwhile, the Plan integrated the water reform and national water projects (PSE, Cayor Canal) as coherent elements of its own efforts. But it did not analyze their social or environmental consequences or whether they contributed to a better repartition among users or to the protection of resources.

Investment decisions for the water sector, however, would not be up to the Diouf administration. In January 1996, president Diouf called upon the IFIs to support the government's hydraulics projects including the Cayor Canal (APS, 1996a). When negotiations for the long-term water project to follow the PSE began in the late 1990s, the government put the Cayor Canal project back on the table.

A consultant working on the reform explains the reasons why the IFIs rejected the project:

> "The 1996 financial, organization and environmental studies comforted this opposition: the canal's operation was problematic; its high cost would capture the sector's financial resources for a long time; the project was not profitable and would significantly impact on tariffs; uncertainty existed over whether the predicted water demand warranted such a large investment; the canal was loaded with sanitary and water waste problems; and serious land speculations were expected. The project was a real estate undertaking involving expropriations and sales of land along the canal—transactions in which public officials and high-ranking civil servants had high stakes and vested interests" (consultant; Paris, Dec. 4, 2006).

A study comparing the technical, financial, and institutional aspects of the canal project and the World Bank-supported PLT rejected the canal option (SFI, 1998). In 2000, Abdoulaye Wade, the leader of the main opposition party, the PDS, was elected president and sped up economic liberalization. In November 2000, the new administration and the World Bank signed

a US$ 125 million credit for the Long-Term Project (PLT).[124] The PLT's time horizon for the sustainable development of water supply to the Dakar region was 2012.

After 2001, investment projects and legal measures implemented a demand responsive strategy to water service development and user-pays systems. The PLT promoted the development of sanitation services through individual facilities provided on the basis of beneficiaries' effective demand, low-cost technologies and community participation. The operation of new sanitation equipment was to be entrusted to the private sector as soon as possible. The Millennium Drinking Water and Sanitation Project (PEPAM 2015; launched in 2005) and the 2008 law on public water services further transferred responsibilities for service management to users and local communities (Law 2008-59 of 24 Sept 2008).

In 2010, Wade announced that after the Affermage contract with the SdE ended in 2011, private sector's involvement in the water sector would be strengthened through a concession scheme. This halted an institutional study undertaken to determine future options and which favored maintaining the affermage. This unilateral decision surprised all in the water sector. It was, however, coherent with the initial objective of the World Bank was in line with the financing for development orientations spelled out during the Monterrey Conference (2002) (see Chapter 2). One may wonder if Wade's decision was related to his ostentatious construction projects, and part of some deal with the IFIs. As Carruthers puts it: as developing country governments often adopt policy prescriptions in secret negotiations behind closed doors without the knowledge or consent of citizens (Carruthers, 2005). Thus, from a broader perspective, this decision may not be so surprising.

These evolutions within the water sector took place in parallel with the elaboration of water management documents. In 2000, Senegal adopted its National Water Vision, (Rep. du Senegal, 2000). In 2002 Senegal's National Water Partnership (PNES, Partenariat National de

[124] The PLT would increase production capacity at the KMS station on the Lake of Guiers and transportation to Dakar, and expand the city's distribution network. The project was financed by the AID (US$ 125 millions); Sweden (0.2 million); Nordic Fund (17 millions); AFD (29 millions); KFW (16 millions); BAD (16.6 millions); the Senegalese State (2.4 millions); the SONES (0.5 million); the private sector (18 millions).

l'Eau du Senegal) started the elaboration of an IWRM Plan of Action, the PAGIRE (Action Plan for the Integrated Management of Water Resources).[125] These documents were to serve as water policy tools and as steps toward the elaboration of a national water strategy. They were widely publicized as national sustainable development efforts in support of ongoing policies, but were never implemented and remained separate from any water management decisions and development strategies.

Both the Senegal Water Vision and the PAGIRE endorsed overall IWRM guidelines (Rep. du Senegal, 2000, 2007). These documents were elaborated through participatory processes as called for by international statements, thus involving actors concerned with equity, ecological integrity and the sustainable management of water resources. As a result, the documents also expressed objectives and analyses reflecting local concerns for ecological, social justice and democratic improvements—values that grassroots actors took more literally and seriously than international water policymakers.

The water documents used sustainable development jargon, but gave it meanings that sometimes differed, or even contradicted, the international consensus. The Vision and the PAGIRE promoted unorthodox measures that did not reflect the belief that desired social and ecological outcomes were natural outgrowths of neoliberal economic policies. Consequently, these documents contained a mix of irreconcilable purposes and recommendations, a collection of eclectic measures, concerns and ideas riddled with contradictions.

Since the PAGIRE was finalized (2007), its validation has encountered obstacles. An hydrologist involved in its elaboration deplores that:

> "The future of the Plan is uncertain. So far, it has no formal recognition at the Parliament and top governmental level. The Plan was a grassroots concern. Now the document is here, but the government did not take the necessary measures for its implementation.

[125] The PNES regrouped representatives from the government, local communities, private companies, unions, and education and research institutions. The IWRM process in West Africa began with the Regional IWRM Conference organized by the Global Water Partnership (Ouagadougou, 1998) and the preparation of the West African component of the World Water Vision. The elaboration of the PAGIRE in Senegal was financed by GWP-West Africa and Canadian cooperation.

> Other structures have not shown much interest in its implementation because the priorities identified do not emanate from these players but from a group of experts. The private sector did not show much interest—industrialists, the hotel industry. The Plan ends up being an instrument for the [Direction for the Management and Planning of Water Resources], which has anyway no resources or capacity to implement any projects. Without the government appropriating the Plan as a water policy tool, it is useless. It is not the basis for designing water development projects. So much for participation!" (hydrologist, consultant; Dakar, March 8, 2010).

Meanwhile, Senegal is still lacking a comprehensive and coherent national water policy. Official policy statements set broad environmental priorities and ambitious objectives for water supply and natural resources' protection, but have little effects on environmental management and are not integrated into sectoral policies. [126] Water policy letters defined the sector's strategic orientations toward the increased and profitable exploitation of water resources, considering their degradation only when it constitutes a financial constraint. The 2005 Water Policy Letter, for example, set the MDGs for drinking water and sanitation in Senegal, and was accompanied by an investment plan, the PEPAM 2015 (Min. de l'Hydraulique, 2005). The Plan claims to target the poor and the protection of resources. Official documents adopt the international agenda and language, and investment projects implement development strategies developed by international actors.

Among the persons interviewed within the water sector, no one made the reform in parallel to the PNAE or the PAGIRE. These were other institutions' concerns. The integrated management implemented by the reform had a different meaning. Resource protection and equitable distribution could only be addressed within the confines of commercial management and the need for increased exploitation. The local agenda was to increase water supply in the

[126] See for example, the National Strategy for Sustainable Development (2005), the Poverty Reduction Strategy Paper 1 (PRSP 1, 2003-2005), the PRSP 2 (2006), the NEPAD (2001), the Sector Policy Letter for the environment (2008), or the Sector Policy Letter for hydraulics and sanitation in urban and rural environment (Commission Nationale pour le Developpement Durable, 2005; Min. de l'Hydraulique, 2005; Rep. du Senegal, 2003, 2006).

capital to sustain the economy and to continue benefiting from international lending. The IFIs' agenda was to integrate the Senegalese water sector in the global market.

This section addressed the sustainable development dimension of the water reform. No attention was given to the significance of the concept during the reform process, showing the hegemonic character of the notion. Sustainable development assumed financial profitability and private management. It supported a consensus-building participation and served as smoke screen to social and environmental concerns. Reform decisions were based on financial considerations, not water resource sustainability. The negative impacts of investments and the new institutional setup were ignored, when they actually induced the overexploitation and pollution of water resources. The reform's "environmental" measures were economically driven.

Sustainable development justified the reform once it was implemented and supported the implementation of further liberalization measures. But decisions for the sector's development remained oblivious to the few grassroots initiatives allowed to consider the meaning of sustainable water management.

IV. Conclusion

This chapter showed that the inroads of the neoliberal economic ideology among Senegalese elites, international pressures to liberalize the country's economy and the dependence of Senegal on international trade and financing combined to induce the government and the political elites to endorse the neoliberal water sector reform and facilitate its acceptance among water professionals.

The reform was part of an ongoing economic liberalization imposed the country by international financial institutions since the 1970s. For these institutions, reforming the water sector was meant to boost the liberalization process and to begin integrating basic services into the global market. During the decade preceding the reform, Structural Adjustment Programmes affected the water sector, introducing autonomy and efficiency management measures,

imposing the commercialization of water supply and making the public utility, the SONEES, responsible for investments and debt services.

The policy discourse that accompanied economic "adjustments" progressively spread neoliberal values, which the Socialist government captured in the president's slogan "moins d'état, mieux d'état." As the neoliberal notion of sustainable development emerged as international guideline, the Senegalese policy discourse advertised sustainable development growth strategies and their benevolent outcomes.

Neoliberal ideas made inroads among Senegalese elites, stressing the evils of public sector and government spending, the need to commercialized basic services and introduce efficiency, rationality and financial sustainability in their management. Private management was the model to emulate in the provision of basic services. When the water sector reform process began in the early 1990s, the ideological climate had changed in favor of neoliberal tenets. This ideological evolution facilitated the overall acceptance of the reform.

The IFIs used the Senegalese government's need for funding for its water projects to impose a reform that would open the sector to private participation, secure its profitability, end state subsidies, and increase water supply available for economic growth. The government did not have much choice but to proceed with the reform in order to obtain loans, but was reluctant to forfeit control over the sector's assets and wanted to avoid riots likely to occur if water price increases were too high.

The World Bank was ready to accommodate the government in order to achieve a successful privatization and maintain social and political stability in the country. It also modified some of its procedures to facilitate the reform's implementation. But flexibility was acceptable so far as the involvement of the private sector was secured, cost-recovery prices would achieve the sector's financial equilibrium in a "reasonable amount of time," and a financially sustainable investment project for the sector was adopted. Thus, the sector's

development remained under state control and water price increases were moderate, but the investments financed in exchange for the reform were not those the government had envisioned.

The reform was carried out by a small group of "experts" and politicians under the aegis of the World Bank. Opposition to the reform emerged from political circles and from within the water sector, but was limited and driven more by parochial interests than by the objectives of safeguarding public services. Political opposition was tamed by implementing an affermage rather than a concession with the private sector. This solution, which left responsibility for infrastructure development in public hands, would more readily attract a private operator and would limit water price increases. Establishing a contractual regulatory system imposing performance targets to the private operator and maintaining a social price of water made the reform acceptable to most actors.

SONEES managers and workers influenced the reform as their demands contributed to the objectives of either the government or financial institutions. The utility's managers initially opposed privatization, but their involvement in the reform process and their neoliberal orientations countered this opposition. Their own objectives for the sector coincided with those of either the government or the IFIs. Their support to the reform was indispensible for its future and legitimacy. Once they understood privatization was not negotiable, managers used their influence to promote a "good privatization," encouraging the inclusion of performance targets for the private operator. These measures would improve efficiency in the institutions they would soon be responsible for, while securing the sector's financial equilibrium and the increased availability of water resources.

The strength of employees' unions in the water sector forced their demands on the reform process. After a strike that deprived Dakar of water for a few days, the sector's workers were guaranteed continued employment and benefits in the new structures, and they accepted the reform. No popular opposition emerged during the reform process. Information about the

changes to come was scant, and most Dakar residents ignored water distribution was being privatized.

Consensus-building efforts accompanied the entire reform process. International consultants contributed to these efforts, backing neoliberal measures with their expert knowledge. The national media relayed the benefits of the reform. Colloquiums and seminars promoted sustainable development and the neoliberal management of water services. Participation effectively stimulated consensus and the support a few unavoidable stakeholders for the reform, and legitimized decisions that had already been made. Consultations officially validated the government's and World Bank's decisions. Committees and seminars gave the opportunity to a few to elaborate measures along prescribed orientations. The various components of the reform were then made binding by law and contracts, giving the appearance of a democratic and consensual endorsement of the reform.

The reform process did not contribute democratic progress in Senegal. It did not help fight corruption in the public sector, increase accountability, or foster a democratic polity. Externally imposed policies and required show of political will by the government constrained the policy process. Passing the law that endorsed the sector's reorganization rested on convincing all deputies from the ruling party. IFIs' conditionalities induced more political maneuvering and a parody of participation to impose the reform. Contracts for studies and construction works financed by international loans were opportunities for business, bribes and supplementary income that nourished political clientelism. Senegalese elites found ways to make their interests coincide with IFIs' imposed measures and lending.

But the reform comprised the necessary elements of a neoliberal sustainable development success: participation, efficient management, social measures, and environmental protection. Financial considerations determined the sector's investments and reorganization. Managing water services was a matter of increasing their financially sustainable exploitation.

The reform's "environmental" measures consisted in the efficient allocation of water resources. The requirements of a "lasting" development were not considered beyond financial needs.

The environmental studies for the investment projects that accompanied the reform served an ideological purpose, rather than attempt to preserve water resources. The known negative impacts of investments were minimized or ignored, while the lack of knowledge about water resources made it impossible to fully anticipate the consequences of investments. The need for sanitation development was overlooked despite the increased water consumption that would result from investments. The studies did not address the impacts of the new institutional setup on water resources, when their private management and separation from sanitation activities would induce their overexploitation and pollution.

The social and economic impacts of the reform were equally disregarded. The social dimension of the reform was limited to maintaining social connections to both the water supply and sanitation networks and a cross-subsidized social price of water that would prove counter-effective in ensuring supply to the poor.

After the reform was in place, sustainable development was used to support further liberalization measures. But water sector decisions remained oblivious to the few grassroots initiatives addressed sustainable water management. Resulting documents proposed management practices and equitable water uses that did not always suit the neoliberal version of sustainable development. The government widely publicized these documents as sustainable development and participatory efforts, but never validated them as policy tools.

The implementation of the water sector reform in Senegal is an exemplary case of the workings of the hegemonic consensus. During the reform process, few questions were asked about the legitimacy of privatization, and none were raised on cost-recovery pricing, access based on effective demand, or on sustainable development in the water sector. The reform pertained to sustainable development. It was good for the environment and good for people. It

was an institutional progress toward efficiency, and therefore financial, social and environmental sustainability.

The reform opened further the Senegalese economy and its natural resources to international business interests. It turned water distribution into a profitable activity, and made more water available for activities with strong effective demand, thus allowing Senegal to better contribute to global capitalist growth. But water diverted towards profit-making activities is not available for local needs and less efficient activities, and thus unlikely to help improve the lives of the majority of the Senegalese people.

Chapter 6

Toward Neoliberal Sustainable Development and Water Resource Management

"Sustainable development" is a contested notion. Its definition and operationalization raise important stakes affecting the meaning, purpose and legitimacy of development, and with them development activities and actors.

This chapter argues that the commonly accepted notion of sustainable development is a neoliberal economic concept that marginalized ecological concerns in order to support profit-making activities and an economic growth-type of development. Thus conceptualized, sustainable development gave new legitimacy to neoliberal economic policies and the expansion of the world capitalist economy. The ideological dimension of the concept wrapped neoliberal economic policies in the good intentions of environmental protection, social equity and democratic participation. When applied to water resources development, this notion of sustainable development encouraged the privatization and commercial management of water services, while promoting the belief that these measures contribute to an equitable access to water services and to the sustainability of water resources.

To understand the emergence and domination of sustainable development as a neoliberal economic concept and its translation into water privatization policy, this chapter investigates how the relationship between environmental problems and development was handled within the United Nations system, and how this management evolved over the years. It examines the emergence of sustainable development as an international policy guideline and its application to the management of water resources, considering the forces at play behind this evolution and its significance for development and environmental sustainability. This chapter shows the role of the UN in the elaboration and spread of the neoliberal notion of sustainable development, and in the adoption of corresponding water sector reforms in developing countries.

Three periods are identified in the UN approach to the environment-development relationship. During the first period (1945-1965), two opposed perspectives emerged proposing different solutions to this conflicting relationship. The primary concerns of one tendency were ecological while that of the other were economic. During the second period (1965-1980), the economic perspective became prominent and developed as the basis for environment policies. The ecological approach was forced to compromise and was ostracized from policymaking. During the third period (1980-today), the economic management of environmental problems reached hegemony: it became the uncontested common sense policy that no longer needs to justify itself.

This chapter shows that the prominence of the economic management of environmental issues reflected the increasing domination of neoliberal economic interests within the international political economy and the UN system. Global neoliberal strides were paralleled by the growing influence of the international business sector and lending agencies on the UN environmental agenda and management decisions, and by the elaboration of a policy discourse that couched these actors' interests and strategies in terms of universal values and common good. Sustainable development was a critical component in the elaboration of this discourse, endorsing the economic management of the environment and growth as an all-purpose solution.

I. 1945-1965: Uneasy Coexistence

During the first period, two perspectives on the relationship between the environment and development emerged within the UN system: an ecological perspective concerned with the conservation of nature, and an economic perspective geared to the exploitation of natural resources for development. Both perspectives recognized the negative environmental impacts of development and industrialization but disagreed on priorities and solutions.

If the two perspectives were expressed, the economic approach dominated official statements and policy orientations for natural resources development and environmental damage management. The diversity of state interests after World War II and the initial degree of

independence of UN agencies explain the emergence of an ecological perspective critical of the development process. But states' competition for growth and power and the institutional setup of the UN explain the domination of the economic perspective.

Reflecting the tensions between the exploitation and conservation of natural resources, the institutional setup of the UN entrenched a de facto sectoral management of these resources and environmental issues. Water resources were subjected to the same fate: an ecological approach to their management developed, but their sectoral management was institutionalized and policies for water management and service development were economically driven.

C. Opposing perspectives within the UN.

1. State competition over natural resources and calls for their preservation.

During the first period, the international political economy was characterized by the divide between "social market economies" with state intervention, development planning and the provision of public services in the West and communist economies in the East.

After World War II, the need to increase the exploitation of natural resources and to conserve them was very much on the international agenda. Reconstruction and rearmament required securing access and massively increasing the exploitation of natural resources and raw materials in developing countries. National control over natural resources became a primary stake among Western powers. Post-war international treaties reflected the eagerness to ensure availability and access to natural resources. They referred to the need for developing the productive resources of all member states and encouraged the full use of the resources of the world to contribute to a balanced and expanding world economy.[127] The UN Programme for Technical Assistance to Under-developed Countries (1948) was established to transfer skills and

[127] See the Atlantic Charter (1941) and the articles of agreement of the Bretton Woods institutions (1944) and the preamble of the General Agreement on Tariffs and Trade (1948)

promote reforms in these countries toward more effective and productive uses of natural resources.[128]

At the same time, industrialized states recognized the need to protect natural resources and use them wisely. They now perceived resource scarcity as both an obstacle to growth and a cause of war.[129] Thus, while entering a harsh competition over natural resources, industrialized states called for international cooperation to protect natural resources and ensure their satisfactory distribution among states.

In the 1950s, the Cold War and the arms race only intensified pressure on natural resources, while developing countries began confronting industrial countries over the use of their natural resources, and criticized the unequal international economic system. As a result of these tensions, competition over natural resources made any serious search for their conservation unlikely.

During this period, water resources emerged as an international concern. Water pollution was becoming an economic threat in Europe and had visible consequences on human health. In developing countries' urban areas, the need for water supply and sanitation services was becoming urgent and called for development assistance.

2. Intellectual independence within the UN.

Within the UN system, in its early years, many ideas and interests were fostered and confronted each other (Emmerij, Jolly, & Weiss, 2001). The equality of member states (one state-one vote) and the possibility for them to regroup around common concerns provided a platform for weaker states to promote their interests or express their grievances. The initial high degree of intellectual independence of agencies' secretariats provided space for developing original ideas and strategies (Weiss, Carayannis, Emmerij, & Jolly, 2005). These particularities allowed UNESCO to elaborate an ecological critique of the development process. This also

[128] Technical assistance for the development of under-developed countries (President Truman's point IV) began with the creation of the UN.
[129] In a letter addressed to the US representative to ECOSOC dated 4 September 1946, President Truman expressed his belief that safeguarding natural resources was the basis for maintaining peace.

allowed developing countries to formulate an economic critique of the international economic system.

The Economic Commission for Latin America and sovereignty over natural resources.

A strong criticism of the international economic system emerged within the UN in the late 1940s. The Economic Commission for Latin America (ECLA) elaborated a critique of trade relations between developed and developing countries—relations which were based on the commercial policies and terms of trade imposed by developed countries (Prebisch, 1950). The Commission claimed that to promote a more equitable development, developing countries should be able to use their natural resources for their own development, and proposed the establishment of quotas for primary commodities, buffer stocks, and higher and less volatile prices, encouraging a type of protected industrialization to substitute for imported manufactured goods. This criticism, however, did not consider the need to conserve natural resources, nor the ecological and social consequences of the destruction, by the North or the South, of the environment in the South. The attack from the South did not question the development model or its ecological implications. But developing countries' claim for sovereignty over their natural resources anticipated their later position on environmental issues: the pursuit of economic growth and the exploitation of natural resources toward that end would not be hindered by environmental concerns.

UNESCO's ecological critique of the Western development model.

As part of its scientific mandate, UNESCO began working on the ecological significance of development, and made recommendations to address environmental problems that had discomforting implications for economic activities.[130] Concerned with biological productivity, UNESCO developed perspective that integrated resource use and conservation based the interrelationships between ecological processes and natural resources (UNESCO, 1965a). Conservation was about resource use, natural cycles, and the perturbations and irreversible

[130] See the Arid Zones (1948) and Natural Resources Research (1955) programmes (merged under the Advisory Committee on Natural Resource Research in 1965), the International Biological Programme (IBP, 1964).

processes set in motion by human actions. This had serious implications for development projects intended on industrialization and intensive agriculture (UNESCO, 1965b).

UNESCO ecological studies were critical of Western development and the economic growth model. Human civilization was dependent on the natural environment and its exhaustible resources, and natural limits were being exceeded. The European-type exploitation of natural resources was abusive. New technological power destroyed resource renewal capacities. In developing areas where the environment was little known, applying western technology (agricultural or industrial methods) led to failures (White, 1963).[131] Malnutrition was rampant in areas where development projects had created irreversible environmental damage. Technologies developed in one set of ecological conditions could not simply be transferred to an entirely different set. Productivity was biological (the conversion of solar energy into organic matter) and determined the maximum utilization of natural resources (Baer, 1967; Worthington, 1973).[132] Finally, Western optimism about natural resources implied a disregard for the poverty of the other half of the world.

The environment was under serious threat and had to be protected. To raise this awareness, UNESCO created the International Union for the Protection of Nature (IUPN, later IUCN) in 1948, and in 1949 held a conference to specifically address nature's protection from an ecological standpoint. The International Technical Conference on the Protection of Nature (Lake Success, 1949) considered that an ecologically sustainable development required adjusting man's demands to natural stocks and to the earth regeneration capacity (UNESCO, 1949).

Ecology was the scientific basis for the rational use and conservation of natural resources, and should guide development planning. The criteria for decisions should not be material success but ecological consequences. The conference called for precaution. More

[131] See the UN Conference on the Application of Science and Technology for the Benefit of Less-Developed Regions (Geneva, 1963).
[132] See UNESCO International Biological Programme (IBP, 1964).

knowledge was needed about natural processes and their interactions with human actions before increasing further natural resources exploitation.

Acknowledging that development and conservation were power and economic issues, the conference underlined that nature's protection was an afterthought of development projects. No ecologically valid solution would be implemented as long as decision power rested with those who economically benefited from development projects (engineers, promoters, contractors). The conference called for the establishment of independent review boards responsible for preliminary studies of large projects and for guiding corporations' activities—boards with the authority to deny or modify projects and activities and whose decisions governments would take into account. These recommendations were never implemented.

D. UN institutional setup and the sectoral management of natural resources.

No environmental organization per se was agreed upon in 1945. The UN institutional setup reflected the tension between the exploitation of natural resources and their conservation and entrenched their separation. The two objectives were entrusted to different agencies. The Food and Agriculture Organization (FAO) was assigned responsibility for natural resources management and agricultural productivity, while UNESCO took the lead in conservation. Conservation and exploitation considerations would therefore develop separately, carried by different and conflicting objectives and promoting contrary policies. Each UN agency handled environmental issues for different purposes. Nature would not be addressed as an integrated entity with its own processes and requirements, but piecemeal based on sectoral concerns. This gave more leeway to the economic management of natural resources geared to increasing their exploitation.

Each UN agency approached water issues based on its particular mandate and with its specific tools, and dealt with different aspects of water pollution: the FAO was concerned with ensuring yields for food production and quality water for fisheries; the International Atomic

Energy Agency (IAEA) with the disposal of radioactive waste; the World Health Organization (WHO) for its impact on health and the requirements for safe water supplies (Key, 1956).[133] The Economic Commission for Europe (ECE), an economic purpose organ, was concerned with the economic cost of water pollution as industrial and urban waste polluted seas and rivers and threatened the fishing industry (Berthelot, 2004). As controlling watercourse pollution required international cooperation, the ECE called for an international conference on water pollution.

UNESCO approached pollution as a biological problem and developed the only ecologically integrated approach of water as a natural resource. Pollution was a biological problem. UNESCO programmes studied hydrology in relation to ecology and conservation (Arid Zones, 1948; Natural Resource Research, 1955; International Hydrological Programme, 1975). Scientific hydrology was needed to determine water management, rational use and conservation, and to inform decisions on water systems. But these studies would never be the basis for water resource management and development policies.

E. The economic perspective dominates.

1. Economic perspective against ecological threats.

Ecological recommendations threatening economic activities were unacceptable to states concerned with economic growth. The economic perspective on environmental issues developed in response to these threats and to the economic cost of environmental degradation.

The UN Scientific Conference for the Conservation and Utilization of Resources.

When in 1946, President Truman proposed holding a conference on the conservation and utilization of natural resources, the proposal was met by immediate warnings: nature's protection should not interfere with economic life. Conservation techniques should try to reconcile nature's protection with man's occupation.[134] The economic implications of nature's protection were all too obvious.

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[133] Reports on surface and ground water pollution were compiled in 1953 and 1956 respectively.
[134] See the European and African Technical Symposium held in Fontainebleau, France, 1-6 October 1948.

The UN Scientific Conference for the Conservation and Utilization of Resources (UNSCCUR; Lake Success, 1949) was a political initiative with an economic purpose (UNESCO, 1948). During this gathering of experts (economists, engineers, sociologists, natural scientists), all agreed that industrial development would lead to the unavoidable depletion of mineral resources, that reducing their consumption meant seriously impairing the welfare of the major nations, and that the reckless use of resources by one nation imperiled the others and should be banned (UNESCO, 1949). But participants held different views on how to handle these problems.

For those ecologically driven, the conservation of resources was needed for the sake of the future and could not be achieved with economic instruments. A price system could not act as a conservation force; no mechanism could equate future needs and social costs with present practices. This perspective was countered by those claiming that industrialization was the "higher stage of human culture," that science would increase available supplies and their effective use, thus promoting industrial development while postponing exhaustion. Science would reconcile development with nature's conservation. The belief in science provided an escape from considering the need to modify the economic system.

For those intended on economic growth, resource depletion was a normal process, and a competitive market system was best for conservation, leading to the economically efficient use of resources and therefore to long-term optimum between present and future uses. Resource development should be assessed by considering the costs and benefits of conservation and utilization. Conservation was about reducing waste—an economic objective. As natural resources were economically interdependent, their conservation required an integrated development: jointly planning the development of industry, energy, agriculture and resources in a given area so that resources would be economically conserved. This view dominated the first UN environment-related conference.

The International Conference on Water Pollution Problems in Europe.

The Economic Commission for Europe (ECE) approached water pollution problems from an economic standpoint. For the Conference on Water Pollution Problems in Europe (Geneva, 1961), water pollution was an economic problem to be handled with economic instruments (Cuperus, 1963; United Nations & ECE, 1961). Governments were interested in solving the financial problems of water pollution and pollution control. Fighting pollution meant considering its economic damage, the most economical prevention or treatment methods, the degree to which control justified expenditures, and who should bear the costs.

2. Sectoral approach and economic management.

The ECE handling of water pollution was sectoral and encouraged the economic management of water resources. Similarly, the lack of adequate water supply and waste disposal in developing countries' growing urban areas was addressed as a development and financial issue divorced from water resource considerations. Demand for water and sewerage services was large and the economic criteria could be met.

In 1959, the WHO launched its Community Water Supply program to promote the provision of safe water and basic sanitary services (Pineo & Subrahmanyam, 1975), and in 1960, the International Development Association (IDA) concentrated its soft lending on urban projects. The WHO was responsible for these projects' pre-investment studies. This first collaboration between the WHO and a financial institution anticipated the future role this agency would play in the participation of the private sector in water policymaking and the development of neoliberal water policies.

Thus, most issues raised by the uneasy coexistence between environmental conservation and economic development, and the solutions to address them, were laid out during the first period in the UN handling of environmental issues. The approach that would dominate the management of natural resources was clear: resource management and conservation were economic issues. Science and economic instruments would reconcile conservation with growth.

The institutional separation of environmental issues between UN agencies not only made an ecologically integrated management of the environment impossible, but also facilitated the economic handling of natural resources and environmental degradation. Scientific ecology developed within the UN independently from and contrary to dominant political and economic interests. Conservation was the concern of a minority of experts without political backing.

II. 1965-1980: Taking Over

Between 1965 and 1980, neoliberals fought back oppositions to the industrial capitalist development model, and economic rationality developed as the basis for natural resources and environmental policies. Ecological opposition was fought primarily ideologically within the UN, where this perspective was forced to compromise and was ostracized from policymaking.

The embrace of development as growth and industrialization was the working assumption of both industrial and developing countries. The belief that poverty and development problems would be overcome with economic growth prevailed. International assistance was strongly involved in projects for the exploration of natural resources in developing countries. Because of their importance for economic development, water resources had to be efficiently managed. “Integrated” water policies were elaborated for that purpose, while the neoliberal policy discourse spread the belief that these policies would ensure the satisfaction of basic needs and resource preservation.

A. Western powers under pressure.

At the beginning of the period, Western powers were under pressure from various claims over natural resources and criticisms of the capitalist economic system. They were caught up between the competition they fought among themselves, the communist threat, and opposition from developing countries whose strength grew with independence. Ecology, which was developing as a political platform, added to these criticisms.

1. Southern opposition.

Developing countries' call for permanent sovereignty over their natural resources and for an international order more favorable to their economic growth grew stronger with independence in the early 1960s. The confrontation between industrial and developing countries over natural resources intensified with the rising prices of raw materials resulting from alliances such as the Afro-Asian Conference (1955), the Organization of Petroleum Exporting Countries (OPEC, 1960) or the Group of 77 (1964).

As more developing countries became member states of the UN, the General Assembly's resolutions reflected their positions, and their concerns were embedded in certain agencies. Seeking to reduce developing countries' dependence on exports of primary products, the UN Conference on Trade and Development (UNCTAD) reaffirmed the sovereign right to trade and dispose of natural resources. The General Assembly recognized that the exercise of permanent sovereignty over natural resources would promote development, and recommended that developing countries exploit and market their natural resources.[135] Permanent sovereignty over natural wealth and resources was included in the International Covenant on Economic, Social and Cultural Rights (1966).

The beginning of the 1970s, which saw the Yom Kippur war, the Arab oil embargo and large-scale nationalizations in many countries, encouraged developing countries' assertive attitude in international affairs. Their criticism of the international economic system culminated with the adoption of the New International Economic Order (NIEO) in 1974.[136] But this momentum would be short lived.

2. Ecological opposition.

In the 1960s and 1970s, as awareness that the human environment was at risk and the tension between economic growth and conservation were growing, ecology developed as a

[135] In 1962, the GA adopted the Declaration on the Permanent Sovereignty over Natural Resources (Res 1803 (XVII)).
[136] General Assembly Resolution A/RES/S-6/3201 of 1 May 1974.

political platform. The extent of natural resource depletion and environmental degradation were coming to the fore. Their consequences were becoming more visible with the effects of DDT products and other harmful chemicals, tanker disasters, water contamination, waste discharge, nuclear testing, population growth and the unrestricted use of natural resources (Dunlap, 2008).

The 1972 publication of *The Limits to Growth* by the Club of Rome increased awareness about the environment-development problematic, and spread the notion that development had a limit dependent on the availability of the earth's resources. The report concluded that to avoid the collapse of the world system, population and economic growth had to be halted (Meadows & Club of Rome, 1972). Development circles stood firm against this pessimistic view.

B. The ideological fight against ecological opposition.

For industrial countries, if the call for national sovereignty over resources was compounded with strong notions of conservation, ecological requirements and irrational Western development, not only their access to natural resources may be jeopardized, but the entire basis of their continued economic growth would be threatened. The criticism of the international economic system and calls for sovereignty over natural resources could not be combined with the ecological criticism of the Western development model at a time of harsh competition among themselves and with the Soviet Union.

1. The international economic crisis and the North-South dialogue.

Developed countries objected that permanent sovereignty over natural resources would hinder the expansion of the world economy and the efforts to increase the flow of private capital, i.e. limit their economic growth. Developing countries had to be maintained in the role of providers of primary commodities. But worldwide economic recession took care of the problem. Unemployment in Western countries, monetary instability, declining exports and terms of trade of minerals (except oil) and other primary commodities, decrease in the flow of foreign investment in natural resource projects, increasing debt service, and risky political climate in

developing countries reversed the little leverage they had mustered. The call for national control over natural resources faded. A new 'spirit of cooperation' emerged, crystallized by the 1975 Paris Conference on International Economic Cooperation, the "North-South" dialogue.

2. Ecology compromised: reconciliation and slipping meanings.

The UN played an ideological role in fighting ecological opposition and promoting neoliberal environmental policies. Official UN declarations recognized the global nature of environmental problems and the interactions between environment and development, but reflecting both industrial and developing countries' interests made clear that environmental concerns could not threaten development objectives (Ozorio de Almeida, Beckerman, Sachs, & Corea, 1972). International conferences were instrumental in the effort to reconcile environmental protection with economic growth and promote economic rationality in the management of environmental services.

UNESCO's ecological perspective with its critique of industrial development developed as an independent scientific endeavor until the mid-1960s. The ecological perspective was then directly challenged. States and development agencies put pressures on UNESCO to integrate economic and social factors as essential to the management of natural resources.

After 1965, UNESCO began introducing economic parameters and encouraged cost-effectiveness in project planning (UNESCO, 1968a). This new orientation led the Biosphere Conference (Paris, 1968) to present contradictory statements and perspectives, trying to reconcile nature's preservation with Western type growth—for which it was commended by ECOSOC and dominant international actors.

UNESCO's scientific work had developed an ecologically integrated approach to natural resources management based on nature's requirements and limits. The integration of economic factors, however, led to the lumping of all factors, ignoring any specific relationship, hierarchy or ordering principle among them. This un-organic and un-organized integration allowed neoliberals to impose economic considerations as determining management factors while

claiming, and appearing, to promote conservation. This marked the beginning of the hegemony of the economic management of environmental issues.

The Biosphere Conference.

The UNESCO Conference on the Scientific Basis for the Rational Use and Conservation of the Resources of the Biosphere promoted side by side ecological considerations and economic rationality (UNESCO, 1968b). To maintain the biosphere's productivity, the conference recommended that technical assistance and investment projects take ecological interactions and long-term concerns into account through the rational use and conservation of natural resources.

The "wise" and "rational" use of resources would solve the contradiction between consumption and preservation. But trapped by the economic imperative and induced by economics' claim to science, the meaning of "scientific," "wise" and "rational" was slipping away from ecology. The use of these terms in a "lumping" integration context helped the transition from promoting the ecologically rational use of resources to their economically rational management.

From then on, natural resources policies were rational when they promoted these resources' efficient economic management. As environmental assets were an economic concern, economic mechanisms would reconcile the need for increased exploitation with environmental preservation. UN agencies would no longer consider the implications of environmental protection for development, but endeavor to present development and preservation as mutually supportive. The ecological rationality in resource management gave way to economic rationality and instruments.

The South: environmental problems as lack of development.

Developing countries' stance against environmental considerations and the environment-development opposition facilitated neoliberal inroads. Developing countries perceived ecological considerations as a threat to their economic development. They rejected calls for environmental protection and standards as potential trade discrimination measures,

and a luxury for rich countries. They insisted on differentiating between the types and causes of environmental problems in the North and the South. In the North, environmental problems resulted from high levels of economic development. Furthermore, responsible for pollution with worldwide impact, industrial countries should bear the cost of corrective measures.[137] In the South, industrial pollution and waste discharge hardly existed, while natural assets and resources were abundant. Environmental problems reflected poverty and lack of development. The solution was more development, more international assistance, and respect for sovereign rights (Founex, 1972).

The UN Conference on the Human Environment (Stockholm, 1972) endorsed developing countries' position (UNEP, 1981). The conference recognized that for the most part the environmental concerns of developed countries would be costly to developing countries, impacting trade, aid and technology transfer, and required additional assistance. Developing countries' environmental problems would be best remedied by accelerated development through financial and technical assistance. No serious attempt was made to avoid the replication by the South of the environmental problems created by Western development.

Rational planning negates environmental limits.

The Stockholm Conference on the Human Environment contributed to solidify the reconciliation between environment and development.[138] The environment-development relationship was the main stake of the conference. The two had to be integrated so that environmental declarations could not be used as instruments for anti-development and conservationist policies, and protecting the environment could be pursued in "harmony" with the goals of development. The vague, all-encompassing and anthropocentric term "human environment," preferred to the scientific notion of the "biosphere," was instrumental in achieving this harmony (Founex, 1972). The human environment included water, housing,

[137] GA resolution 2849 (XXVI) of 20 December 1971.
[138] The conference had been called for by the Swedish government at the time of the Biosphere Conference in 1968. It was held in Stockholm (Sweden), 5-16 June 1972.

sanitation, nutrition, disease, and natural disasters. Development, whose goal was to enhance the human environment, was the perfect cure. Such rhetorical reconciliation helped diffuse conflicts between environment and development objectives.

The Stockholm Declaration reaffirmed that rational planning using economic instruments reconciled environmental protection and development goals (UNEP, 1981). Implementing economic incentives such as taxes, effluent charges, subsidies, regulations, and standards based on cost-benefit calculations would reduce pollution by integrating environmental externalities and social costs into planning policies. Environmental considerations were a comparative advantage that determined the opportunities for industrial development.

The conference called for preserving the environment for future generations, but ignored the particular nature of non-renewable resources, which could be "employed in such a way as 'to guard against the danger of their future exhaustion'" (Stockholm Declaration Principle 5). Denying that the use of these resources led inevitably to their exhaustion implied that industrialization and limitless growth could be sustainable. This was a direct rebuttal of the fearful assertions made in *The Limits to Growth*.

After Stockholm, UN appeals and resolutions on protecting natural resources and ecosystems in the interests of present and future generations followed one another.[139] Guidelines for the management of nature and its resources promoted rational planning for the sake of development, assuming that resource preservation was a natural part of the process.

C. Developing neoliberal water policies.

Neoliberal economic strategies were applied to water management policies by promoting economic rationality as most fitted to address the urgent need for water services in developing countries and by involving the private sector in water policymaking.

[139] See for example the World Charter for Nature (1982).

1. Economic rationality and private sector involvement.

From the 1960s, numerous national and international water conferences and symposia were organized: water quality and quantities were important for economic activities and human needs. In the 1970s, the sense of a world water crisis was emerging, spurred by population growth, industrial, agricultural and urban water needs, and the irrational use and pollution of water resources. Improving water supply and management in developing countries became everybody's business. The Second UN Development Decade (1970-80) set the first international goals for water supply.[140]

With cities as engines of growth, water services in urban areas were particularly important. The Stockholm Conference recommended focusing international assistance on improving water supply and sewerage in human settlements, giving priority to research in water supply and waste disposal systems and to water resource assessment and management. The World Bank began funding "urban environment" projects (1972) of which water infrastructure was a large component. Urban water services were also a primary concern for the UN Conference on Human Settlements (UN-Habitat), established in 1976 (Vancouver).

But the current investment trends would not allow reaching the Decade water targets. Appropriate strategies for water resources development and management were needed: developing water services based on households' effective demand, pricing policies and low-cost technologies. In its work on water, the WHO suggested to redirect investments toward technology innovations appropriate to local situations and community self-help projects (Pineo & Subrahmanyam, 1975; WHO, 1973). With facilities people could afford, communities could pay for the development of water services. This was the first step toward treating water supply and sanitation as market rather than public services, making people pay for the quality and level

[140] The Decade's goal for water was to provide all urban dwellers with safe water supplies through domestic connections (60%) and standpost (40%), and reasonable access (200 meters max from dwellings) to 25% of the rural population by 1980.

of service they could afford, with no regards for the quality of service, environmental impacts, and the inequalities created.

The status of water services, not only as public services, but also as a right, was a main stake. Expectations of basic sanitary amenities as a right rather than "goods" were rising in developing countries' urban areas. Many within the UN accepted the idea of access to water as a right.[141] But approaching water resources and services as economic goods was aggressively promoted. Strategies for their efficient management based on pricing policies were called for.

Mar de Plata - Integrated water management.

The 1977 UN Water Conference (Mar del Plata) was the first attempt at an internationally coordinated "integrated water resource management" along neoliberal tenets.[142] This approach integrated the objectives of providing water supply to satisfy human needs, economic activities, and resource preservation (Mar del Plata Action Plan). As economic instruments now reconciled growth and environmental protection, water resource preservation could be integrated into water development policies. Appropriate pricing would ensure integration, encouraging efficient water use and financing the costs of operation of infrastructure with due regard to social and environmental objectives. The conference called for a better assessment of available resources and patterns of demands, not to determine pollution thresholds or renewability requirements, but to facilitate supply and demand equilibrium.

2. The birth of partnerships.

The creation of the Water and Sanitation Program (WSP) in 1979 was the first step for involving the private sector as partner in water policymaking. The World Bank and the UN Development Programme (UNDP) established this multi-donor water partnership to further develop principles and strategies based on cost-effective management and technologies to provide water services to the world's poor.

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[141] The International Conference on Primary Health Care (Alma Ata, USSR, 1978), for example, asserted that primary health care included an adequate supply of safe water and basic sanitation, thus establishing water services as requirements for the realization of a human right (Declaration of Alma Ata).

[142] The conference was an initiative of the ECOSOC Committee on Natural Resources (established in 1970).

D. Ecology is marginalized.

As economic neoliberalism took over environmental issues, overall ecological concerns and perspectives were marginalized within the UN. The environment was no longer left to natural scientists. Any serious management was economically rational.

1. UNESCO hydrological studies.

In parallel to the development of official water policy guidelines, UNESCO pursued its work on hydrology, biology, and pollution, assessing water resources and gathering knowledge on hydrosphere processes and the influence of man on the hydrological cycle (Rzoska, 1970; UNESCO, 1972); (Slivitzki, 1974). Studies showed, for example, that industrial and sewage waste was bringing nitrogen and phosphorus to lakes and rivers in quantities that resulted in ecosystem changes of alarming proportion (International Biological Programme, 1964-1972) (Rzoska, 1970). With a limited reservoir of oxygen, freshwater bodies could not cope with a surplus of organic nutrients beyond biological equilibrium, and faced eutrophication.

After 1975, the International Hydrological Programme (IHP, 1975-) addressed the influence of irrigation, urbanization, land use, etc. on the water cycle. Among other areas, the Programme focused on urban and industrial hydrological subsystems (UNESCO, 1978). IHP studies on the urban hydrological cycle and the hydrological effects of changes in land use deplored that in the urban planning process water issues were considered too late and the interrelationships between water and urban factors were overlooked or oversimplified.

IHP studies, which could have served as the ecological basis for the sustainable development of urban water resources, did not inform water management policies. Hydrology and its interactions with the urban environment were never part of the 'integrated management' of water resources or neoliberal water sector reforms.

2. Ecology's last gasps.

A few ecology-minded and equity-centered activities took place within the UN during the second period. The Cocoyoc Symposium (1974) was the last major manifestation of these

concerns, focusing on inequalities, basic needs and natural limits (UNEP & UNCTAD, 1975).[143] The Symposium asserted that poverty resulted from inadequate social and economic distribution and use of resources rather than their scarcity and lack of development. Market mechanisms made resources available to those who could pay for them rather than those who needed them. Growth not conducive to the satisfaction of basic needs betrayed the idea of development. The Cocoyoc Declaration called for the satisfaction of basic needs without transgressing the limits of natural systems, and for national self-reliance (UNEP & UNCTAD, 1975).

The Symposium rejected the duplication by developing countries of the Western model, and sought to redefine the goals of development: introducing environmental dimensions into the development process would lead to a different kind of international economic order. The path did not lie in an optimistic belief in technological solutions, but in the appreciation of environmental constraints and the search for development styles and methods that would preserve environmental assets. The Symposium did not give priority to economic progress above all, nor put conditions on the need to preserve the environment.

At around the same time, the UN Environment Programme (UNEP) developed the notion of eco-development: a development consistent with the natural potentials of each particular area, with natural resource use, technological and organizational methods respecting natural ecosystems and social and cultural patterns (UNEP, 1975).

The last major internationally visible ecological statement was the IUCN *Conservation Strategy* (IUCN, UNEP, & WWF, 1980). This document introduced the notion of "sustainable

[143] UNEP and UNCTAD organized the Symposium, which was headed by Barbara Ward. Barbara Ward, a British economist, was a heterodox figure in international development circles. Urging Western governments to share their prosperity with the rest of the world, she added environmental questions to her attention in the 1960s. In 1966, she published *Spaceship Earth* (Ward, 1966). For Ward, wealth distribution and natural resource conservation were closely connected, and combining them was a rational policy. Careful husbandry of the Earth was a requirement for human survival and for the creation of decent ways of life for all. Ward referred to the "inner limits" of the human right to an adequate standard of living and to the "outer limits" of what the Earth can sustain. Even if they never used the term, she is seen with Rene Dubos as one of the parents of the concept of sustainable development. In 1972, they co-authored *Only One Earth: The Care and Maintenance of a Small Planet* (Ward & Dubos, 1972), a report commissioned by Maurice Strong for the Stockholm Conference.

development," a concept based on ecological considerations and their economic implications. The *Strategy* encouraged a type of development aiming at improving people's quality of life while preserving the vitality and diversity of the earth. Sustainable development combined ecological requirements with national self-reliance and the satisfaction of basic needs, prompting reflections on the unequal situation between Third World and industrialized countries.[144] The *Strategy* questioned the purpose, content and significance of development, as well as the legitimacy of liberal economic policies and the capitalist world order.

The UN General Assembly endorsed the IUCN report, but linking the environment to a basic needs strategy for development was rejected as official UN policy guideline. Self-reliance was progressively presented as a utopia. Thus, socio-ecological calls were ignored and, while social and environmental problems were becoming more urgent, the economic management of environmental issues was making inroads as the only rational policy.

III. 1980-Onward: Hegemony

After the 1980s, the neoliberal economic management of environmental issues reached hegemony and neoliberal water policies became the norm, reflecting the interests of powerful international actors and the search for economic growth. Economic rationality took hold, while ecological considerations were further lost to business interests. Neoliberal economic interests came to dominate the international political economy and the UN contributed to build consensus around neoliberal policies through the elaboration of a neoliberal notion of sustainable development that could support these policies. Neoliberal water strategies reached hegemony as they were connected to sustainable development. This evolution was accompanied by a process that redistributed roles within the UN: the World Bank took leadership in setting the environmental agenda and the private sector became a legitimate actor in the elaboration of water policies.

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[144] See Nouvelles de l'Eco-développement edited by Ignacy Sachs.

A. The neoliberal offensive engulfs the international political economy.

1. Structural Adjustment Programmes: reducing public services.

In the 1980s, the debt crisis further constrained developing countries and tightened their dependence on the North. For industrial countries, the debt crisis provided the opportunity for a neoliberal economic offensive away from state intervention and economic planning (Bennett & DiLorenzo, 1993). Structural Adjustment Programmes (SAPs) were put in place by the World Bank and the International Monetary Fund (IMF) in many developing countries. Credits were agreed upon the endorsement of policies to liberalize agriculture trade, deregulate labor markets, cut government budgets, and rationalize the management of public enterprises, increasing the prices of services and reducing subsidies. The global trend toward privatization and economic liberalization was gaining momentum. Growth would take place through market forces and private enterprises. Power was passing into the hands of foreign investors and creditors, and domestic groups linked to the international economy.

2. The end of the communist threat and globalization.

The fall of the Berlin wall and the reunification of Germany marked the end of the 1980s, while the Soviet Union officially ceased to exist in 1991, celebrating the end of the Cold War and the communist threat as an official alternative to capitalism. The globalization of trade and finance that followed was dominated by the G7 agenda. Globalization, it was asserted, would create wealth and solve human welfare problems. Most states took measures to let market forces operate more freely and privatized public services. Social and economic planning instruments were banned and public institutions eroded. Financial and commercial institutions ignoring the social implications of their actions became more powerful, while responsibility for absorbing the damage fell onto non-governmental agencies and weakened communities. Some countries were able to take advantage of the new opportunities at the price of growing internal inequalities, but

rather than rapid growth and poverty reduction most experienced social tensions, civil strife and declining standards of living.

The 1990s shook off any lingering doubts about growth and technology and restored confidence in the universal applicability of the western path. Poverty alleviation, free trade, and technological innovation were mutually enhancing. Liberalization engulfed basic services and secured their commodification, as the IFIs and bi-lateral lenders pushed privatization policies upon services such as health, education, water, and electricity—strategic sectors providing services considered so far public responsibilities and social goods that ought to be under national sovereignty.

B. Consensus-building and leadership.

1. Building-consensus: an ideological undertaking.

After the disastrous impacts of Structural Adjustment Programmes (SAPs), systemic problems were rhetorically adjusted. The situation in developing countries worsened dramatically: declining standards of living, declining terms of trade for primary commodities, rising poverty and overwhelming urbanization. Various UN organs brought evidence of the negative impact of stabilization and adjustment policies on distribution and poverty (Cornia, Jolly, & Stewart, 1987; UNDP, 1990a). They advocated policies to stimulate growth while improving health and education. These criticisms led to new international development rhetoric and mottos such as adjustment with a human face, human development, and poverty alleviation. This contributed to the development of new indicators but had little impact on policies. Sustainable development would be added to the list of adjustment mottos.

Sustainable development: from IUCN to Brundtland.

As it first appeared, sustainable development was a threat to business interests and economic growth (IUCN et al., 1980). The international development community adopted the term, which carried powerful values and was gaining popularity, but endeavored to modify its significance. Reformulated, sustainable development would serve the goal of development as

economic growth and support neoliberal policy orientations. Distorting the concept away from ecological concerns was necessary to entrench the economic management of environmental issues in international development policies. International conferences and expert reports contributed to this transformation.

To counter the discomforting content of sustainable development, UNED introduced the notion of eco-efficiency, setting the goal of creating more goods and services with fewer resources and less waste and pollution (World Industry Conference on Environmental Management, Versailles, 1984).[145] Reducing resource use intensity and environmental impact, eco-efficiency was "proper" management for sustainability and continued growth. In 1992, the Earth Summit endorsed eco-efficiency as a means to implement *Agenda 21* in the private sector (UNCED, 1993).

In 1983, the UN General Assembly set up the World Commission on Environment and Development (WCED or Brundtland Commission) to address the consequences of environmental degradation on development and promote a new form of growth.[146] Modifying sustainable development proceeded by switching the focus of the environment-development relationship. "Sustainable development" had emerged from concerns about the consequences of development on the environment. Glossing over that relationship, developmentalists focused on the consequences of environmental deterioration on economic growth. Special attention was given to environmental degradation caused by poverty in the Third World. If poverty was the environmental problem, lifting people out of it was the solution, and the best remedy was growth.

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[145] The conference was organized by UNEP and the International Chamber of Commerce (ICC), and led to initiatives such as the ICC-UNEP training kit for environmental managers, the Business Charter for Sustainable Development (1991), the business awards for environmental achievement (since 2000), or the African Business for Sustainable Development.

[146] General Assembly resolution 38/161 "Process of preparation of the Environmental Perspective to the Year 2000 and Beyond" of 19 December 1983 established the UN Commission on Environment and Development (A/RES/38/161). The Commission was headed by G. H. Brundtland, Prime Minister of Norway.

In the Commission's report, *Our Common Future* (WCED, 1987), sustainable development became a unifying, all-encompassing concept. The Commission broadened sustainability to include economic, political, social, and environmental considerations aiming at growth, poverty alleviation, social equity, environmental protection and sustainability for future generations.

Rhetorically introducing the future made development sustainable:

> "Sustainable development seeks to meet the needs and aspirations of the present without compromising the ability to meet those of the future" (WCED, 1987, p. 40).

This definition re-actualized the need for any society to ensure the means to maintain and reproduce itself over time, but for many referred to maintaining production capacities, taking the focus away from the natural environment (see chapter 1). The broad notion of environment and the intergenerational dimension did not help specify the time horizon of sustainability. This conception was far from reflecting growing scientific concerns.

This notion of sustainable development carried such diversity and vagueness of interpretations that it was freed from the constraints of scarcity, limits, and the failures of development. Indeed, the report specified that limits were not absolute but imposed by present technology and social organizations, which could be improved to make way for a new era of growth (WCED, 1987, p. 8). The purpose of sustainable development was to ensure the world's population with an economic development similar to that of industrialized countries so they would have sufficient means to fight pollution and eradicate poverty. World economic growth was the only way to deal with poverty and environmental problems.

This version of sustainable development encouraged economic growth and made it sustainable:

> "Far from requiring the cessation of economic growth, it [sustainable development] recognizes that the problems of poverty and underdevelopment cannot be solved unless we have a new era of growth … policy makers guided by the concept of sustainable development will necessarily work to assure that growing economies remain firmly

> attached to their ecological roots and that these roots are protected and nurtured so that they may support growth over the long term. Environmental protection is thus inherent in the concept of sustainable development" (WCED, 1987, p. 40).

The new pattern of growth that was called for would respect the economy-environment interdependence and not undermine future economic prospects. One may wonder how policymakers would "necessarily" make this happen when "growing economies nurturing their ecological roots" is a biophysical impossibility. But faith in the market prevailed, and the positive interdependence between growth and environmental protection was "obvious." Negating the contradictions between economic expansion and socio-ecological requirements, sustainable development became a unifying concept supportive of that expansion.

After the Commission's report, sustainable development emerged as a guiding principle for international and national development policies. It spread as the new and appealing framework for doing business. All UN agencies, development activities, public and private institutions turned "sustainable." The World Bank's focus and resources shifted to environmental issues. Its internal structure was reorganized, and new procedures, such as environmental impact assessment, were institutionalized.

"Sustainable and environmentally sound development" became the common lingo. The vaguest terms were consecrated: wise, sound, appropriate, proper. Integration was emphasized more than ever. Everything was interrelated and interdependent. The interrelations between sustained economic growth and sustainable development were reinforced at all UN gatherings.

The Brundtland version of sustainable development was carried through to the 1992 UN Conference on Environment and Development (UNCED or Earth Summit, Rio de Janeiro). The Conference action plan, *Agenda 21*, set aside any vestiges of natural scarcity and limits, and reconfirmed the status of economic growth, essential to global environmental solution (UNCED, 1993). Sustainable development and sustained economic growth were practically synonymous. Sustainability came down to ensuring the open-ended growth that would solve all ills, and

sustainable development entailed social equity, ecological integrity, and participation in decision-making (Carruthers, 2005). The international discourse harmoniously integrated socio-ecologico-democratic values to liberal economic growth.

Neoliberal policies become sustainable development policies.

Economic policies for privatization, growth and profit became sustainable development policies favorable to environmental protection and social improvement. The neoliberal framework for environmental protection elaborated in the 1970s was transferred to sustainable development policies: an unscientific definition of the environment integrated with development through economic instruments; development as solution to environmental degradation; and growth and industrialization made sustainable by ignoring non-renewable resources (UNEP, 2002).

Efficient resource management, the monetization of environmental assets, and market solutions to environmental issues were recipes for development and sustainability. These policy orientations participated to weakening the role of government in favor of the private sector, and to promoting natural resources and "environmental services" as economic goods as opposed to public services. Neoliberal economic policies came to be broadly accepted as "the most efficient way" to achieving sustainable development, thus gaining new moral legitimacy.

Water strategies elaborated during the 1970s were further refined and became the foundation for water resource management. Water policy guidelines shared the same values and orientations of the neoliberal sustainable development strategy. The Integrated Water Resources Management (IWRM) approach embedded this strategy for the water sector: economic efficiency was the best management, and the private sector the most suited manager (UNCSD, 1998).

Sustainable development and the water policy discourse.

Sustainable development contributed to legitimizing and creating consensus around neoliberal water policies (Haque, 1999). The policy discourse depicted the benevolent,

democratic, environment-friendly dimensions of neoliberal water policies that would benefit all. Sustainable water sector development was a matter of good governance and efficient management based on cost recovery and users' willingness to pay, which would lead to economic, environmental and social sustainability.

Sustainable water development meant developing commercial water services for growth inducing activities. It encouraged water service pricing and demand responsive development strategies, and made the financial viability of the water sector a necessary condition. It supported the involvement of the private sector in the provision of water services, and contributed to delegitimize public services and the role of government in service provision (Reed, 2002). It contributed to the assumption that neoliberal water management was conducive to protecting water resources and water-related ecosystems, as well as social equity achieved through community participation in the development process.

2. The private sector and the World Bank dominate water policymaking.

The ideological undertaking that gave a new face to neoliberal development policies and silenced ecological influences reflected the increased involvement of the private sector in policymaking and the World Bank's leadership in international environmental issues. The elaboration and promotion of water strategies illustrate this evolution.

The World Bank and the international business sector became fully in charge of water policies and overlooked all water-related events. The roles the UN system had played in the water sector were declining and taken over by institutions like the World Water Council, the Global Water Partnership, and the Stockholm Water Symposium dominated by water business and lending agencies (Biswas, 2004; Biswas & Tortajada, 2009).

The UN facilitated the introduction of "multi-stakeholders" in the elaboration of water policies, which it then promoted. UN official guidelines and water programs systematically

endorsed the strategies agreed upon by water partnerships and the World Bank.[147] UN agencies relayed water guidelines throughout the system and into national water sector policies. UN programs for cities, water supply and sanitation development were created to implement sustainable urban management strategies.[148]

In this scenario, the role of intergovernmental agencies stuffed with representatives from elected governments became one of implementing policies developed by nonelected, non-representative, special interests groups. The all importance of non-representative interests in water policymaking and the collusion between business and political power run counter to democratic accountability in the sector. Inter-governmental declarations endorsed water management strategies, whose elaboration was removed from national policymaking processes.[149]

The private sector: from consultations to global compact.

Through a number of international initiatives the private sector was involved in the elaboration of water management strategies and became a legitimate partner for policy-making and projects' funding. UN agencies and other development institutions set up consultations to determine water guidelines, as well as partnerships, water councils, and other initiatives that served as entry points for the private sector. Partnerships of lenders, UN agencies, the private sector, governments and research institutes were a critical tool to elaborate and promote neoliberal sustainable development water strategies.[150]

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[147] See GA resolution 45/181 "International Drinking Water Supply and Sanitation Decade" of 21 December 1990; Agenda 21, Chapter 18: "Freshwater Resources", adopted by UNCED (Rio, 1992); the UN Water Panel and the UN Commission on Sustainable Development 6th Session (UNCSD, 1998).

[148] See the Urban Management Programme (1986) initiated by UNDP, UN-Habitat and the World Bank focusing on infrastructures and land management in urban areas; UN-Habitat Sustainable City Programme; UN-Habitat Global Campaign for Urban Governance.

[149] See for example, the Ministerial Declaration on Water Security in the 21st Century adopted by the Ministerial Conference on water (The Hague, 2000) held in conjunction with the World Water Forum, welcomed the World Water Vision and Framework for Action, "Towards Water Security: A Framework for Action," elaborated by the Global Water Partnership.

[150] See for example, the Water Supply and Sanitation Collaborative Council (WSSCC, 1988), an initiative of the OECD-DAC regrouping External Support Agencies to help developing countries formulate water strategies—the GA recognized the Council in 1990 (A/RES/45/181); see also, the Global Water Partnership (1996) established by the World Bank, UNDP and the Swedish International Development Cooperation; the World Water Council, a multi-stakeholder partnership and water policy thin-tank, whose creation was suggested during the Dublin and Rio

In the 1980s, the WHO was instrumental in getting the private sector involved in water policymaking. All major institutions involved in development financing, including governmental and international agencies, financial institutions, consultants and private corporations—now called External Support Agencies (ESAs)—made a coordinated effort to promote guidelines reflecting their agreed upon strategies. Between 1984 and 1988, the WHO organized consultations with ESAs to determine concepts and strategies to be implemented in developing countries' water and sanitation program (WHO, 1988). The resulting *Global Sector Concepts for Water Supply and Sanitation* (WHO & GTZ, 1987) reflected concerns for the sustainability of loans and projects: the major concepts were institutional strengthening and cost recovery. The donor community was encouraged to help water utilities reach a sound financial position, and not to undertake projects which might undermine the financial viability of the sector.[151]

From then on, all global water events involved the private sector. [152] In 2000, the international water business elaborated the *World Water Vision* setting international water development goals and orientations for the new millennium, and the plans of actions to implement them (World Water Commission, 2000).[153]

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conferences (1992) and the 8th World Water Congress (Cairo, 1994) by the International Water Resources Association—the Council organizes the World Water Forums.

[151] Through its Community Water Supply and Sanitation programme, the WHO was working on cost-recovery in the water sector, and articulated most of these arguments. The WHO served as the Secretariat of the Steering Committee for the International Drinking Water Supply and Sanitation Decade.

[152] See for example, the Global Consultation on Safe Water and Sanitation for the 1990s organized by UNDP (New Delhi, 1990); the UNDP Symposium, A Strategy for Water Sector Capacity Building (Delft, 1991); the International Conference on Water and the Environment (Dublin, 1992), one of the preparatory expert meetings toward the Earth Summit; the International Roundtable on Water and Health in Under-privileged Urban Areas (Sophia-Antipolis, France, 1994); the Ministerial Conference on Drinking Water Supply and Environmental Sanitation (Noordwijk, The Netherlands, 1994); the First World Water Forum (Marrakech, 1997); the Expert Group Meeting on Strategic Approaches to Freshwater Management (Harare, 1998); the Petersberg Process on Trans-boundary Water Management (1998-); the International Conference on Water and Sustainable Development (Paris, 1998) organized by the World Water Council and the French government.

[153] The First World Water Forum (Marrakech, 1997) requested the World Water Council to elaborate a World Water Vision for 2025. Ismael Serageldin, former Vice-President of the World Bank, chaired the World Commission for Water in the 21st Century which elaborated the *Vision*.

World Bank leadership: agenda setting and funding policy.

In the early 1990s, the International Financial Institutions (IFIs) and bilateral lenders launched their privatization thrust on urban services, including water and sanitation services. The World Bank took up a leadership role in setting the international environmental agenda, and shifted its focus from intergenerational problems linked to the degradation of natural resources to problems of urbanized populations in developing countries—i.e., to the "urban environment" (Leitmann, 1996). Developing urban services—now called "environmental services"—became the top environmental priority (World Bank, 1992).[154]

Urban development became a major focus of sustainable development projects. The need to provide water services was boosted by the perception of an "urban water crisis." Rapid urban growth was destroying local water resources, and the cost of exploiting distant water sources threatened development. Furthermore, the living conditions in urban dwellings in most developing countries had deteriorated to a point that spurred criticism of international actions (UNCHS, 1994).

According to its new urban lending policy, the World Bank began funding investments based on the links between the urban economic activities they would serve and macroeconomic performances (World Bank, 1990). Investments in urban "environmental services," including water resources management, were to induce growth and would be captured by the private sector.

According to the Bank's new orientations for water projects, financing water service development would not come from additional funding from international agencies, but from the international private sector and local communities (World Bank, 1993). The private sector would finance growth-inducing investments, while poor communities would pay for their own facilities. Subsequent water declarations on financing water service development endorsed a

[154] Urban management was a main issue of the *World Development Report 1992: Development and the Environment*, which the Bank used to push this agenda at the Earth Summit.

division of labor between sources of funding: all sources would be tapped but for different purposes.[155]

International private sector financing infrastructure investments required making water a more attractive investment opportunity and managing risks.[156] Targeting assistance financing to water sector reforms, capacity-building and policies for sound water management, the IFIs would create these required conditions, while public investment budgets would help infrastructure improvement until water systems became interesting enough for private management (World Bank, 2003). Once the profitability of service provision improved, infrastructure operators would contribute to sector investments.

The use of public funds wad restricted to basic needs with targeted subsidies for the poor. Local resources would be mobilized by improving cost recovery, raising tariffs, providing low-cost facilities, and applying polluter charges. For local communities to pay for services, manage and build facilities, better access to local credit was needed. Local capital markets, development banks, and microcredit had to be developed (CEDD, 1998; World Bank, 1993).

C. Water policy and ideology.

The main purpose of water management strategy was to exploit water resources for profit. Commercial services would provide water supply and benefit profit-making activities. As *Agenda 21* puts it, water resources would serve development, and water policies would be a catalyst for economic growth (UNCED, 1993: parag. 18.11-18.90). Water policy objectives required privatizing water services, and to that end making the water sector financially viable. To support the liberalization of the water sector in developing countries, new institutional arrangements and new approaches to urban services were needed (Serageldin, Cohen, & World

[155] See for example, the Ministerial Declaration of The Hague on Water Security in the 21st Century, Second Water Forum (The Hague, 2000); the Conference Report of the International Conference on Freshwater (Bonn, 2001); and the Report of the World Panel on Financing Water Infrastructures (2003).
[156] Only 5% of private investments in the 1990s went into water and sanitation and were concentrated in low-risk economies in East Asia and Latin America (United Nations, 2003).

Bank, 1995). The Integrated Water Resources Management (IWRM) encouraged the implementation of these new approaches (UNCSD, 1998).

1. Policy and strategies.

IWRM aimed at the sector's financial viability through efficiency and competition. This would be achieved by pricing water services for full cost-recovery and demand management, implementing a demand-responsive approach to service provision through low-cost technology, community participation and beneficiaries' effective demand, and limiting subsidies to targeting the poor (ICWE, 1992; UNCED, 1993, chap 18.12; World Bank, 1993); (CEDD, 1998; ICWE, 1992; UNCSD, 1998).

Against negative social consequences and political implications, international statements encouraged that full cost recovery be gradually phased in with targeted subsidies and cross-subsidies for the sake of equity and basic needs (CEDD, 1998; UNCSD, 1998). Targeted subsidies and redistribution among service beneficiaries would make water affordable for basic needs and at the same time counter the claim of water as a right.[157] Water strategies approached the right to water services as the right to access clean water and sanitation at an affordable price (ICWE, 1992). Beyond the satisfaction of basic needs, users should be charged appropriately (UNCED, 1993, chap 18.8); (World Bank, 1993).[158]

The privatization of water services implied that where services could not be privately delivered because of populations' insufficient income, low-level services would be collectively provided by local communities or individual facilities. Service provision therefore depended on affordable technologies. Adequate technologies would reduce funding needs, and improve cost-recovery and the ability of communities to operate services (WHO, 1985)WHO, 1985). Communities' access to services matching effective demand determined the adequate

[157] In 1990, the Global Consultation for Safe Water and Sanitation (New Delhi) officially recognized the right to water access: all people had the right to have access to drinking water in quantities and of quality equal to their basic needs (UNDP, 1990b).

[158] See CSD/ECOSOC: Report of the Expert Group Meeting on Strategic Approaches to Freshwater Management (Harare, Zimbabwe, January 1998), and CSD 6th Session – Decision 6/1: Strategic approaches to freshwater management (UNCSD, 1998).

technology and service level. Community participation in service development would allow services to be tailored to consumers' "needs" and "willingness to pay" (WHO, 1985) (CEDD, 1998). [159]

Implementing these policies required institutional reforms that would reduce the role of government in the water sector, increase the autonomy of water utilities so that they could implement cost-recovery pricing, and allow the involvement of the private sector (World Bank, 1993); (UNCSD, 1998; UNDP, 1991). The role of government had to change from service provider to facilitator, creating legal, social and economic frameworks to facilitate efficient water management (UNDP, 1990b); (CEDD, 1998; World Bank, 1993). The first step towards service privatization was to rationalize management, reduce political influence and improve efficiency in public enterprises. Decentralization was needed for local participation and for mobilizing local resources. With increased local or private responsibilities, service delivery functions could be transferred to the local or private sector, or to community organizations (World Bank, 1993).

2. The ideological dimension of the water policy discourse.

The ideological dimension of the sustainable development water policy discourse is found in the misleading use of vocabulary; in objectives and measures couched in terms of universal values and common good; in unquestioned assumptions; in triggering a sense of guilt, inadequacy or irrationality if looking for solutions outside the set framework; and finally in outright lies.

Integration ignores conflicting objectives and environmental limits.

According to the policy discourse, water resource management is "integrated" (IWRM) because it promotes sustainable water services, environmental protection, good governance, health and poverty alleviation (World Bank, 1993). IWRM would bring about productive and sustainable interactions between human activities and freshwater systems through a balanced

[159] See also the Water and Sanitation Programme (1992), the WSSCC action plans and the 'Vision 21 - Water for People' initiative (1997): http://www.wsscc.org/sites/default/files/publications/wsscc_vision_21_shared_vision_and_framework_for_action_2000.pdf (12/2/2008)

consideration of the requirements of all users and the environment (UNCED, 1993; World Bank, 1993). Recognizing the social and economic value of water, IWRM links development with resource protection and community participation, (CEDD, 1998). The policy discourse made these assertions as a matter of fact and serenely lumped together contradictory goals and measures, ignoring their relationships and environmental limits.

A most confusing perspective on the nature and functions of water underlined integration. Water was a scarce resource essential to life, development, stability, basic needs, and ecosystems (CEDD, 1998; ICWE, 1992). It was "part of the ecosystem, a natural resource and a social and economic good" (UNCED, 1993, chap 18.8). Water was equally essential to all its uses. It had no primary nature and function on which its other uses depended and which ought to be preserved as a priority.

The compatibility of water uses and management goals was not an issue, nor was "the requirements of all users" or the economic and political forces at play behind each sustainability objective. Interrelations were emphasized as reasons for integration, but were never defined and their implications were not specified. No priority or hierarchy between ecosystems and socioeconomic activities was attempted. Who did the "balanced considering" or the "'recognizing" and how was not an issue. The market was in charge, and in a neoliberal world economic order, agents, whatever their activities are equal and externalities are compensated for by setting surrogate prices.

Prices as universal solution.

Assuming the effectiveness of the market for all purposes is the basis of the neoliberal model. Through the market, water resources are allocated towards their most productive, least wasteful uses, and therefore are preserved. Accordingly, failure to place a price on water that reflects its economic value leads to misallocation, and to wasteful and environmentally damaging uses. Water had an economic value in all its competing uses (ICWE, 1992). An adequate economic value had to be attributed to all water uses and the miracle of the market

would happen: cost recovery prices would reduce waste and manage demand toward efficient allocation.

Price mechanisms guaranteed all objectives would be achieved. They would strike a balance between human and environmental needs, promoting social equity, the satisfaction of basic needs and environmental protection (UNCSD, 1998). In fact, the social, environmental and economic values of water were mutually supportive (CEDD, 1998).

Now that it meant using economic instruments and was measured in monetary terms, water resources' protection was integrated into their management. Protection measures would be achieved through cost-recovery pricing and cost-benefit calculations. Cost-effective mechanisms (prices, pollution fees or taxes) ensured the ecologically sustainable management of water resources (World Bank, 1993). On this basis, reducing unsustainable consumption patterns meant eliminating unpaid consumption and responding to effective demand, not reducing or redistributing consumption.

This approach assumes the possibility of giving an adequate economic value to the impact of water pollution and depletion, or to ecosystems and their sustainability over time. But economic trade-offs cannot ensure environmental sustainability, and the damage of pollution and long-term consequences on other resources and ecosystems that do not have an immediate economic impact are not addressed. So far, the "interlinked and mutually supportive" values of water have proven rather mutually antagonistic.

Eluding the problematic relation between social progress or environmental preservation and the search for profit and growth is the ideological hallmark of neoliberal economic policies. The policy discourse induces the belief that efficient allocation through the market takes care of everything. On this basis, claims to pursue social and environmental objectives appear legitimate.

Knowledge-based action.

Water strategies called for increasing water resource knowledge and environmental assessment for decision-making. Environmental impact studies became mandatory for all major water resources development projects (UNCED, 1993; World Bank, 1993). Environmental concerns were thus concretely addressed. But funding was not directed to resource assessment or monitoring, but to infrastructure development (CEDD, 1998; UNCSD, 1998; World Bank, 1993). Water reforms and investment projects were undertaken without adequate knowledge of the environment and their impacts on water resources.

Participatory process.

Participation evokes openness and inclusion. It is essential in a democratic bottom-up decision-making process for development based on people taking responsibility for their own needs. "Participation" assumes that actors are involved on an equal footing for the good of all (World Bank, 1993).

The call for community participation extended to policy decision, target setting, project design, water resource management, and impact assessment. Decisions should be made at the lowest appropriate level with public consultation and users' involvement, women in particular (Dublin, 1992). This call seems rather demagogical and hypocritical when the stakeholders involved in policy decisions and project designs are powerful international and national actors. Calling for participation is indeed ironic in the context of External Support Agencies defining global concepts for policies to be implemented by developing countries as conditions for loans.

Community participation was also called for the management and preservation of water resources. Such call, however, ignores the power relations behind the use of water resources. The community may be the right management level if communities are sufficiently isolated to determine water uses and control activities within the watershed. But when local water resources are exploited for distant uses or used locally for non-local needs, communities have no mandate, capacities or resources for managing and protecting water resources. This leaves

actors with market power to manage resources, while pretending local communities are responsible for protecting these resources.

Participation actually served to facilitate the implementation of the demand-responsive strategy for water service development. It helped determine the "adequate" technology and service level households could afford, and mobilize local resources. Participation served to promote an individually privatized system for water services and to legitimize private sector involvement in water service provision. Participation also allowed international development agencies to support and control NGOs and community organizations that followed prescribed orientations, but to marginalize and shrink the resources of groups promoting alternative approaches.

Adequate technology.

Low-cost technologies are not considered adequate from the standpoint of human and environmental needs, but from that of eliminating public subsidies, making people pay for services, and achieving water sector financial viability. Meanwhile where the economic criteria can be met, large investments are made in sophisticated technologies promoted by multinational corporations, funded by financial institutions, and supported by local politicians mesmerized by "modernity" and the potential paybacks of big contracts. This has resulted in systems with endless operational problems whose costs and hassles are born by the public, when alternative technologies for smaller scale infrastructures adapted to local conditions are available but disregarded.

Institutional strengthening and enabling environment.

The water policy discourse called the reforms needed for involving the private sector in the exploitation of water resources "institutional strengthening," "enabling environment," and "good governance." "Institutional strengthening" implied that developing countries' institutions were inadequate. "Good governance" called forth problems of corruption, lack of transparency

and inefficiency in public agencies influenced by politics and social pressures. Privatization was therefore necessary for better services, best management, and sustainability. “Enabling” meant an environment conducive to private sector participation and profit-making activities, i.e. reducing the role of government in the provision of services and increasing utilities’ capacity to implement cost-recovery prices.

Decentralization, which was usually undertaken in parallel to liberalization reforms, carries the idea of bringing management and decision-making closer to populations’ concerns and needs, thus improving democratic governance. It also implied that because of governments’ limited financial and administrative resources, nothing should be done at a higher level that can be done satisfactorily at a lower level (UNCSD, 1998).

In the water sector, decentralization allowed implementing participation and delegating water service responsibilities to local levels and to the private sector. But the transfer of responsibility to local levels is never accompanied by an adequate transfer of resources, resulting in reduced overall public capacity to provide services. Local districts are left with resorting to the private sector, therefore making communities pay commercial prices for services.

Thus, the water policy discourse presented strategies aiming at transforming water services into commercial services and improving water availability for growth-inducing activities as pro-democratic, pro-environment and pro-people. Water strategies would ensure the satisfaction of basic needs and protect water resources. Price mechanisms and economic value had to be trusted. Urban services became “environmental” services, and profitmaking “sustainability.” Integration and participation blurred reality and ignored contradictions and environmental requirements. Institutional reforms were meant to addressed corruption and inefficiency for the sake of all.

D. UN transmission mechanisms.

Since the 1980s, UN initiatives promoted neoliberal water policies, reforms and ideology. They contributed to bring the economic management of water resources and the privatization of water services to hegemony.

1. From the International Water Decade to the Millennium Development Goals.

The International Drinking Water Supply and Sanitation Decade (1980-1990) set the goal of providing access to potable water and sanitation facilities to all. [160] The Decade's initiatives aimed at stimulating political will and investment in the water sector. Governments and the international community were urged to adopt recommended strategies and mobilize the important resources needed to achieve the Decade's targets.

By the end of the 1980s, however, progress in water supply and sanitation was clearly too slow and would leave many people without suitable services by the year 2000. The international community called for intensified national efforts and international cooperation to reach the Decade's targets by the end of the century.[161] National reforms would have to match financing conditionality.

In 2000, the transition to the new millennium was celebrated by setting new targets for development and poverty eradication by the year 2015—the Millennium Development Goals (MDGs) (Millennium Summit, 2000). The MDG for water was to reduce by half the proportion of people unable to reach or afford safe drinking water by 2015 (less ambitious than the 1980 goal of providing water supply and sanitation to all). In 2002, the Johannesburg Summit made water the number one priority, and officially added reducing the number of people without access to sanitation to the MDGs.

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[160] The International Drinking Water and Sanitation Decade had been called for during the 1977 Mar del Plata Water Conference. See GA resolution 35/18 of 10 November 1980.
[161] GA resolution 45/181 of December 1990.

2. Consultations, conferences, and partnerships.

The 1980s was the decade of consultations and partnerships that gathered international support for neoliberal water policies, and elaborated the water policy discourse. The WHO, in addition to global water consultations, organized national Decade consultations in developing countries to encourage national strategies and projects suitable for donor support. UNDP Resident Representatives also served as a transmission belt for the same purpose.

The 1990s witnessed intensive international activity to promote water strategies and reforms. Numerous water conferences were held and new initiatives and partnerships hammered strategies and discourse over. The Earth Summit (Rio, 1992) contributed to publicizing the link between neoliberal water policies and sustainable development. The World Bank began holding annual conferences on environmentally sustainable development focused on "sustainable urban growth." From the Dublin Conference on Water and the Environment (1992) to the World Water Forums (1997, 2000, 2003, etc.), all international statements reiterated that water had an economic value and that investments required beneficiaries to meet the corresponding costs. The fact that safe water was not a free good had to be widely promoted (ICWE, 1992).

By the 2000s, the World Bank deplored that the implementation of full-cost pricing for service delivery remained an issue for private sector involvement (World Bank, 2000, 2003). Compliance with full cost-recovery pricing had been very uneven. Numerous national actors still resisted cost recovery tariffs and wanted to maintain social water pricing. For the Bank, resistance to full cost-recovery pricing stemmed from persisting confusion between social, environmental and commercial aims in water management (Bojö et al., 2001). Political interference, poor management structures, inconsistent legal and regulatory frameworks, and lack of transparency endured (World Panel on Financing Water Infrastructure, 2003). Defects in governance hampered the sector's ability to generate and attract finance, with political pressures on water contracts and tariffs.

International water conferences, forums, or visions all promoted the same policies and reforms.[162] The international community would help developing countries manage their water resources toward sustained economic growth, valuing water in a way that reflected its economic, social, environmental, and cultural values for all its uses. During the World Summit on Sustainable Development (Johannesburg, 2002), the private sector stressed the need to create an enabling environment using aid for capacity-building, involving all stakeholders, and moving to full cost recovery. This call reflected the Monterrey Consensus for the implementation of domestic policies promoting free trade and the business sector in order to trigger international and domestic financing and development.

3. African endorsement.

Neoliberal water policies were promoted and endorsed in Africa. Environmental degradation and water and sanitation problems in urban areas justified the numerous UN-sponsored water conferences and initiatives for the continent. During these gatherings, African leaders endorsed prescribed guidelines for the sustainable development of water resources and encouraged the implementation of neoliberal water sector policies and reforms in their respective countries.

By the 1980s, Africa was plagued by a large backlog of environmental degradation and new environmental problems related to population growth, urbanization, and industrialization (Stren & White, 1989). Africa was the only continent that fared worse in terms of access to water and sanitation at the end of the International Water and Sanitation Decade. Even more Africans were without adequate services ten years later. Estimates showed that in Africa, an 80% increase in the numbers of people served over the next 15 years was required to meet the water target of the MDGs (Second World Water Forum; The Hague, 2000).

[162] The International Conference on Freshwater (Bonn, 2001); the World Water Forums (The Hague, 2000; Kyoto, 2003).

Conferences and other initiatives.

In the 1980s and 1990s, UN agencies and partnerships sponsored international conferences and initiatives promoting neoliberal water management strategies. In parallel to international water events, UN agencies sponsored regional water conferences; partnerships and initiatives were launched; African consultations, declarations and resolutions mushroomed.[163] The UN established regional programs for water supply and sanitation services and water resources management.[164] The World Bank was involved in most of these efforts.

All water initiatives adopted the same goals and strategies and encouraged their implementation. The Africa 2000 Initiative for Water Supply and Sanitation (1994) was established to support countries in setting national action plans along agreed-upon guidelines.[165] The UN System-wide Special Initiative on Africa (UNSIA, 1996), an economic development program, established a Working Group on Water, chaired by UNEP and the World Bank, to carry out the Africa 2000 Initiative. [166] The Water Utility Partnership (WUP, 1995) regrouped utilities, donors, NGOs and research institutes[167] seeking better water sector performance to provide training, advocacy, and technical advisory. In the 2000s, more initiatives, partnerships and conferences endorsed the goals of sustainable water access and management for development, and promoted the implementation of water strategies and

[163] See the African Ministerial Conference on the Environment (Cairo, 1985); the African Water Supply and Sanitation Conference (Abidjan, 1990) sponsored by the World Bank and UNDP; the Water Utility Partnership (1995) initiated by the World Bank; the Africa Consultative Forum organized by WSSCC/WASAI (Abidjan, 1998); the Ministerial Conference on Partnership in the Water Sector for Cities in Africa held under the auspices of UN-Habitat (Cape Town, 1998); African NGOs-UNEP Partnership Meeting (Nairobi, 1999).
[164] See UN-Habitat Sustainable City Programme (1993); the Africa 2000 Initiative; the UN-Habitat/UNDP Managing Water for African Cities Programme (1999); and UN-Habitat Global Campaign for Urban Governance (1999).
[165] The Africa 2000 Initiative was launched during the WHO Regional Committee for Africa. The WSSCC later endorsed it (1997) as its African chapter—the Water and Sanitation African Initiative (WASAI)--, and the OAU followed suit (OAU Doc. CM/2057 (LXVIII) Add. 3).
[166] The UNSIA had been requested by the Secretary-General, Boutros-Ghali, to raise the priority given to development in Africa. It was launched in 1996.
[167] The WUP was an initiative of the West Africa Infrastructure division of the World Bank, the Union of Africa Water Suppliers, and the NGOs CREPA and Trend.

reforms for the efficient use of water resources.[168]

African ministers met for the first time in the mid-1980s to address environmental issues and consider policy guidelines (Cairo, 1995).[169] The continent policy statement, "Guidelines for the Development of Country Strategies for the 1990s," adopted during the first African Water Supply and Sanitation Conference, embedded neoliberal water strategies (Abidjan, 1990). Before the Rio Summit, African ministers adopted the "African Common Position on Environment and Development" as the continent's contribution to the Summit plan of action (Abidjan, 1992).[170] The "Position" reflected the Brundtland consensus and fully endorsed international orientations while calling for African solutions.

African leaders insisted on their commitment to creating enabling environments for sustained economic growth, asserting their leadership in water service development and their openness to partnership. African politicians were preparing the continent for far-reaching water sector reforms that would hopefully attract desired international financing. [171] Africa as a continent and African countries individually were in line with the global sustainable development ideology and policies.

African leaders worried that the lack of adequate water would constrain food production, ecosystem protection and development (AMCOW Statement, WSSD, 2002). Securing water for urban development, economic growth and social stability was crucial.[172] Water resources in Africa were underexploited, and had to be managed so as not to become a growth-limiting factor. The full potential of the continent's water resources had to be unleashed to stimulate growth, reduce poverty and protect the environment.

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[168] See the New Partnership for Africa's Development (2001), an economic development program of the African Union; the African Ministerial Conference on Water (AMCOW, 2002); the ADB Water Organizations Meeting and the Accra Declaration (Accra, 2002); and the Pan-African Implementation and Partnership Conference on Water (Addis Ababa, 2003).
[169] The African Ministerial Conference on the Environment (AMCEN) was sponsored by the OAU, the UNECA and UNEP (Cairo, 1985). Committees on the continent's main ecosystems were created, along with technical cooperation networks on soil and fertilizers, climatology, and water resources among others.
[170] The African Common Position was adopted during the 1991 meeting of African Ministers in Abidjan.
[171] See the Africa Consultative Forum (Abidjan, 1998) and the Africa Water Resources Policy Conference (Nairobi, 1999) organized by the World Bank within the framework of the Global Water Partnership.
[172] Abuja Ministerial Declaration: Water – Key to Sustainable Development (April 2002).

African water policy statements identified the same obstacles to water development as those identified by international water policies: inefficient institutions, inadequate legislative frameworks, low cost recovery, crumbling infrastructures, low priority given to sanitation, and un-integrated water resources management. The same remedies were encouraged. Official declarations were a replica of international water policy guidelines: create an enabling environment for public-private partnerships to provide efficient services and stimulate a greater flow of investment (Abidjan, 1990; Brazzaville, 1998; Cape Town, 1998). [173]

The only departure from international guidelines was the emphasis on the need for infrastructure rehabilitation investments (Abidjan, 1990). Most water infrastructures in Africa had been built during colonial times and were falling in disrepair. The decrepit state of water systems was a hindrance to service performance and private sector involvement. The World Bank, however, considered that rehabilitations were a governments' responsibility and that investments should be directed into systems expansion (World Bank, 1993). Rehabilitation would be dealt with through performance contracts involving the responsibility of the public and private sectors.

The issue was resolved by the end of the 1990s. African statements then recognized that infrastructure maintenance had been neglected and that directing borrowed resources to rehabilitation was an indirect way of borrowing for maintenance. In other words, rehabilitation was a form of delayed maintenance (Cape Town, 1998). Maintenance had to be paid for with users charges. This accorded with the World Bank priority to help countries develop institutional and financial arrangements for sustainable rehabilitation and maintenance. This would improve the management of existing infrastructures, while funds would be directed to developing new growth-inducing infrastructures.

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[173] See the African Water Supply and Sanitation Conference (Abidjan, 1990); the Brazzaville Declaration adopted at the First Regional Consultation of the Africa 2000 Initiative (Brazzaville, 1998) or the Cape Town Declaration made by the Ministerial Conference on Partnership in the Water Sector for Cities in Africa (Cape Town, 1998).

As the WSSD added sanitation to the MDGs, the African Sanitation and Hygiene Conference (Africasan, Johannesburg, 2002) made sure neoliberal sustainable development policies would be applied to the development of sanitation services. [174] The conference called for strengthening policies and institutions, involving all actors, increasing resources to the sector, and making the most of public funds by using them only for households unable or "unwilling" to pay; subsidies should be carefully targeted to the most vulnerable.

After 2000, the emphasis was on financing. To reach the water and sanitation targets for the continent, increased infrastructure financing was needed.[175] Changes in policies, strategies, laws, institutions and management were necessary for attracting funding (World Bank, ECA, & ADB, 2000). Success factors included liberalizing water markets, mainstreaming full cost recovery, service differentiation and demand-responsive allocation, modifying water laws and regulations to reflect market principles, and moving public funds away from recurrent spending toward capital expenditure (World Bank, 2002).

Following the Monterrey Consensus and in accord with the new World Bank water strategy paper (World Bank, 2003) and the report of the Panel on Water Financing (World Panel on Financing Water Infrastructure, 2003), the Pan African Implementation and Partnership Conference on Water (Addis Ababa, 2003) focused on new funding mechanisms.[176] The conference deplored that governments continued to depend on donor funds for almost all development projects, and encouraged them to spend at least 5% of national budgets on financing water infrastructures. The Africa Water Facility was created soon after (2004) to help

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[174] The African Sanitation and Hygiene Conference was jointly co-hosted by the Water Supply and Sanitation Collaborative Council (WSSCC), the Water and Sanitation Program (WSP) – Africa Region, and the Department of Water Affairs and Forestry of South Africa.

[175] The Africa Water Vision calculated that US$20 billion per year was needed, with an initial $10 billion to meet urgent water needs including $6 billion to meet water supply and sanitation targets, $2 billion to promote irrigated agriculture, $2 billion to support institutional development, capacity building, research and education. Between 1990 and 2000, the average annual investment for water supply and sanitation in Africa was 40% of the requirement for meeting basic needs.

[176] The Pan African Implementation and Partnership Conference on Water (Addis Ababa, 2003), was organized by the AMCOW and the NEPAD.

create enabling environments by funding projects for capacity-building, institutional reforms, and IWRM strategies, thereby attracting private investments to the sector. [177]

Africa's special demands.

African water statements, however, added specific elements deemed necessary for the continent to implement water policy guidelines. These concerns were first embedded in the 1992 OAU "Common Position" and reiterated in conference statements and declarations. [178] They included additional aid, more favorable lending terms, debt rescheduling or recycling, technology transfer, sovereignty over natural resources, trade opportunities and foreign investments. Additional international financial aid was required for Africa to safeguard its environment, but should be provided on equitable and affordable terms. Debt recycling could be used to divert funds into environmental protection, but environmental programs should not be a precondition for financing other areas of development.

The economic conditions for Africa to meet its needs had to be created. Africa had embarked on reforms aiming at financial sustainability and full cost recovery pricing, but poverty had to be addressed in order to sustain access to services. Improved incomes were necessary for cost recovery strategies. Foreign trade, investments and technology transfers were crucial to generate household incomes. African leaders therefore called for trade opportunities through market access, trade barriers removal, and fair exchange of agricultural produce. Water infrastructure financing and access to international markets were inter-related issues that should focus on development and income generation.

Thus, neoliberal growth-oriented water policies required prior growth to be implemented. Growth and poverty reduction are necessary for implementing cost-recovery strategies supposed to promote growth and reduce poverty. Does this mean the strategies don't work?

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[177] The African Water Facility was an AMCOW initiative, first announced at the WSSD. It is hosted by the ADB.
[178] See Africa's Common Position. In 2002, the OAU endorsed the African Ministerial Statement adopted by the meeting of Ministers of the Environment, Economic Development and Planning (Nairobi, 2001) as a Contribution of the Africa Region to the Summit.

IV. Conclusion

This chapter showed how the UN system participated in the elaboration and spread of a neoliberal economic notion of sustainable development. This economic notion helped bring neoliberal environmental policies to hegemony. In this process, the interests of powerful international actors came to dominate environmental management strategies, harnessing natural resources for growth, and addressing environmental degradations as economic problems to be solved with economic instruments.

During the first period of the UN handling the environment-development relationship, the diversity of state interests and the degree of independence of UN agencies allowed the development of an ecological perspective on the environmental significance of development and on the management of water resources. But the economic perspective, which was in line with dominant states' interests and was facilitated by the institutionalized separation of environmental concerns within the UN, dominated policy orientations. During the 1965-1980 period, neoliberals vigorously fought back oppositions to the expansion of the capitalist system: while the debt crisis disciplined developing countries' claim of their share of global economic benefits, ecological contentions were marginalized. The ideological reconciliation between economic growth and environmental preservation was elaborated. Reconciliation was possible by negating environmental limits and ignoring the conflicts between social and environmental objectives on the one hand and economic growth on the other hand. Economic rationality took over environmental management policies, including water resources development. Market mechanisms became environmental solutions. Meanwhile, the private sector made its official entry on the international water scene.

After 1980, sustainable development emerged and was transformed, as the World Bank and the private sector came to dominate UN environmental and water management policymaking. Neoliberal policies became sustainable development policies: increasing the exploitation of water resources for profit would lead to their sustainable development.

International conferences, partnerships and other initiatives effectively spread the neoliberal sustainable development ideology and water policies. African leaders endorsed discourse and policies, and encouraged the institutional reforms required for the private sector to appropriate water services in their respective countries.

Thus, if UN agencies were at first divided, allowing for the development of an ecological perspective on development and water resource management, by the 1980s, all dissenting voices were muted. As the international political economy moved from national social market economies to an increasingly liberalized and privatized world economy, neoliberal interests made sure environmental policies would not jeopardize economic growth. Ecological values threatened the interests of powerful businesses or states seeking growth. They questioned the legitimacy of economic activities and the development model at the basis of their power and wealth. Sustainable development could not imply the ecological management of natural resources or the ecological regulation of development activities.

But environmental protection was popular, giving strength to policies and actors promoting it. For neoliberals, ecological values had to be made harmless and, even better, support the very policies they threatened. This required the elaboration of an ideological discourse, which while carrying environmental and social values connected them to neoliberal policies, and presented these policies as the only valid strategies to "take care" of environmental and social problems. Solutions to environmental degradation thus arose from the same paradigm that caused them: more growth, commercialization, privatization, technologic innovations, and remedies arising from financial and political objectives. Northern countries did not give up one bit of their consumption patterns or accept to modify the patterns of trade and technology transfer to environmental considerations (Uruguay Round, 1995-2000).

Through this process, sustainable development became all encompassing and quasi synonymous to growth, encouraging capitalist industrial development. The notion became the vehicle for neoliberal policies, promoting the image of a benevolent, democratic, and

environment friendly growth. Growth remained the primary measure of development and the ultimate solution to the satisfaction of basic needs, improved wellbeing, social justice and environmental preservation. This ideological transformation supported the belief that no alternative exists, is reasonable or rational. Any discussion about the meaning and purpose of development and how to achieve it was excluded. Hegemonic consensus implies a restricted political debate in which challenging reflections are excluded and dominant tenets are unquestioned. Sustainable development now stood alongside capitalism and liberal democracy to form the picture of universal hegemony (Carruthers, 2005).

In this context, policies promoting the exploitation of natural resources for capitalist development appeared to promote sustainable development values. In the water sector, Integrated Water Resources Management policies embodied sustainable development, and supported turning water management to big business for the sake of efficiency, better and more equitable access to services, and resource preservation. Water sector reforms in developing countries moved water services away from public services. They increased the financial autonomy of water utilities, and involved the private sector in service delivery, especially the operation of large water supply and sanitation infrastructures that received the bulk of international funding. Services became dependent on cost-recovery pricing and demand-driven development. Decentralization, which was often part of broader national reforms, facilitated demand-responsive strategies to mobilize local resources. None of the reforms included meaningful measures and financing for water resources conservation and knowledge. The Integrated Water Resources Management was essentially their increased and privatized exploitation. These policies paid lip service to environmental, social and democratic values, but were effective in promoting neoliberal economic interests.

Sustainable development policies contributed to the further integration of developing countries and their natural resources in the global market economy. This objective was later pursued through the new development financing strategy articulated in the Monterrey

Consensus (United Nations, 2003). Financing for development was organized so as to move "toward a fully inclusive" global economic system in the pursuit of growth, poverty eradication, equity, and sustainable development. Sustainable development constituted the ideological basis of this strategy for including all segments of all societies into the neoliberal hegemonic world order.

If sustainable development supported global economic integration and sustained hopes for replicating the western-type development model, the poor in developing countries have experienced the increasingly polarized effects of this model's inequality-creating and destructive nature. The actors empowered by sustainable development policies were transnational corporations and financiers, and their political allies molding the world to meet their profitmaking objectives. In developing countries, these policies benefited local elites and the bourgeoisie: domestic and foreign entrepreneurs connected to the global market, the rich, and public officials translating international loans and contracts into personal paybacks.

Like the rest of Africa, Senegal embraced sustainable development growth strategies (Rep. du Senegal, 2002). The 1996 urban water sector reform was adopted within the neoliberal hegemonic context, alongside a national liberalization, privatization and decentralization process. Privatization and market incentives in the provision of water services conditioned investment funding to increase water distribution, and were justified by sustainable development.

Chapter 7

Conclusion

I. The Genesis

This dissertation is the product of a number of converging concerns about the sufferings caused by increasing poverty and environmental destructions in the sprawling cities of developing countries, their relation to global inequalities and development. Underlying these concerns are questions about the purpose and effectiveness of development policies and associated ideas, international power relations, and the significance of the natural environment in the economic process and structural inequalities.

Access to water supply and sanitation, and the pollution and depletion of water resources are so essential to life and directly connected to the environment that they constitute a good indicator of sufferings, environmental destruction, and the effectiveness of development projects and policies. Thus, the Senegalese urban water sector reform provided the elements for studying development policies, the role of ideas, the impacts of both on poverty, inequalities and the environment, and the evolution of Senegal within the international political economy.

An international political economy approach addressing the interactions between social, political and economic factors at the national and international levels seemed most suited for understanding the causes of international inequalities. Robert Cox's perspective satisfied this integrative inclination, which, beware of simplistic explanations, explains in part the length of this work. But more important, this perspective considers that the striking gap between areas of the world characterized by abundance, overconsumption based on an increasingly individualized and "gadgetized" consumption, and waste, and areas where people have barely enough to eat and drink, is not just the result of local differences but of the nature of the international political economy, the relations among areas within it, and the historical processes that shaped these relations, and that ideas are part of the equation.

From this perspective, the widespread publicity about sustainable development, even in its vapid version, hinted that something more than what was made of it was at stake. The notion raised questions about the relations between the environment, economic activities, and global inequalities, adding a new dimension to the above approach. Human life depends on the global ecosystem, but the economic process ignores this dimension: environmental assets are the inputs (natural resources) of any production and consumption, as well as their end point (waste absorption). Ecological economics articulated this missing but fundamental element and provided an explanation for its omission, uncovering a forgotten aspect of the destructive and inequitable nature of industrial capitalism.

Environmental destructions and controversies around their significance and the solutions to be applied became central. Even more so as asserted good intensions called forth by sustainable development fell short of policy decisions and UN recommendations abstracting political economic conflicts. Sustainable development projects did not follow through with the notion's promises, triggering my curiosity for understanding why, and what would be needed for it to do so. This exemplifies the "subversive" potential of value-laden ideas, even after they have been emptied of their radical content. The implementation in a developing country of an internationally sponsored sustainable development reform affecting urban life included all these concerns.

II. The Research Process

The research for this work included interviews, field observations, and documentary analyses. For the most part all went smoothly, but information was sometimes unavailable or purposely concealed. The overall lack of resources for gathering data and keeping archives and documentary centers is a recurrent problem for all researchers in Senegal.

Quantitative data were not easy to gather, as they are often inexistent, unreliable or unavailable. Senegalese institutions, including the water sector, as well as NGOs or the

university lack the resources needed for data gathering and analysis. Scientific funding is scarce and data on pollutions, for example, are minimum.

Documents from the same institutions often provided inconsistent data, particularly those regarding access to water supply. Inconsistencies were also found within the same documents from both the World Bank and the Senegalese government. Data from the private operator were not always easy to obtain. Even the public water company does not have a precise map of the network it owns and is responsible for developing. Furthermore, data established by the operator for its management purpose are not easily useful for other purposes. For example, no cumulated percentage of disconnected households or comparisons of consumptions by type of connections were calculated. Many data are raw estimates showing general trends. Often extrapolated to minimize problems or reflect success, they tend to underestimate reality.

The lack of institutional resources also affects archives. Documentary research was sometimes hindered by the absence or poor quality of archives in water institutions as well as the National Assembly. Records were never published. Documents were lost or "someone kept it." Access to certain official and public documents was also hindered by the unwillingness to disclose them. Some of these documents provided evidences of my argument, and were therefore critical to my work. It was out of sheer luck and through unexpected channels that I obtained them.

The interviews were all very rich and often provided unexpected but priceless information. The diversity of interviewees was very important and made possible thanks to various points of entry into Senegalese society. This allowed me to contact people from a wide spectrum of socio-economic backgrounds. The lack of answer to certain questions or outright lies was a precious source of information, indicative of known problems, injustices, negative impacts, corruption, etc. On the other hand, a number of interviewees explaining their work, for example, made casual comments without realizing the seriousness of their implications and their broader significance.

Visiting public water and sanitation facilities would not have been possible or would have been very restricted and under close watch, thus not very useful, without fateful encounters that allowed me full disclosure and thorough explanations.

III. Summary of Findings

The findings of this work showed that the impacts of the Senegalese water reform have been contrary to its claimed success and expectations from sustainable development: services did not improve for all and did not contribute to reduce illness and poverty. Since the reform, services are of poor quality and increasingly unaffordable to the poor, and the destruction of water resources has accelerated. But integrated into the market economy, water distribution can satisfy the demands of the rich and contribute to economic growth, thus benefiting only a few international and Senegalese actors. This evolution demonstrates the unsustainable nature of policies commodifying water resources in support of a growth-oriented development process.

This work then showed that the water reform was part of the ongoing economic liberalization process imposed on Senegal by the IFIs, and an exemplary case of the workings of the neoliberal hegemonic consensus. The reform process illustrates the consensual form of power prevalent in a hegemonic world order, and ideas facilitating "adjustments by subordinate actors to dominant interests." The reform implemented the main international water policy guidelines (IWRM). A small group of government and water sector officials, the World Bank, and their consultants elaborated the reform. These actors had endorsed the neoliberal notion of sustainable development, and this ideological consensus facilitated the adoption of the reform. The legitimacy of privatization and the commercial management of water services was easily accepted. The reform actors saw it as a progress toward efficiency, and therefore financial, social and environmental sustainability.

This particular understanding of sustainable development was elaborated within the United Nations and contributed to strengthen the neoliberal economic consensus. The Integrated Water Resources Management policy operationalized the application of this notion to

water services. International water guidelines promoted the commodification of water resources and the privatization and commercial management of water services as measures for improving services and protecting resources. This confirms the importance of ideas in the pursuit of economic interests, and the ideological role of international organizations in perpetuating the existing international order by absorbing ideological challenges (Cox, 1996).

A. The sustainability of the Senegalese water sector reform.

The impacts of the reform did not reflect the promises of sustainable development, but the socially and environmentally destructive patterns of capitalist development. The efficient management of water services indeed improved after the reform, but with it the destruction of water resources, services out of rich for the poor, and increased inequalities in both access to services and the burden of pollution.

1. Unaffordable and inequitable access to drinking water.

Despite official claims to the contrary, the water reform did not improve access to drinking water for the majority of Dakar residents. Seeking the sector's financial sustainability, the reform determined infrastructure investments, measures targeting the poor, and a management of water supply that proved disproportionately unfavorable to the poor. Access to distributed water became dependent on wealth, forcing many urban residents to reduce their consumption of drinking water, abandon individual private taps and return to collective supply, and resort to polluted underground water. The unfairness of the redistribution system among water consumers was exacerbated, equating to a reverse redistribution from the poor to the wealthy. Thus, the reform differentially affected domestic users and economic activities.

Infrastructure investments increased overall water production and distribution for Dakar. But exploitation infrastructures negatively affected water access for populations and economic activities outside the Dakar region, lowering underground tables, drying up village wells, and hindering local populations' access to the Lake of Guiers. Meanwhile, large plantations and industries consuming drinking water and/or pumping into the lake and

underground tables did not suffer.

In Dakar, densifying the distribution network increased water access inequalities and left the poorest areas without supply network or with insufficient collective water points. Collective standposts, which do not induce important increases in water consumption per person, were not the focus of investments. Meanwhile, network extensions and domestic private connections improved access in better-off neighborhoods already served by the network. Among the measures to improve water access for the poor, the social connection program implemented in areas supplied by the network excluded the poorest neighborhoods, while eligibility criteria excluded the poorest households. But wealthier families could benefit from the program. The upper middle class gained the most from private tap installations since the reform.

The water tariff system based on cross-subsidization among consumers did not ensure the basic water needs of the poor, and induced an inequitable redistribution. Determined by consumption at each connection (meter) rather than households' income, the social price of water is not adapted to poor crowded households who inevitably consume beyond the social tariff threshold volume, though water consumption per person remains very low. The water price charged collective standposts is higher than the social price charged home consumers, making water supply more expensive to poorer consumers for a restricted access. Finally, the across-the-board application of the high commercial tariff to all institutions (large and small, for- and non-for-profit) makes water supply unaffordable to small institutions providing basic services in poor neighborhoods. Thus, paying more than the social tariff, the poor subsidize the social consumption of wealthier but smaller households. The same situation was created by the new redistributive system among agriculture water consumers: quota-based prices induced small producers with insufficient water quotas to pay more for water than large plantations consuming much more but benefiting from adequate quotas.

The management of water supply for profit implied high water prices, higher increases for lower block tariffs, and disconnections for nonpayment. This reduced affordability, and

resulted in numerous and prolonged disconnections, inducing people to revert to collective supply and resort to underground water. The disconnection policy led to the total disappearance of public taps where water was still free (markets, mosques, public showers), affecting the most destitute. Small social, health or education institutions were hit hard by this policy, seriously impacting the lives of local residents. Directing supply and good quality water to high consuming areas, water distribution left poor areas with supply interruptions, low network pressure and poor quality water. Wealthy residential, commercial and industrial areas, on the other hand, receive sufficient and regular supply of better quality water.

The reform benefited those who could afford water prices and whose activities are sufficiently lucrative to afford drinking water. The others bear the brunt of underground water pollution and the use of raw wastewater. Only the small minority of well-off households living in the city center and residential areas, industries, and large plantations producing for export benefited from improved water supply. Poor urban residents not only reduced their water consumption and reverted to collective supply, but more serious resort to polluted underground water for domestic and professional use, and to raw wastewater for irrigation in urban agriculture. Informal subsistence activities that sustain the lives of the majority of the Dakar population cannot afford distributed water. The use of these alternative sources of supply has serious health consequences.

Improving water access for the poor was not the objective of the reform; increasing profitable distribution was. This worsened the gap between rich and poor, did not help reduce illness and poverty, and supported a development process that benefits only a few. Precarious situations became even more precarious, putting the health and subsistence of many at risk.

2. Sanitation services not to burden water distribution.

The impacts of the reform on sanitation services only added to the worsening water supply situation. The cost-recovery management of sanitation services and their demand-driven development, together with the absence of an integrated management and the sector's choice of

technologies, resulted in very poor services, unmet needs, and increased inequalities in service access and in the burden of pollution. Sanitation infrastructures are technically, economically and environmentally inadequate. Their operation is affected by insufficient resources, the deficiency of other sanitation services, and irresponsible urban development. Most Dakar residents suffer from lack of sanitation, widespread flooding, and associated pollution, diseases and increasing poverty. Wastewater collection and treatment improved far less than increases in water distribution, leaving more wastewater pollute the environment. Rainwater drainage did not keep up with worsening floods.

The reform separated the non-profitable sanitation subsector from water distribution in order to transfer the latter to a private operator. An autonomous public sanitation agency, the ONAS, was created, but has neither the resources nor the capabilities to fulfill its mandate. The sanitation development strategy, which endorsed international guidelines, sought to increase sanitation coverage at least cost and to achieve the subsector's financial autonomy. Coverage increased by differentiating services based on users effective demand, and cost-recovery was achieved by increasing users' contributions. Thus, the provision of sanitation services no long burdened water distribution.

Coverage by bulk sewers increased little, and provide bad services to a few at very high costs. The focus on coverage rate and network efficiency, and the heavy technical requirements of bulk sewers restricted their extensions to a few already privileged areas. Resources from water sales were insufficiently increased for the ONAs to properly operate these complicated infrastructures, while their inadequacy to local water consumption and the natural environment, as well as uncontrolled urbanization, and deficient rainwater and trash management raised their operation costs. Breakages and wastewater spills are frequent and long lasting in many neighborhoods.

In low-income peri-urban areas, a development project, the PAQPUD, subsidized the installation of individual sanitation facilities and semi-collective small diameter networks. The

project officially increased coverage rate, but left many areas with no facilities and unmet needs. Demand-driven and relying on individual and community management, the PAQPUD provided low-quality and unreliable services, and increased access inequalities. For the PAQPUD to reach its objectives, modifications had to be introduced: household contributions were lowered; lending opportunities were created; local authorities were involved in the project's implementation; and performance targets were set.

In targeted areas, the poorest households could not afford any facility; the others obtained the facility they could afford, not what they needed. Furthermore, the low-quality facilities became useless soon after their installation, not surviving floods, eating habits, or poor maintenance. These facilities also failed to protect underground water resources from wastewater pollution in areas where water tables are most vulnerable and where people resort to this source of supply for all uses.

The PAQPUD turned the provision of sanitation services into a private responsibility, dependent on users' ability to pay for the installation and maintenance of facilities. This compounded inequalities created by the differentiated service development strategy. Residents in poor areas pay more for constraining and lower quality services than residents connected to bulk sewers, but contribute to sewers' operation through the sanitation tax included in their water bills.

Semi-collective small diameter network projects adopted the same development approach, and left the management of small networks to local communities with insufficient resources and capacities, making for precarious services and uncertain future. After ignoring local initiatives for many years, the ONAS took up the realization of small networks as part of the second phase of the PAQPUD. These systems are suited to local conditions, much cheaper and technically simple, and better protect underground water. The diversity of small network projects, however, exacerbated access inequalities. Each project required a different level of contribution from households and provided different lending opportunities. The involvement of

local authorities, as well as the protects' technical and funding incoherence, increased inequalities further. The small size of projects, their poor designs and the cost of in-house equipment made their implementation difficult. Once the networks were in place, the poor conception and maintenance of in-house equipment hindered their operation, adding to management difficulties.

Without treatment, wastewater collection constitutes incomplete sanitation services, inducing pollution increases and transfers, diseases and social conflicts. Bulk sewers displace wastewater pollution, transferring this burden from some neighborhoods onto others. When conflicts erupted in Cambérène because of insufficient treatment and pollution transfer, they were met with police force, and diffused by public officials bribing local notables and feeding the population with lies. Individual sanitation facilities are not treatment systems and release polluted effluents into the ground and underground water tables, and the sludge they produce is anarchically disposed of. But no sludge management services accompanied the installation of individual systems.

Despite investments, wastewater treatment capacities improved little. The sector's choice of technology combined to its cost-recovery management hindered this development, as well as the effectiveness of existing infrastructures, and the use of treated effluents as alternative source of water supply. Only a tiny fraction of collected wastewater is treated, and the main treatment plant operates poorly, releasing dirty effluents into the ocean. The ONAS has insufficient resources to operate treatment infrastructures, which are like collective sewers expensive and complicated to build and operate, and are not adapted to local conditions. Meanwhile, local scientists and NGOs developed promising low-cost treatment alternatives for better services and affordable effluents reuse. But the ONAS did not support these initiatives. The sector's investment decisions replicated sophisticated technologies developed elsewhere. In addition to the unquestioned preference for "modern" technologies, special interests and parallel income derived from international contracts influenced these decisions. Despite negative consequences,

projects currently under study envision the realization of similar infrastructures to be managed on the same basis.

Since the reform, the gap between drainage services and worsening floods widened. Improving rainwater drainage was far removed from the reform's priorities despite its impact on people's lives and on other sanitation activities. Drainage infrastructures are inadequate, unequally distributed and ill functioning. No infrastructure exists in areas of the suburbs most affected by floods. The reform transferred responsibility for rainwater drainage to the ONAS, but no additional resources to fulfill it. Very few drainage investments were realized. Eclectic and uncoordinated small projects undertaken by different institutions made for ineffective infrastructures and incoherent rainwater management. Furthermore, the poor maintenance of drainage systems, and the intrusion of sand, trash, wastewater and sludge hinder their operation, exemplifying the inadequacy of overall sanitation management.

Meanwhile, irresponsible urban development increased the seriousness of floods, causing more diseases and poverty. But, rather than enabling the water sector, developing a preventive flood management strategy and regulating urbanization, the government launched successive ambitious plans, which were opportunistic political and profitable moves but did not solve any problems. Individuals and local communities are left managing floods with almost no resources, and become poorer in the process.

Beyond the need to manage sanitation services as a public service, concerns for improved services point to the need for integration and research. Research on sanitation systems adapted to local economic, social and natural conditions, and based on water resource knowledge is essential. In its management of sanitation services, the water sector ignored the interactions of sanitation activities, and of these activities and urban development and water resources. Activities under ONAS' responsibility are interdependent, and the insufficiency of one contributes to the inadequacy of the others. Their development and management therefore need to be integrated. Furthermore, trash collection and urban development, which strongly affect

sanitation services, ought to be coordinated with sanitation management. Flooding cannot improve, for example, if wastewater and trash hinder rainwater drainage, and if urban development continues to increase flooding. Finally, integrating the management of sanitation and water supply, both within the water sector, would improve water supply and better protect water resources.

3. Destroying water resources.

Since the reform and despite official claims, the water sector implemented a non-integrated and unsustainable management of water resources. Preserving water resources was not the goal of water sector reformers, Senegalese politicians, or international financial institutions. The water sector commercialized water supply for profit, increased the exploitation of underground and surface resources to satisfy Dakar demand, and addressed the financial costs of pollution and waste through cost-benefit calculations. If this contributed to sustain the country's economic growth, it accelerated the destruction of water resources.

As the exploitation of the Lake of Guiers intensified, a management strategy was elaborated to address potential conflicts among users and protect water quality. The creation of a lake managing agency was decided, but its mandate was weakened before its creation was endlessly delayed. The Office for the Lake of Guiers is therefore unlikely to have enough power to impose protection measures and arbitrate among users.

The lake management strategy ensured the water needs of powerful users (large plantations and industries) were satisfied, but left local populations with reduced access to the lake and farming possibilities, and no drinking water. Controlling pollution sources would strongly constrain large plantations and industries, and require authority over development projects and land use that calls for substantial power and resources which consultations and the future Lake Office are unlikely to garner. Thus, pollution reduction depends on polluters' good will.

Management decisions were made with little knowledge about the lake's hydrology and sustainability mechanisms, or the implications for the Senegal River that feeds it. Furthermore, management only concerns activities around the lake, when all activities affecting the watershed of the Senegal River and the lake have to be sustainable for the lake's water to be protected. But relevant political, economic and environmental factors are beyond the scope of the current lake management and the authority of the Lake Office. Thus, management decisions rest on the balance of power between Dakar increasing water needs and agriculture and industrial development around the lake. Powerful actors using its water will *de facto* continue to manage the lake and determine its future.

The water sector's management of underground water resources is not integrated around the goal of preserving them. The sector increased the exploitation of underground tables despite pre-existing overexploitation and known negative consequences. It implemented ineffective protection measures, its own activities contribute to polluting these resources, and it ignores other sectors' destructive impacts. Persisting overexploitation and pollution will lead to the destruction of all tables. Aquifers are not being replenished, their levels are dropping, and water quality is degraded. In the Dakar region, contamination is beyond prescribed norms in all respects, and some resources are lost. In the Niayes region, contamination is progressing and fossil resources are being exploited. Because of hydraulic continuity between aquifer systems, pollution is transferred to all tables, including non-exploited ones, and deeper layers are recharged by emptying upper ones. Their proximity to the ocean puts all lowering aquifers are at risk of salinization, and thus of destruction as freshwater sources.

The measures adopted to protect underground resources were far from addressing overexploitation and pollution. Little was invested for improving resource knowledge and monitoring. Water pollution was addressed by diluting poor quality water, and by increasing draw-offs in good quality sources so that the exploitation of tables whose quality is a problem for distribution could be reduced.

The water sector ignored numerous factors contributing to underground water pollution and depletion, including the vulnerability of exploited tables. The lack of integration between water supply, sanitation and rainwater drainage hinders the effectiveness of these activities, while land development, economic activities and urbanization are polluting tables and hindering their renewal. This combination speeds up degradation, and makes its reversibility further unlikely.

Water tables in the Dakar and Niayes regions are particularly vulnerable to contaminations from polluted ocean water, inadequate sanitation, agriculture, industrial activities, and urbanization. Lying one yard below sandy soils, water tables are direct receptacles for excreta, trash and any chemical pollution. Contaminated coastal waters intrude lowering tables. Planned sanitation projects to are unlikely to adequately treat domestic and industrial effluents discharged into the ocean and reduce pollution around the peninsula. Meanwhile, shoreline developments accelerate coastal erosion, speeding up seawater invasion.

The increased volume of water available for consumption in Dakar facilitates wastewater infiltration and pollution transfer to underlying aquifers. But the water sector did not develop sanitation to match that increase. Furthermore, sanitation development projects led to the installation of environmentally unsafe facilities in areas where the aquifer is most vulnerable. When a study confirmed the inadequacy of these systems, it was kept secret and the sector did not modify its development strategy. Finally, the sector barely addressed the urgent need for sludge collection and treatment, leaving an increasing amount of excreta materials contaminates the ground and underground water. Meanwhile, the sector marginalized alternative treatment technologies adapted to local needs and conditions.

Beyond the water sector, inadequate trash management is an important source of underground water contamination. Trash is buried or burnt everywhere. Anarchic dumpsites are spreading, receiving domestic as well as industrial and medical wastes. The unique official, and humongous, landfill sits on top of the water table. Even if the landfill is shut down,

contamination will persist for decades, and with no clear management plan, trash will continue to contaminate underground water in the entire region.

The country's industries are concentrated in one vulnerable area. No industrial sanitation exists, and factories discharge in their surroundings toxic wastes and effluents that infiltrate underground water. Intensive agriculture in the Dakar and Niayes regions contaminates water tables with herbicides, pesticides and fertilizers, including illegal organo-chlorinated products. Urban development takes place without regulations to protect water resources. Contaminated run-offs end up in water tables. Niayes and water table recharge areas are filled-in for construction. Urbanization hinders the functioning of sanitation infrastructures and natural rainwater drainage.

The commercial management of water supply did not promote the preservation of water resources, but caters to the unsustainable demands of profitmaking and economic growth. Its short-term perspective is incompatible with water sustainability requirements. It addresses water waste and pollution to the extent of their financial costs. The water sector implemented a demand-management strategy to reduce financial losses from unpaid and lost supply, not luxury or unnecessary consumption and overexploitation. Commercial and technical measures reduced network losses and unpaid domestic and public water bills. But reducing low-paid agriculture water consumption was more difficult as it runs counter to the country's development objectives and the interests of powerful civil servants. Financial considerations led the sector to ignore the industrial consumption of distributed supply, of unnecessarily high quality but charged high prices, and to neglect the development of alternative sources of supply.

The environmental impact studies and management plans that accompanied investment projects served to validate these projects and obtain international funding, but did not help protect water resources. They did not influence investment decisions or management strategies, and made inadequate recommendations often not implemented.

Local politics, the search for economic growth and international pressures hindered the development of a political will to protect water resources. This lack of political will concurred with the water sector's ineffective protection measures, and the reform's neoliberal orientations. The reform's main achievement was to improve the sector's profitability and introduce a private operator. Strengthening public control over water resources goes against privatization interests, restricting the private sector's potential benefits from water services. Effective resource protection would also be unfavorable to the country's rapid economic growth strategy encouraged by Senegal financial and economic partners. Thus, water reformers and government officials did not provide the technical, financial and institutional support needed for elaborating a coherent national water policy and adequate regulations, and for enabling institutions to effectively protect water resources.

Without political will to protect resources, the commercial management of water supply caters unhindered to the demands of economic sectors under the pressure of a growth-oriented development process. The water sector reform contributed to sustain this process, bringing more water to the rapidly growing urban area and its growth-inducing activities. As this process is pursued, more and more water will have to be brought to Dakar, causing the irreversible destruction of local and distant resources.

Thus, the Senegalese water reform privatizing water supply, the lack of political will to preserve water resources, and international water development policies were coherent in promoting the exploitation of water resources for profit and economic growth, while disregarding their sustainability requirement. But the politics of water successfully hid this disregard and the contradiction between increased exploitation and resource protection behind the conciliatory power of the neoliberal notion of sustainable development.

B. Ideas, interests and policymaking

The process leading to the adoption of the water sector reform reflected the interests of powerful international and Senegalese actors, and the hegemony of the neoliberal economic

ideology. Behind the disguise of sustainable development, the reform opened further the Senegalese economic to international business interests, and thus contributed to global economic growth. If efficiency and financial sustainability were real objectives, efforts at participation, social equity and environmental protection illustrated the parody and rhetorical function of neoliberal sustainable development.

This interpretation of sustainable development was developed within the UN to counter the critical content of the original concept and the threat of its appealing values. From challenging economic growth on an ecological basis, sustainable development came to encourage the economic management of environmental assets and growth as an all-purpose solution. This interpretation fit neoliberal water policies and promoted them as socially and environmentally beneficial.

1. ***The reform process.***

The adoption of the Senegalese water reform resulted from a combination of coercion and consensus in which ideology was critical. The IFIs encouraged the reform to speed up the ongoing economic liberalization imposed on Senegal since the late 1970s. A neoliberal propaganda endorsed by the Socialist government accompanied this process and took hold among Senegalese elites, including water professionals. Ideological change and liberalization efforts pertained to the evolution of the Senegalese political economy since independence, from African Socialism to full-fledged liberalism with President Wade after 2000. This evolution reflected the rise of neoliberalism as hegemonic culture, with sustainable development as one of its pillars.

During the decade preceding the reform, Structural Adjustment Programmes imposed the commercialization of water supply, and the public water utility, the SONEES, became responsible for investments and debt services. In parallel to these “adjustments,” the policy discourse progressively spread neoliberal values and undermined the legitimacy of public

services, stressing the evils of public sector and government spending, the need to commercialize basic services for the sake of efficiency, rationality and financial sustainability.

By the time of the reform, the country's ideological climate had changed. The neoliberal notion of sustainable development was pervasive, and contributed to circumscribe opposition to privatization. The reform was accepted as a "sustainable development" endeavor, necessary to increase water distribution, preserve water resources, and secure the sector's future.

The government did not have much choice but to proceed with the reform in order to obtain loans for its water development projects. But the full divestiture of the sector's assets to the private sector was still politically sensitive. The government also wanted to avoid riots likely to occur if water price increases were too high. The World Bank accommodated these demands for the sake of a successful privatization and the country's stability, as long as the private sector took over water distribution, and infrastructure investments and water prices achieved the sector's financial "equilibrium" in a "reasonable amount of time."

Thus, though the investments the World Bank accepted to finance were not those envisioned by the government, the development of the water sector remained under state control. Only water distribution was transferred to the private sector. A public asset-holding company, the SONES, was created, and a contractual regulatory system imposed performance targets on the private operator. Water price increases were moderate and a social price of water targeting the poor was maintained. A separate public agency in charge of sanitation services was established. These decisions made the reform politically acceptable and suited water sector managers.

Opposition to the reform was limited and driven more by parochial interests than by the objectives of safeguarding public services or opposing capitalist development. Its influence on the reform was possible so far as it did not threaten privatization and profitmaking. No popular opposition emerged. Public information was scant, and most Dakar residents ignored water distribution was being privatized, even after it was voted in Parliament.

The water utility's managers initially opposed privatization, but their neoliberal orientations and their involvement in designing the reform countered this opposition. Their own objectives for the sector coincided with those of either the government or the IFIs, while their support was indispensible for the legitimacy of the reform and its future. Once they saw privatization was not negotiable, SONEES managers endeavored for a "good privatization," promoting measures to improve efficiency in the new institutions they would soon be in charge of, secure the sector's financial equilibrium and increase the availability of water resources.

The neoliberal ideology had also worked its way among the sector unions, more concerned to safeguard their interests than to maintain public water services and a socially oriented economy. After a strike that deprived Dakar of water for a few days, the sector's workers were guaranteed continued employment and benefits in the new structures. Satisfied, they accepted the reform.

Consensus-building efforts supported the reform process and legitimized decisions. International consultants, the media, colloquia and seminars explained the benefits of the neoliberal management of water services. Participatory gatherings validated government's and World Bank's decisions, and gave the opportunity to a few to elaborate measures along prescribed orientations. Then, parliamentarian votes rubber-stamped decisions, and measures required for the reform's success were made binding by contracts.

This strategic endorsement gave the appearance of a democratic and consensual reform, but did not contribute democratic progress in Senegal. It did not help fight corruption in the water sector, increase accountability, or foster a democratic polity. On the contrary, imposed measures and required public show of good will constrained the policy process, inducing political maneuvering and a parody of participation. Contracts for the reform's investments were opportunities for business and income that nourished political clientelism.

But the reform comprised the necessary elements of a neoliberal sustainable development success: participation, efficient management, social and environmental measures.

Sustainability was primarily financial and subsumed other sustainable development requirements. It determined the sector's investments and reorganization, as well as service development and management. The reform's "environmental" measures consisted in the efficient allocation of water resources. The social dimension of the reform was limited to subsidizing social connections to the water supply and sanitation networks that would benefit only a few, and a social price of water that would prove counter-effective in ensuring basic supply to the poor.

The environmental studies for the investment projects served an ideological purpose, attesting to the sustainability of the sector's development. These studies minimized or ignored the negative impacts of investments, and contributed no knowledge on water resources. They overlooked the urgent need for sanitation induced by increased water supply, and ignored the impacts of institutional changes (private management, the separation of water supply and sanitation) on water resources.

After the reform was in place, the sustainable development discourse applied to water services (IWRM) helped consolidate the new institutional setup and implement further liberalization measures. Water sector decisions remained oblivious to the few grassroots initiatives that reconsidered the implications of sustainable development for the management of water resources and made recommendations that did not always suit the neoliberal perspective. The government widely publicized these participatory sustainable development efforts, but never validated the documents they produced as policy tools.

Thus, the inroads of the neoliberal economic ideology among Senegalese elites combined with international pressures to liberalize the country's economy, and the dependence of Senegal on international trade and financing induced the government and the political elites to endorse the neoliberal water reform, and facilitated its acceptance among water professionals.

The reform opened further the Senegalese economy and its natural resources to international business interests. It turned water distribution into a profitable activity, and made

more water available for activities with strong effective demand, thus allowing Senegal to better contribute to global capitalist growth and to the interests of those benefiting from it. But water diverted towards profit-making activities is not available for local needs and less efficient activities, and thus unlikely to help improve the lives of the majority of the Senegalese people.

2. Sustainable development and water reforms.

Sustainable development as an ideological disguise to neoliberal economic policies was elaborated within the UN system. It was transformed away from ecological concerns into a concept that encourages the privatization and commercial management of basic services and natural resources. The UN was central to the diffusion of this neoliberal concept and concurrent water policy guidelines in developing countries.

Though an ecological critique of the destructiveness of the development-as-growth model emerged within the UN in its early years, the economic management of environmental issues immediately dominated policy orientations. This management allowed development activities to proceed unhindered by the costs of environmental degradation, rather than adjust to environmental protection needs. This prevalence of this perspective reflected powerful states' interests and coincided with the UN institutional separation between environmental protection and the development of natural resources.

The term "sustainable development" emerged at a time when ecology had been ostracized from development policy, and the ideological reconciliation between economic growth and environmental preservation was almost complete. This reconciliation was part of the backlash against oppositions to the expansion of the capitalist system that took place during the 1960s and 1970s. States rejected any development strategy aiming at satisfying basic needs without transgressing natural limits, i.e. restricting growth. Official UN declarations, negating environmental limits, the inevitable exhaustion of non-renewable resources and conflicts between social, environmental and economic objectives, promoted industrialization and growth as sustainable and benevolent. Economic rationality took over environmental management, and

market mechanisms became environmental solutions. The “proper” management of environmental assets involved their monetization and commercialization based on cost-recovery pricing, and market solutions to problems of scarcity, pollution and mismanagement.

Initially, sustainable development was a counter hegemonic tendency, challenging the industrial capitalist growth model. It encouraged policies that threatened the interests of dominant international actors. But as the international political economy was becoming increasingly liberalized and privatized, the World Bank and the international business sector came to dominate the UN environmental agenda and policymaking. They made sure that environmental policies would not jeopardize economic growth: sustainable development would not imply the ecological management of natural resources or the ecological regulation of development activities.

To counter the threat arising from the popularity of sustainable development with its ecological and social values, a policy discourse was elaborated positively connecting sustainable development to neoliberal economic policies. Sustainable development was turned into an all-inclusive vague concept, excluding ecological constraints and any timeframe for sustainability. The notion integrated the economic management of the environment, and growth as an all-purpose solution. Sustainable development became quasi synonymous to growth, encouraging capitalist industrial development, and promoting the image of a benevolent, democratic, and environment friendly growth.

If this redefinition was far from reflecting growing scientific concerns about the global environment, it was adapted to neoliberal economic policies. With the sustainable development label, these policies were asserted to promote the satisfaction of basic needs, social equity and environmental preservation. Thus, what caused environmental degradation became its solution: more growth through privatization and commercial management.

The rhetoric of sustainable development reinforced the global consensus and brought neoliberal environmental policies to hegemony. These policies were now perceived as the only

rational strategies to “take care” of environmental and social problems. Discussions on possible alternatives were excluded. The policy debate was restricted, assuming dominant tenets as common sense and excluding challenging reflections.

When applied to water services, sustainable development encouraged reforms and management strategies harnessing water resources for profit, and restricting concerns for their degradations to cost-benefit calculations. The Integrated Water Resources Management guidelines embedded this approach and encouraged turning the management of water services to the private sector for the sake of efficiency, and therefore of improved and equitable services and water resource preservation. Increasing the exploitation of water resources for profit implied their sustainable development. Cost-recovery pricing and demand-responsiveness would determine the provision of water services, thus eliminating them as public services.

Under the auspices of the UN, international conferences and partnerships spread the neoliberal sustainable development ideology and water policies throughout the developing world. African leaders endorsed discourse and policies, and encouraged the reforms required for the private sector to appropriate water services in their respective countries. By giving these strategies a new outlook, sustainable development gave new legitimacy to the very policies it initially criticized—the same policy reforms international financial institutions and Western powers had pushed on developing countries since the late 1970s. Thus, sustainable development reforms contributed to the further integration of developing countries, their basic services and natural resources into the global market economy.

If sustainable development supported global economic integration and sustained hopes for replicating the western-type development model, the poor have experienced the increasingly polarized effects of this inequitable and destructive model. In Senegal, access to water services worsened for the poor who pay more for worst services and suffer the most from the destruction of water resources. Though the Millennium Development Goals for water and sanitation may be officially achieved, unmet water needs, the desperate lack of sanitation, the destruction of water

resources, and a management that is all but integrated deny the water reform's success at sustainable development.

The actors empowered by the reform were transnational corporations and financiers, and their political allies. The reform benefited foreign companies (contractors, consultants) and domestic entrepreneurs connected to the global market, the rich, and public officials translating international loans and contracts into personal paybacks. A multinational water corporation took over water distribution. Upper class residents, industries and large plantations have a secured access to water supply.

This dissertation brought the environment as a critical dimension of the international political economy and of development. Bringing in the environment shed a new light on the destructiveness and unequal nature of western industrial capitalism and its expansion to a developing country. Addressing the sustainability of the water sector in Senegal implied considering the country's overall development, and therefore its place within the global economy.

Environmental concerns lead to reconsider the nature and purpose of development. Sustainable development starts with the sustainability of all environmental assets (natural resources, ecological cycles, absorption capacities) and technologies, in relation to social and human needs. Satisfying basic needs while respecting environmental sustainability thresholds would therefore determine economic activities. With limited resource availability, choices among the uses of natural resources have to be made. Priority uses have to be determined. As environmental destruction dismisses hopes for trickle down from an increasing economic pie, improving people's lives based on an equitable share of natural resources becomes the purpose of development.

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