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Water Institutions and Management in Switzerland

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Abstract

The main characteristics of water management in Switzerland are its big diversity, strong decentralisation, and different modes of management between drinking water supply and sanitation. Both, the distribution of water and sanitation, fall within the competences of the cantons, which normally delegate this mandate down to the municipalities. The water sector in Switzerland is organised as a local monopoly, with the most common organisational structure being the municipal water service for drinking water supply, and the (non-autonomous) municipal management for sanitation services. Although significant changes are not expected in the sector in the near future, there are important features and dynamics that may help understanding how the sector will most likely evolve. Firstly, and especially in what concerns water supply operators, there has been a trend towards the autonomisation and professionalisation of the public entities. Secondly, there is a growing trend towards regionalisation of operators both for economic, technical, and security reasons. Thirdly, there is a general consensus that the degree of water liberalisation is unlikely to increase in the near future. And, finally, public opinion is considered by the specialists as the most important driving force of the Swiss water sector.

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1. INTRODUCTION

This case study addresses the provision of water supply and sanitation (WSS) services in Switzerland, in particular their structure and type of management, as well as their institutional arrangements. Special attention is paid to the current debates and challenges that the Swiss water sector is facing.

Traditionally, the provision of WSS services in Switzerland has been under the jurisdiction of the municipalities. Therefore, the structure of water services provision is highly local. In Switzerland, the involvement of the private sector is often considered inappropriate given, it is argued, the merit good characteristics and the strong environmental and public health externalities of water services, and the conviction that public entities are more capable of providing these services than are private ones.

First it is important to state that, given the scope of this work, the water sector is limited to water supply and sanitation, i.e., to the supply of drinking water, and the collection and treatment of wastewaters. The transfers of raw waters over long distances, hydroelectric schemes, and irrigation are excluded from this study.

This study starts out by recalling the main characteristics of the country (Switzerland) affecting the structure, the institutions, and the type of management of the water sector. The remainder of the first chapter summarises the historical background and evolution of the WSS services, the national consumption habits, and, finally, the characteristics of the services provided. Chapter 2 looks at the legal framework, favouring a national perspective, given that at present there are no supranational legal rules, which determine the structure, the type of management, or the institutional arrangements of the Swiss water sector.

Chapter 3 follows with the analysis of the institutional and regulatory arrangements typifying the sector. The water market is presented in chapter 4, namely in what concerns the existing management structures, the nature of the private sector participation, and its current dynamics. Chapter 5 focuses on financing aspects in the Swiss WSS sectors, followed by some concluding remarks in chapter 6.

1.1 Country Facts

1.1.1 Environmental and Geographic Issues (water-related)

Switzerland has a total land area of 41 290 km², which, in geological terms, belongs to the Alpine mountain system. The topography of the territory explains the variety of local climates and the high level of precipitation, which is twice the European average.

With an estimated 262 billion cubic meters of water, Switzerland can be classified as a high water availability country, holding about 6% of the Europe's freshwater resources. The majority of this amount of freshwater lays in lakes (51%), 25% rests in the country's glaciers and snow, about 21% are stored in the underground, and, finally, about 1% in man-made lakes (see table 1). Due to climate changes, overuse, and reduced ability of surface waters to infiltrate, groundwater levels have dropped in recent years.

Table 1: Water resources in Switzerland.

Resource	vol. in million m ³	%
Natural lakes	134'000	51.1
Glaciers	67'500	25.8
Groundwater	56'000	21.4
Reservoirs	4'000	1.5
Streams and rivers	500	0.2
Total	262'000	100

Source: Swiss Federal Statistical Office (SFSO), 2002

Switzerland shares several river basins with its neighbours, the most important being the Rhine, the Rhone, the Po, the Adige, and the Inn.

A total of 2 560 million m³ of water is annually abstracted in Switzerland (EEA, 2003). In the past, it was possible to extract water from water bodies without restriction. However, today a concession is needed for every use of a water body, be it for irrigation, electricity generation or cooling purposes. Regarding drinking water, the main sources of abstraction are spring water (about 40%), ground water (around 40%) and, to a lesser extent, lake water (approx. 20%). Therefore, spring and ground waters are the major water supply sources in Switzerland (see fig. 1).

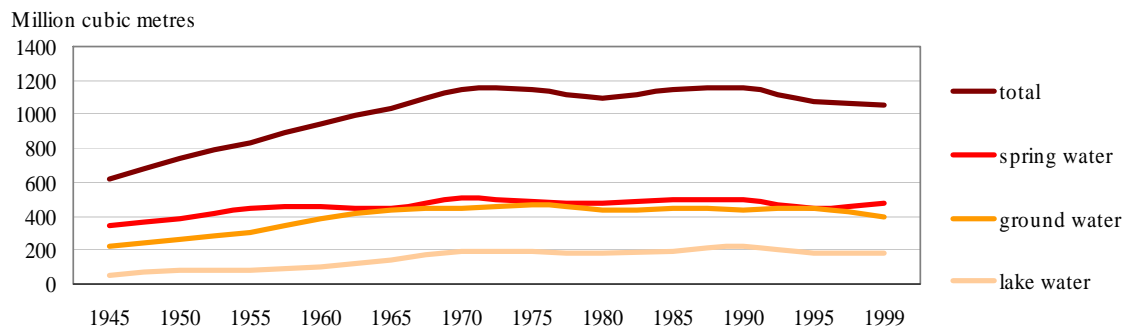


Fig.1: Evolution of drinking water abstraction per source, 1945-1999¹.

Almost half of the ground and spring water withdrawn require no further treatment and can therefore be used directly as drinking water. Nevertheless, this situation is changing due to a deterioration of the quality of many aquifers with an increase in pollution of all kinds, especially from agricultural and industrial activities, urbanisation, transports, as well as from air pollution².

¹ Source: Swiss Gas and Water Industry Association website, <http://www.svgw.ch> [2000].

² Source: Swiss Agency for the Environment, Forests and Landscape website, <http://www.umwelt-schweiz.ch/buwal/eng/index.html> [2003].

1.1.2 Demographic and Socio-Economic Factors

The country has a total population of 7.2 million inhabitants, of which about 70% live in urban areas. The average population density is very low in the mountains – which represent about half of the territory – but it is very high in plain and metropolitan areas. In the past two decades, the concentration of the population and economic activities has increased, especially in two areas: (1) the “Golden Triangle” between Basle, Olten, Zurich, Zoug and St. Gallen, and (2) the “Lake Geneva Basin” between Geneva and Lausanne. This has also been the case, although with less intensity, in the Alpine areas.

Switzerland has one of the highest development indexes in the world. The nominal Gross Domestic Product (GDP) was CHF 416.84 billion in 2002, with the services sector accounting for about 60% of that value. According to the data from SFSO, in 2002 about 70% of the active population was employed in this sector, 25% in industry and business, and the remaining 5% in agriculture and forests. Two important trends can be identified since the early seventies, namely the decline in persons employed in the industrial sector and the continuous reduction of active farmers. These structural changes necessarily affect the water supply and sanitation needs.

1.1.3 Institutional Profile

Switzerland has a decentralised political structure. It is a federalist state since 1848 with three levels of government: federal, cantonal, and communal. The Confederation has authority in all areas assigned to it by the Federal Constitution. All areas not explicitly assigned to the Confederation fall within the domain of the cantons. At present there are 23 cantons, each one with its own constitution, parliament, government, and courts. The municipalities have tasks and competencies entrusted to them by the Confederation and mainly the cantons. In fact, the degree of autonomy granted to the municipalities is determined by the canton; it therefore varies considerably from one canton to the other.

The Swiss legislative power - the Federal Assembly - is constituted of a parliament composed of two chambers mostly directly elected by the people: the National Council (200 members) and the Council of States (46 representatives from the cantons). The Federal Assembly elects the government, namely the seven members of the Federal Council, as well as the Federal Chancellor, its chief of staff. The Supreme Court is also elected by the legislative authority, i.e., by the Federal Assembly.

The system is based on political consensus, which therefore favours stability over change. This results in a relatively low speed of reforms since, often, every step requires democratic legitimation. In the late 19th century, the referendum was introduced, enabling the people to cast their binding vote on any federal act adopted by parliament³.

³ The condition is to collect the signatures of 50 000 voters within three month (about 1 per cent of the electorate).

1.2 Water Supply and Sanitation Sector

1.2.1 Historical Background and Evolution

Water supply is a municipal task since the Middle Ages, even though until the end of the 18th century only a minority of households was directly connected to the public networks. The development of the first water management systems occurred during the 18th century. The second half of the 19th century was particularly productive for the water sector, with the development of urban supply networks under pressure in cast iron conduits. These networks were independently exploited by the municipal services, private enterprises, or corporations.

During this period, several epidemics and environmental degradation problems highlighted the risks of contaminated drinking water and the dangerous effects of non-treated wastewaters. These were at the basis of the beginning of large sewer and treatment plants construction works.

The network and the services provided were progressively developed throughout the 20th century. An important step was the interconnection of local supply networks, motivated by a growing demand, and the reintegration of the private networks into municipal public services. During the 1960s, some inter-municipal and regional networks were created on the basis of increased technical efficiency. A more recent step has been the creation of supra-regional networks due to new demands in terms of security, reliability, and water quality.

1.2.2 Water Consumption Habits

The main consumers of drinking water in Switzerland are households and small businesses, accounting for about 60% of the total⁴, with commerce and industry following next with 17% of the total consumption (fig. 2). Losses are estimated to be about 12%.

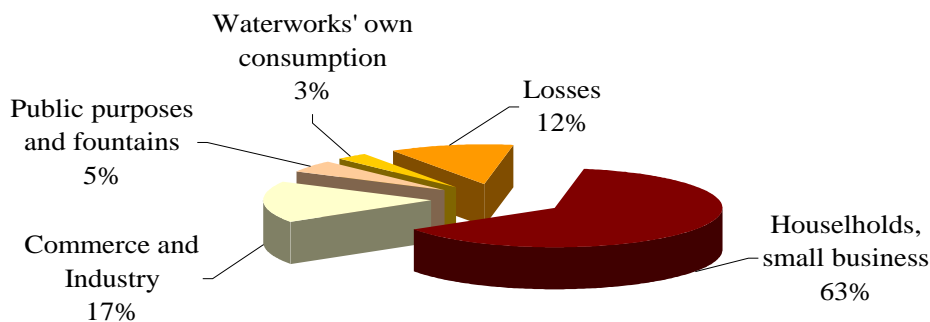


Fig. 2: Estimated relative water consumption per type of users⁵.

For the past 30 years, water consumption in Switzerland has been constantly diminishing. Mean water consumption per household dropped from 180 to 162 litres per day between the early eighties and the

⁴ It should be noted that statistics in Switzerland do not differentiate between water used for agriculture and water pumped by industry.

⁵ Source: Swiss Gas and Water Industry Association website, <http://www.svgw.ch> [2003].

late nineties largely because of water-saving taps and sanitary installations, as well as greater public awareness for the need to conserve water. In general, domestic consumption, including small business and industry, fell from about 500 litres per inhabitant per day in the early seventies to about 400 litres in the late nineties⁶. However, it was the industrial sector, which has contributed most to the general decrease, due to the introduction of new production processes and the reorganisation of the sector.

1.2.3 Water Supply and Sanitation Services

According to the statistics, 98% of the total population is linked to piped water supply networks, which are spread over 53 000 km. The tolerances and threshold values for drinking water are regulated by the Ordinance on Extraneous Substances and Ingredients in Foodstuffs of June, 26th 1995 (revised in 2002).

Switzerland's sewerage network is virtually completed, comprising about 40 000 km of underground pipes and sewers carrying wastewater from households and industries to sewage treatment plants. The majority of the approx. 1 000 wastewater treatment plants meet the current statutory requirements. However some older plants, dating back to the 1960s, still need to be upgraded.

Today about 95% of the population is connected to wastewater treatment plants, which represents a huge progress compared to 14% coverage levels in 1965 (fig. 3). A further 2% of the population could still be connected, but for the remaining 3% there is no point in connecting them since they live in remote and less densely populated areas⁷.

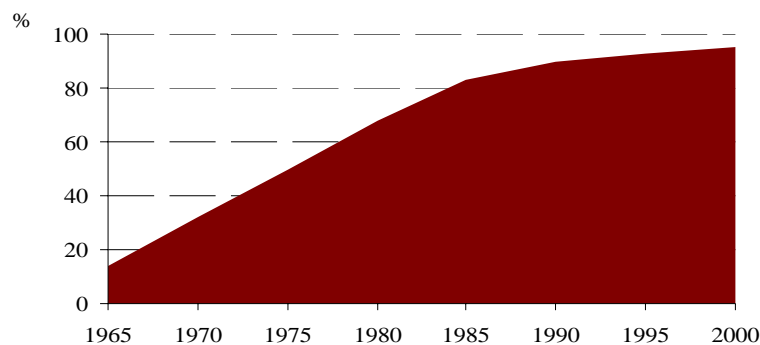


Fig. 3: Evolution of the connection to wastewater treatment plants⁸.

In international terms, Switzerland records one of the highest levels of connection in the world, with the Organisation for Economic Co-operation and Development, (OECD) average being about 62%. In addition, it generally uses the most advanced technologies in its treatment plants.

⁶ Source: Swiss Gas and Water Industry Association website, <http://www.svgw.ch> [2005].

⁷ It is permitted by the Water Protection Law of October 28th 1998, which makes provision for other systems for treating their wastewater.

⁸ Source: Swiss Agency for the Environment, Forests and Landscape website, <http://www.umwelt-schweiz.ch/buwal/eng/index.html> [2003].

2. LEGAL FRAMEWORK IN THE WATER SECTOR

2.1 National Framework

The management of water in Switzerland is under public law, and is subject to strict water quality and environmental requirements. Table 2 gives an overview of the most important environmental protection legislation, developed at the federal level, regarding water bodies.

Table 2: Laws and Ordinances governing the protection of water bodies.

The Water Protection Law	LEaux Jan, 24 1991
The Ordinance on Water Protection	OEaux Oct, 28 1998
The Ordinance on Protection of Water from Liquids Hazardous to Water	OPEL Jul, 1 1998
The Technical Ordinance relating to the Treatment of Waste	OTD Dec, 10 1990
The Ordinance on Contaminated Sites	OTAS Apr, 5 2000
The Major Accidents Ordinance	OPAM Feb, 21 1991
The Ordinance on Environmentally Hazardous Substances	Osubst Jun, 9 1986
The Ordinance on Handling of Special Wastes	ODS Nov, 12 1986
The Ordinance relating to Contaminants in Soil	OSol Jul, 1 1998
The Ordinance on Agricultural Materials	O Dec, 7 1998
The Ordinance on Air Pollution Control	OPair Dec, 16 1985
The Law on Toxic Substances	LTox Mar, 21 1969

Source: Swiss Federal Statistical Office (SFSO), 2002.

The federal Law⁹ on Water Protection from January 24th, 1991 and the respective Ordinance from October 28th, 1998 remain the main legal framework for water resources management in Switzerland. With a strong emphasis on the protection of the resource, one can find its origins in the first inclusion of an article relating to water protection in the federal constitution dating back to 1953. Four years later, the first Water Protection Law came into force, with important amendments in 1971 and 1991, namely regarding provisions to improve water quality (e.g., development of a sewerage network and its connection to sewage treatment plants).

The Water Protection Law (WPL) states specifically the objectives of “*preserving the health of human beings*” and of “*guaranteeing the supply of drinking water to industrial and domestic uses*” (art^o.1). The responsibility to implement this Law and the required regulations rests with the cantons (art^o.45) and, as a consequence, the responsibility for the provision of water supply is ultimately at the cantonal level.

In Switzerland, the provision of drinking water is considered to be a public task. The majority of the cantons have a specific law about water supply, water management or the protection of waters, or have included the water related legal aspects in the Constitution of the Canton (see table 3). Apart from this

⁹ There are six federal laws specifically concerned with the environment, one being the Water Protection Law of 24 January 1991.

majority, there are three particular situations regarding the communal legal framework of water services provision: (1) in Appenzell Innerrhoden where the provision of water services is considered to be an objective of the protection of nature; (2) in Valais where it constitutes an objective of land management; and (3) in Basel and Geneva where it is integrated in the cantonal industrial services.

Table 3: The most important cantonal legal sources for water services.

Canton	Law	date
Appenzell A.	<i>Verfassung des Kantons AR</i>	30.04.1995
Appenzell I.	<i>StKB betr. die vorläufige Errichtung von Naturschutzzonen</i>	18.12.1984
Argovie	<i>Verfassung des Kantons AG</i>	25.06.1980
Bâle	<i>Verfassung des Kantons Basel-Landschaft</i>	17.05.1984
Basel	<i>G über die Versorgung des Kantons Basel-Stadt mit Energie und Trinkwasser durch die industriellen Werke Basel</i>	21.04.1988
Berne	<i>Constitution du canton de Berne</i>	06.06.1993
Fribourg	<i>L sur l'eau potable</i>	30.11.1979
	<i>R d'exécution de la L du 30.11.1979 sur l'eau potable</i>	13.10.1981
Geneve	<i>L sur les eaux</i>	05.07.1961
	<i>L sur l'organisation des Services industriels de Genève</i>	05.10.1973
Glaris	<i>V über die Reinhaltung der Wasserversorgungen und Wohnstätten</i>	04.07.1964
Grisons	<i>EG zum BG über den Schutz der Gewässer</i>	08.06.1997
Jura	<i>L sur l'utilisation des eaux</i>	26.10.1978
	<i>O conc. les installations d'alimentation en eau potable</i>	06.10.1978
Luzern	<i>Wasserversorgungsgesetz</i>	20.09.1971
Neuchatël	<i>L sur les eaux</i>	24.03.1953
Nidwall	<i>G über die Rechte am Wasser (Wasserrechtsgesetz)</i>	30.04.1967
Obwald	<i>Verfassung des Kantons Unterwald ob dem Wald</i>	19.05.1968
	<i>AB über die Ausscheidung von Grundwasserschutzarealen</i>	31.03.1992
	<i>AB über die Sicherstellung der Trinkwasserversorgung in Notlagen</i>	06.04.1993
Saint-Gall	<i>G über die Gewässernützung</i>	05.12.1960
Schwiz	<i>Wasserrechtsgesetz</i>	11.11.1973
Shaffhouse	<i>G über das Gemeindewesen für den Kanton SH</i>	09.07.1892
Solothurn	<i>Verfassung des Kantons Solothurn</i>	08.06.1986
Tessin	<i>L sull'approvvigionamento idrico</i>	22.06.1994
Thurgovie	<i>Verfassung des Kantons TG</i>	16.03.1987
Uri	<i>Verfassung des Kantons UR</i>	28.10.1984
	<i>Gewässernützungsgesetz (GNG)</i>	16.02.1992
Valais	<i>L conc. l'application de la LF sur l'aménagement du territoire</i>	23.01.1987
	<i>D conc. les objectifs d'aménagement du territoire</i>	02.10.1992
Vaud	<i>L sur la distribution de l'eau</i>	30.11.1964
Zug	<i>G über die Gewässer</i>	22.12.1969
Zurich	<i>Wasserwirtschaftsgesetz</i>	02.06.1991

Concerning wastewater treatment, the federal WPL clearly states that cantons are responsible for the construction of public sewerage systems and treatment stations. This is especially the case of water from new urbanised and other areas, for which special methods of treatment do not guarantee a sufficient protection of water, or are not economic. The cantons are also responsible for the economic operation of these installations (art^o.11).

A number of principles are enumerated in the WPL concerning water treatment, namely (1) water evacuation in public sewers, always favouring separate networks; (2) treatment in central treatment plants; and (3) compulsory infiltration in non polluted waters. The objectives are very clear in the sense that water protection, including water sanitation, has to be complied with, both in terms of quality and quantity.

2.2 International/transnational binding legal aspects

The country is actively involved in several international commissions, namely the Central Commission for the Navigation on the Rhine (CCNR), the International Commission for the Protection of Lake Constance (IGKB), the International Commission for the protection of the waters from Lake Geneva (CIPEL), the International Commission for the protection of the Italian-Swiss Waters (CIPAIS), and the Convention for the Protection of the Marine Environment of the North-East Atlantic OSPAR (North East Atlantic)¹⁰.

The Federal Office for Water and Geology, namely its Water Resources Management Division, coordinates trans-border cooperation between cantonal and federal agencies and neighbouring national, as well as with international organisations in issues relevant for the management of international catchment basins.

However, none of these Commissions and Conventions is legally binding for the Swiss water supply and sanitation markets, neither in terms of structure nor in terms of organisation. In the future, the only international legal aspect, which may bind the Swiss WSS sector, is the General Agreement on Trade in Services (GATS).

¹⁰ According to the Swiss Agency for the Environment, Forests and Landscape website, <http://www.umwelt-schweiz.ch/buwal/eng/index.html> [2003]

3. INSTITUTIONAL AND REGULATORY FRAMEWORK IN THE WATER SECTOR

3.1 Institutional structure/arrangements

Switzerland has a federal government, which means that a lot of responsibility lies in the hands of the decentralized levels of the administration, i.e., cantons and municipalities. In fact, the responsibilities for water supply and sanitation are divided over three institutional levels, namely the municipal, the cantonal, and the federal levels (see table 4).

It is important to outline the differences that exist in institutional terms between the provision of water supply and sanitation services, which are explained by the different types of provisions specified by the federal law.

Table 4: Distribution of competences between the three institutional levels.

Competence level	Tasks
Federal	<ul style="list-style-type: none"> * Definition of principles related to water resources (protection, conservation, provision of services, exploitation); * Definition of the legal framework for the protection of the resources and drinking water quality standards;
Cantonal	<ul style="list-style-type: none"> * Regulation related to water resources (protection, conservation, provision of services, exploitation); * Responsibilities for the administrative, legal, technical and financial control of the sector; * Responsibilities for the provision of water supply and sanitation services (yet these responsibilities are normally delegated to municipalities);
Municipal	<ul style="list-style-type: none"> * Responsibility for the provision of water services (most frequent case)

3.1.1 Federal level

The Confederation is responsible for establishing the legal framework for the protection of water resources and for the drinking water quality standards. Moreover, according to art°.57 of the WPL, it has to carry out surveys of national interest about issues such as the quality of surface and ground waters, as well as drinking water supply. Regarding financial aspects, the Confederation may participate in financing the development of infrastructures and processes in the general interest of water protection.

The responsibility for the general coordination of water protection activities and the announcement of related regulations and technical norms, later applied by the cantons and/or by municipalities, lies with the Federal Office for Water and Geology (FOWG). This office pursues an integrated management approach of all waters, namely considering water use, water protection, and flood protection projects as being interdependent. Along these lines, the FOWG needs to collaborate actively and define a sustainable water policy with other federal offices, such as the Federal Office for the Environment, Forests and Landscape, the Federal Office for Agriculture, the Federal Office for Territorial Development, and the Swiss Federal Office of Public Health (FOPH).

According to the recent revision of the Ordinance on Extraneous Substances and Ingredients in Foodstuffs, the FOPH authorises: (1) the means and processes used for water disinfection; (2) the chemical substances added to water at the time of its treatment; and (3) the processes being used for water treatment.

There are other entities, organised at a national level but independent from the federal government, that also play an important role in the water sector. Two important entities in the WSS sectors are the Swiss Gas and Water Industry Association¹¹ and the Swiss Water Pollution Control Association, which are responsible for setting norms in the water utility industry.

3.1.2 Cantonal level

Cantons have the responsibility to assure the administrative, legal, technical and financial control of the water sector. They are responsible for water quality and water source protection in their territory. The competences are allocated to different cantonal entities, normally the industrial services and the water and environmental offices.

Water supply

The distribution of water falls within the competence of the cantons, which normally delegate this mandate to the municipalities. Each canton has competences of its own to apply the law on water and, consequently, each canton has its own regulation in the field, as well as its own type of water supply management.

Water sanitation

According to the federal law, cantons are responsible for the construction of the public sewerage systems and treatment stations, and for their economic operations. In particular, cantons must ensure that construction, exploitation, maintenance, sanitation, and replacement costs from drainage and treatment plants are recovered by those who produce the waste waters (art^o. 60a WPL).

3.1.3 Municipal level

Cantons normally delegate to municipalities the responsibility for the provision of water services. The degree and type of competences awarded to municipalities change from canton to canton, making the Swiss water sector highly diverse and decentralised. For example in Geneva, municipalities have only limited competences (management of secondary networks), as the canton keeps the majority of the water management and water protection functions. In other cantons such as in Vaud, municipalities have larger competencies including fixing the water prices. The canton of Valais is the most extreme case where municipalities are responsible for water quality and pricing, as well as for managing all water cleansing infrastructures.

Water supply

Municipalities keep a very broad autonomy on water supply services, especially concerning the choice of the structure and organisation of the service. Municipalities may choose to provide directly the service or to delegate it to a third entity. In the former case, municipalities have to guarantee the

¹¹ In French, *Société Suisse de l'Industrie du Gaz et des Eaux*, SSIGE.

human and financial resources demanded and are the sole responsible for the management of water supply. Nonetheless, this mode of management may take different forms and assume variable degrees of autonomy. In the latter case, delegated management involves the transfer of responsibility for a limited period of time to a public or (rarely) private partner.

The choice among different types of management is often constrained by the size of the municipality (or the canton). In smaller municipalities, the maintenance of the infrastructure (pipelines) tends rather to be subcontracted out to a (private) company than is the case in bigger municipalities. Another solution has been the creation of inter-municipal associations, which benefit from economies of scale (e.g., certain cases in Fribourg). In bigger municipalities, it is common that the water is managed through a “specialised” water service or it is integrated into local public multi-utility (i.e., industrial services).

Water sanitation

The provision of water sanitation services rests under the responsibility of municipalities. In contrast to the provision of water supply services, water sanitation services must be directly managed by the municipality, normally under a non-autonomous municipal service, relying on its own resources and with no separate accounts from the municipal budget. The only possible form of indirect management is through an association or syndicate of municipalities.

Municipalities are also responsible for building the necessary infrastructures and organising the wastewaters’ evacuation and treatment in their territory. Moreover, they are responsible for controlling the construction, the quality of operations, and the maintenance of private schemes (only allowed in special circumstances such as in isolated areas).

3.2 Regulatory functions and instruments

The regulation of water services comprises four functions, namely economic regulation, technical regulation, environmental regulation, and consumer protection (in particular Universal Service). In Switzerland there is no sector regulator, and these regulatory functions are attributed to different institutional levels.

The specific function of water protection (i.e., environmental regulation) is a federal competence, whose main instrument is the definition of quality standards. The Federal Office for Water and Geology is the responsible entity, also for the definition of technical norms, later applied by the cantons and/or by municipalities. Finally, at the federal level, one needs to mention the Price Supervisor, an entity belonging to the Federal Department of Economics, whose main responsibilities are to monitor the evolution of prices, to avoid the establishment of abusive prices, and to inform the general public about its activities.

In general, the majority of the water-related regulatory instruments are defined at the cantonal - and sometimes municipal - level, namely the attribution of concessions to use water bodies, and the definition of the fees for water use and wastewater treatment (i.e., economic regulation). Given the fact that the country is highly decentralised, each canton and sometimes each municipality is free to choose and fix the regulatory instruments. One can say that each canton acts in fact as a sector regulator of its own.

4. THE WATER MARKET IN SWITZERLAND

The present chapter presents the management structures in the Swiss water sector, the nature of the private sector participation, as well as the main dynamics in this market. The Swiss market is highly segmented, with each area being characterised by a local monopoly normally controlled by the municipality or the municipally owned operator (direct public management). It can be said that there is hardly any type of competition in the Swiss water market, or to be more precise, in the multitude of water markets within the federal territory. There is no competition in the market, and both competition for the market and yardstick competition are practically inexistent.

4.1 Management structures

At present there are some 3 000 independent water suppliers¹² operating in the market, none of them owned by the federal level, due to the historical cantonal and local organization of the sector. There are slightly less water entities than the total number of municipalities as a result of multi-municipal services. In fact, and as it was outlined before, municipalities are the main actors in the sector, directly managing the provision of the water services or, in less frequent cases, delegating part or the totality of these management tasks to a public corporation or a private company.

One can find the following management structures in the Swiss water sector: autonomous and non-autonomous entities under public law, cooperative societies, and public and private corporations under private law.

Non-autonomous entities under public law are technical and administrative units, which assume a well defined public mandate. Normally, these units have their own accounts, separated from the local administration, but have no competences in terms of human resources and financing. It is the most widespread form of operation and management in the water supply sector.

Autonomous entities under public law are independent corporate bodies under public law. The interference of the municipal executive and the population in operational and managerial matters is limited, in theory, to the selection of the board, to the approval of the accounts, and to the modification of the founding charter.

Cooperative societies, which are normally under private law, can be public, mix or privately owned. They have as a final goal the economic cooperation between the members, normally drinking water users. It accomplishes all the tasks reserved for a “Water Service” and charges taxes that cover their costs. Their activities are ruled by a contract for the provision of the service signed with the municipality (or a group of municipalities). The use of this form of management in the water sector is limited due to some legal constraints, namely the compulsory application of public law if its members are corporations under public law (e.g., municipalities), and the right each member has to participate in every decision independently of his/her share in the capital.

Finally there are the cases of *companies under private law* whose ownership may be public, private or mixed. Although they are few in number, they provide water supply services to about 10% of the

¹² Source: SSIGE website, <http://www.trinkwasser.ch> [2003].

Swiss population. Even when municipalities are the majority owners, this type of organisation has the advantage of being flexible and politically independent, enabling the participation in capital markets and the making off alliances. These corporations are particularly appealing for multi-utilities¹³, as they permit the creation of holdings with affiliates for each sector.

Box 1: Water supply in Wittenbach.

In 1897, a group of 26 citizens in Wittenbach invested their money for constructing the first water supply network, expecting to increase water supply reliability. At the same time, they founded the Water Corporation, since then responsible for managing water supply in the village. In 1932, the corporation was forced by a court decision to open the membership to all adult inhabitants of the village, who have to pay a fee set by its executive board. Operation, maintenance, and rehabilitation are executed by a private service provider whose duties are clearly defined in a contract and are controlled by the executive board of the corporation. The municipality is by law formally responsible for the water supply, yet this task is completely delegated to the corporation. The canton controls water quality, checks and approves the tariff structure, and takes care of water source protection.

Given the fact that private law companies (e.g., cooperatives and corporations) are subject to different fiscal rules, in practice there is an obstacle to their further expansion in the water sector. In fact, municipalities and their services are exempt from direct federal tax and, in the majority of the cases, from cantonal taxes. Cooperative and limited corporations may only be exempt from these taxes if they prove to provide services of public interest, which happens to be very difficult to prove, especially in the particular case of multi-utilities.

The number of privately owned companies under private law in the Swiss water market is very limited. The existing ones are normally local companies operating in limited areas for several decades, and which enjoy a long-term relationship with the municipality.

4.1.1 Water supply

The majority of the water supply services are provided by entities under public law. In fact, the most common type of operator is the “water services” (non-autonomous public law entities). In the majority of the cases, the water service has no independent legal personality and all the strategic decisions are taken by the municipal council. Therefore, the competences of the water services are normally limited to administrative ones. In some cases, especially in the biggest municipalities, several sectors are regrouped in larger industrial services providing water, electricity, gas, urban heating, and others more. In Basel and Geneva, these industrial services are organised at the cantonal and not at the communal level.

Multi-municipal services (non-autonomous public law entities) are the second most common way to organise water supply services. The infrastructures and service management of each municipality is shared among the group of municipalities, which have only administrative competences. All decisions are taken by the inter-municipal council, which is controlled by the individual municipal councils. The

¹³ Multi-utilities are companies ensuring at the same time the distribution of several services including for example electricity, natural gas, and drinking water.

ownership of the infrastructure and the responsibility of service provision remain with the municipalities (see Box 2).

Box 2: Berne's region water community.

The case of the regional water suppliers in the region of Bern is singular because several water suppliers were created from the beginning to be managed at a supra municipal level. There are six regional water distribution syndicates comprising the 60 water suppliers that are connected to the network. In order to avoid the abuse of monopoly positions, there is a legal mandate specifying all the obligations of supply, technical demands, financing, and pricing.

4.1.2 Water sanitation

Water sanitation services are always provided directly by municipalities, in the majority of the cases within a non-autonomous service. The only possible form of indirect management is through an association or syndicate of municipalities.

4.2 The nature of Private Sector Participation

In principle, the ownership of the network (i.e., the infrastructure) lies with the municipality or a group of municipalities. Only in one exceptional historical case, the case of Zoug (see Box 3), a private company owns the water infrastructure. In Zurich, Luzern, Schwyz, Nidwald, Zoug, Fribourg, Bâle, Tessin, Vaud, St-Gallen, and Neuchâtel communal laws enable the participation of the private sector in the provision of water services (see table 5 for an illustration of the potential tasks that can be delegated under the current legal framework from public to other entities in the canton of Zurich).

Box 3: Water distribution in the canton of Zoug.

For historical reasons, the water distribution in Zoug has a very heterogeneous structure, involving about 16 water suppliers (including public cooperatives, municipal services and private entities). The most important water distribution entity in the canton is the *Wasserwerke Zug AG* (WWZ), a private multi-utilities company created in 1878, which supplies water to the municipalities of Zoug, Cham and Hünenberg.

All decisions are taken by the Board of Directors, composed by representatives of the private (the majority) and public sectors. The regulation of the construction of the infrastructure and the provision of the water distribution service in the municipality is based on a concession contract signed between the parties, i.e., the municipalities and the private corporation. The concession contract defines the mandate and establishes the rights and obligations of the water supplier. There is no competitive tendering process to select the concessionaire.

Table 5: Potential to delegate from public to other entities in the case of the canton of Zurich¹⁴.

Level	Tasks	Transferability
Federal	Water management I: definition of the principles related to water resources	no
Canton	Water management II: application of ordinances about water resources	no
Municipalities	Provision of drinking water	yes
	Securing fire protection	yes
	Provision of drinking water in emergency situations	no
	Definition of the perimeter for the provision of public utilities	no
	Prudential supervision	no
	Ownership of capital/physical assets	yes
	Financing	yes
	Build/construction physical assets	yes
	Operation of physical assets	yes
	Fixing and collecting charges	(yes)*

* The transfer of setting and collection of charges to third parties is possible, but not from profit.

Source: Wiget (2001).

In practice, the participation of the private sector in the Swiss water sector is still limited to a few cases. This participation of the private sector may take the form of a concession agreement for the provision of water supply, as well as the construction or the maintenance of infrastructures. The award of these concessions is not normally subject to international competitive tendering. These concessions are regulated by contracts establishing the conditions for service provision, which must be approved by the municipal and state councils before coming into force.

For the particular case of infrastructural developments, there is an obligation to make a public tendering for bigger adjudications (normally exceeding 50'000 CHF). The main criteria for selecting the service provider are the guarantee of quality, the respect for delays, and the price. In most of the cases, the selected company belongs to the territory of the canton (both for bigger and smaller projects).

The only privately owned water supply operator in the Swiss water market is the *Wasserwerke Zug AG*, a multi-utility company operating in Zoug (see Box 3). The historical background and the type of strategy of this private multi-utility is closer to the “traditional” multi-utility entities active in the Swiss market (i.e., the industrial services) than to the new private multi-utility corporations, which have recently been created in other countries worldwide. In fact, *Wasserwerke Zug AG* is limited to its local area of competence and is capable of supplying the same customer with water, electricity and

¹⁴ According to federal law and the Zurich’s canton law.

gas. The evidence shows that the relationship with the local authorities is based on long time collaborations and relies on high levels of mutual trust developed during decades of cooperation.

4.3 Current dynamics in the market

Although significant changes are not expected in the Swiss water sector in the next couple of years, there are important dynamics that may help understanding how the sector will most likely evolve.

4.3.1 Autonomisation and professionalisation of operators

The main mode of management at present in the Swiss water sector is non-autonomous direct public management. Yet, in the past ten years, and especially in what concerns water supply operators, there has been a trend towards the autonomisation of the public entities. Even though autonomous public entities only represent about 10% of the total number of operators, it is interesting to note that most of these autonomous operators are situated in big cities like Baden, Arau, Bern, Lucerne, and Geneva. At the core of this evolution is the restructuring of the water and industrial services, which aim at more autonomy in their management.

The recent wave of legislation on consumable goods has an impact on the water sector. The Ordinance on Extraneous Substances and Ingredients in Foodstuffs of June, 26th 1995 (as revised in 2002) increases the responsibility of water operators by holding the operator legally responsible in case of the contamination and/or deterioration of the water quality. This new bill thus pushes for more transparency on water quality standards and procedures, and for more professionalisation. Indeed, in the case of small communes, professionals in water services could well be hired by fear of the legal responsibility that one has to assume according to this new law.

4.3.2 Regionalisation

According to some interviewees, municipalities (mainly smaller ones) have come under increasing pressure from (1) the multiplication, increasing complexity, and interdependency of communal tasks; (2) the worsening of their financial situation¹⁵; and (3) the increasing citizens' demand. This has contributed to a mounting number of inter-municipal collaborations¹⁶ in the fields of water distribution, water treatment, and network development and rehabilitation (Steiner, 2000). Encouraged by some cantons (e.g., Neuchâtel, Soleure and Berne¹⁷) for economic, technical, and security reasons, inter-municipal entities are already a common type of organisational structure in the Swiss water sector.

In fact, the main reasons for regionalisation are the exploitation of complementary equipment, the collaboration between overdrawn networks to optimise the management of the resource (namely

¹⁵ This fact is constantly mentioned as a source of pressure for municipalities, although there is no data available at the national level to confirm it.

¹⁶ Inter municipal collaboration is defined as the fulfilment of a public task by at least two municipalities or a municipality and a third entity.

¹⁷ The canton of Berne has actually pursued very actively this policy since it conditions subsidies for new infrastructure to regionalisation activities.

avoiding the overexploitation of groundwater reserves), the rehabilitation of infrastructure, and the budgetary constraints. However, one should expect to find regionalisation when municipalities have more or less the same size, rather than being federated around big systems, such as Zurich and Geneva (basically because the smaller communes feel they lose their autonomy).

There is no single model concerning multi-municipal associations' competences and legal form, and they actually differ from region to region (e.g., they may take the form of municipal syndicates under public law or companies of limited responsibility under private law). Independently of the form of organisation, one of the most important advantages of these associations is the possibility to manage water distribution in a more global and sustainable way, due, for example, to the planning independence from the municipal political authorities.

4.3.3 Liberalisation is not an issue

There is a general understanding that liberalisation is unlikely to take place in the Swiss water market in the near future, even if it has come under increasing pressure to open up its water services to the private sector (for example from water multinationals – for example, Veolia Environment and Suez¹⁸ – and in the context of the GATS negotiations). Water distribution and sanitation have been traditionally in public hands and there is a very strong and politically active lobby opposing the liberalisation of the sector¹⁹, arguing that the national water system works very well and opening the market would only increase the prices and deteriorate the quality of the service provided²⁰.

There are three main areas of concern regarding liberalisation, namely quality standards, security of supply, and prices. As mentioned above, quality standards are defined at the federal level, but an important part of the precautionary measures, which are not described in the law but have a significant impact in reaching the high quality levels of the sector in Switzerland, are carried out by local (often municipal) suppliers. The participation of the private sector in water services provision is then perceived as a dangerous evolution towards lower water quality levels. In fact, there is a common understanding that, in a federal regime, the necessary regulatory framework for guaranteeing the same levels of water quality and security of supply in the event of private sector participation is difficult and expensive to design and implement. As a result, water prices would have to increase in order to absorb these new regulatory costs.

About two years ago, it was expected that the liberalisation of the electricity and gas market was going to affect water supply management. Indeed, electricity, gas, and water supply services were usually regrouped in the same entity under municipal control and the change in the status of electricity and gas towards legal private entities could well have triggered significant changes in the water supply sector. However, the liberalisation of the other network industries has rather acted as a counter force to

¹⁸ Veolia Environment - previously named Vivendi Environment – is already present in other Swiss markets such as waste management and treatment. Suez is also present in the Swiss market through its Odeco Degrémont Company, specialised in water treatment technology.

¹⁹ One of the most important lobbyists in this matter is the Working Group on Water as a Public Property, gathering several non-governmental organisations and politicians.

²⁰ See for example «Campaigners say keep water public», Swissinfo November 14, 2002; and a recent survey done by the Swiss Gas and Water Industry Association showing that 76% of the people in Switzerland were against the privatisation of water supply services.

liberalisation, reinforcing the main specificities of the water supply sector. For example in Beinwelden, local politicians were willing to transform the municipal company managing several utilities into a private law company so as to adapt to the changes in the energy sectors. This company would still be under public control but, following the reaction of local citizens, special rules were adopted for water when it comes to pricing and the decision-making process. This shows how special water is when perceived by the citizens of Switzerland.

4.3.4 The importance of public opinion

Public Opinion is considered by the specialists as the most important driving force of the water sector in Switzerland. Public opinion clearly influences the orientation and the possible evolution of the sector. There are already several cases where the role of public opinion in blocking moves towards more autonomy in the water supply sector is evident. Public opinion and local politics could also prevent regionalisation, since again water is conceived as something very local, which must be municipally driven (direct contact). In terms of sanitation, public opinion seems much less interventionist than in water supply, and one could therefore imagine more changes and developments in the sanitation sector. Overall, public opinion is very happy with the current status quo, as it obtains good quality water for a perceived good price. Public opinion is therefore pushing for the maintenance of the status quo.

5. FINANCING ASPECTS

The main guiding principle behind water sector financing is the equitable allocation of financial charges between the Confederation, the cantons, and municipalities, with a compensation benefiting municipalities with weaker financial capacity.

According to Saladin (2002), a total of 250 CHF per inhabitant per year was invested in water supply infrastructures, operations, and maintenance by the three governing levels. This amounts to about 0.5% of the gross domestic product. The majority of these investments (65 to 80% according to the WWF, 2003) are linked to the construction, maintenance, and renewal of network infrastructures.

There are mostly three sources of financing in the water supply and sanitation sector: tariffs, fees, and contributions from users; the municipal budget; and subsidies.

Tariffs, fees and contributions

The tariffs charged for water supply and the connection and user fee for sanitation are the most important source of financing of the sector. Given the division of competences between cantons and the Confederation, the responsibility to fix water prices rests with the cantons, which they normally delegate to municipalities. The structure of the tariffs is therefore highly heterogeneous (e.g., some municipalities have fees for connection, for the meter, or for consumption), as is the way of calculating the fixed fee (e.g., some municipalities use tax estimations and others the number of connections).

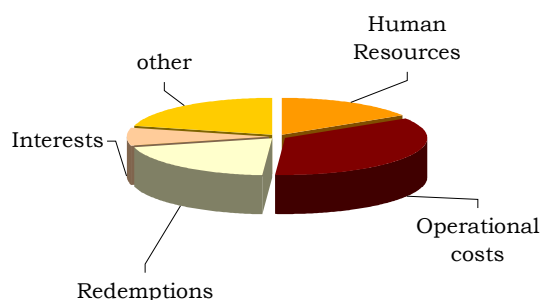
In practice, water prices vary from municipality to municipality, depending on issues such as the availability of the resources, the topography, and the length of the pipe. The price²¹ of tap water can vary between CHF 0.50 and CHF 3.50 for every 1000 litres, with the average being CHF 1.60. At present, water tariffs have a rising tendency due to a relatively old network, which consequently requires investments. Some specialists consider that this may be a problem especially in very small communes managed by non-professionals, given that the renewal of the infrastructure may have been omitted in the pricing costs.

Even if the total consumption of water has been declining, the price of the service has not decreased. The reason for this is that the burden of the fixed costs is much higher than that of the variable costs. According to the Swiss Gas and Water Industry Association, the fixed costs associated with the infrastructure network (construction, maintenance, and renewal) are independent of the level of water consumption. Therefore, even if the consumption decreases, there will be the need in the long run to increase the price of water in order to guarantee the financing of water supply.

Box 4: Structure of the total costs of water supply operators.

The major cost categories for the median water supplier operator in Switzerland are operational costs (accounting for more than one third of the total), depreciation costs (adding up to about 20% of the total), human resources costs (about 15% of the total costs), and, finally, the payment of interests (about 8% of total costs).

²¹ Source: SSIGE website, <http://www.svgw.ch> [2005].



Source: Surveillance des Prix, 2001

Figure 8: Structure of the total costs of water supply operators, 2001.

In the past couple of years, total costs have increased. Considering the different categories of prices, operational and human resources costs have increased the most, while capital depreciation and interest costs have decreased. This reduction may be explained by the decline in the national interest rates and, consequently, by better credit conditions.

According to DFE (1998), factors such as the amount of water services provided, the number of interruptions in the network, and eventually the water losses have a considerable influence on total costs per m³ of sold water.

Municipal budget

The municipal budget is especially important for financing sanitation services. In fact, according to their competencies, municipalities have to gather the financial resources necessary for the sanitation sector. Depending on the volume of investments, municipalities may take loans at market conditions (for bigger amounts of capital) or include the expenses in their operational budget (for smaller amounts). The fact that municipalities must present balanced budgets to the cantons acts as a tool to avoid uncontrolled indebtedness.

Subsidies

Subsidies in general, and in particular those at the federal level, have been decreasing constantly since the seventies. Furthermore, a distinction needs to be made between water supply and sanitation. Water supply, at least in theory, is financed through full cost recovery pricing. This information is very difficult to check (since the accounts of the communes are generally not really transparent) and it may be possible that there are some cross-subsidies between the different sectors or services within the communes. However, water supply services do not get any subsidies from the federal or cantonal levels for the maintenance of the infrastructure. For the extension of the infrastructure, some subsidies are however available. As for sanitation, this sector benefits from more subsidies at the federal and cantonal level. Federal and cantonal subsidies are essentially meant to motivate and empower measures such as environmental protection.

6. CONCLUSIONS

The main characteristics of water management in Switzerland are its big diversity, strong decentralisation, and different modes of management between drinking water supply and sanitation. Both, the distribution of water and sanitation, fall within the competences of the cantons, which normally delegate this mandate down to the municipalities. In what concerns drinking water supply, municipalities are very autonomous, namely when it comes to the choice of the structure and organisation of the service. Indeed, they may choose to provide the service directly or to delegate it to a third party. Regarding the provision of water sanitation services, they must, by law, be directly managed by the municipality. The water sector in Switzerland is organised as a local monopoly, with the most common organisational structure being the municipal water service for drinking water supply, and the (non-autonomous) municipal management for sanitation services.

Switzerland's direct democracy system slows down any significant changes to the way the water sector is organised, and, in addition, also favour heterogeneity. In fact, there is no large regional network, and both public authorities and water suppliers give preference to local management solutions.

Although in general both consumers and authorities are satisfied with the overall performance of the Swiss water sector, there is increasing conflict between three following principles: (1) according to the federal law, water must be available in sufficient quality and quantity at all times (which cannot be done without high costs); (2) for environmental reasons, water saving is good, yet it reduces the income of utilities, threatening their ability to maintain the costs of high levels of supply security; and (3) water utilities should be financially sound and self-sufficient, thus covering their costs by the income from the provision of water services.

Moreover, several inefficiencies are pointed out. On the one hand, the very small size of several suppliers limits the benefits that can be derived from economies of scale. On the other, the growing financial demands for maintenance and rehabilitation of the networks, coupled with the growing financial pressure in several municipalities, as well as the political unease with price increases, may lead to insufficient investments, thus affecting the quality and reliability of the services.

The liberalisation of WSS markets is not directly envisaged by the main actors in the sector (including the public authorities). Indeed, there is a general consensus that the degree of water liberalisation is unlikely to increase in the future, and that by giving enough autonomy to the utilities, the business principles and practices can be adhered to without suffering the disadvantages of liberalisation.

Nevertheless, there are important restructurings going on in the Swiss water sector. Firstly, there is a trend towards an increasing autonomy of water management in relation to politics, even though municipalities remain in the majority of the cases the owners of the assets. The most common cases are the transformation of organic units within the municipality or cantonal structures into autonomous organisations possessing sole decision-making competency at all levels of managerial action. Finally, it is the regionalisation of the distribution of drinking water in the form of inter-municipal or regional associations, a beneficial solution especially for smaller municipal water and industrial services, which can profit from important synergies (e.g., benefits in terms of procurement and laboratorial services).

REFERENCES

- ANTOINE, Patrick, 1993. *L'assainissement en Suisse*, Strasbourg : Laboratoire Gestion des Services Publics.
- DFE, 2001. *Le marché suisse de l'eau potable : Coûts et prix. Actualisation des principaux résultats de l'enquête de 1997/1998*, Berne : Département Fédérale de L'économie (Monsieur Prix).
- DFE, 1998. *Le marché suisse de l'eau potable : Coûts et prix. Principaux résultats d'une enquête de la Surveillance des prix*, Berne : Département Fédérale de L'économie (Monsieur Prix).
- DISERENS, Thierry, 1998. « Eaux usées. Les grandes étapes de l'assainissement des eaux en Suisse », in « 25 ans dans un environnement turbulent », Lausanne: EPFL.
- EEA, 2003. *Europe's Environment: the third assessment*, Europe Assessment Report no. 10, Copenhagen: European Environmental Agency [site visited in May 22nd 2003, http://reports.eea.eu.int/environmental_assessment_report_2003_10/en].
- HARE, Matt, 2003. « Participation in Zürich case study », in *Participatory Integrated Assessment in five case studies*, Report of workpackage 4 of the FIRMA project, [site visited in August 2003, <http://firma.cfpm.org/Documents/firma-wp4.pdf>].
- KRAYENBUHL, Laurent, 1998. « Eau potable. Approvisionnement et distribution d'eau potable en Suisse », in « 25 ans dans un environnement turbulent », Lausanne: EPFL.
- LANZ, Klaus, 2003. *Ökologische Konsequenzen einer Privatisierung bzw. Liberalisierung der Schweizer Wasserwirtschaft*, Hamburg: International Water Affairs.
- SALADIN, Matthias, n.a. “Wittenbach, where a club for a few evolved into a co-operative for all”, Community Water Supply in Switzerland, Series of Case Studies, St-Gallen: SKAT Switzerland.
- SSIGE, 2001. *Le secteur de la distribution d'eau en mutation: changements de structure et perspective d'avenir*, Zurich : Société Suisse de l'Industrie du Gaz et des Eaux.
- SFSO, 2002. *Environment Switzerland: Policies and Outlook*, Neuchâtel: Swiss Federal Statistical Office.
- SFSO, 2002. *Environment Switzerland: Statistics and Analyses*, Neuchâtel: Swiss Federal Statistical Office.
- STEINER, Reto, 2000. *Collaboration intercommunale et fusion de municipalités en Suisse*, Berne : Institut de l'organisation et du personnel de l' Université de Berne [site visited in August 7th 2003, <http://www.iop.unibe.ch/>].
- TOGNINA, Andrea, 2003. “Water flows through Switzerland's history”, Swissinfo, March 14th.
- WIGET, Roman, 2001. “Privatisierung im Trinkwassersektor – Möglichkeiten und Grenzen”, Travail Postgrade du Cycle d'études postgrade en aménagements hydrauliques, Lausanne: EPFL.
- WWF, 2003. “Pour une gestion durable de l'eau dans les zones habitués de Suisse”, Vernier: WWF Suisse.