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Drinking Water: The Emergence of a Sustainable Resource in the Energy and Climate Transition of the Bordeaux Metropolitan District, France

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Abstract

Since 2000, the development policies of the Metropolitan Region of Bordeaux have taken a definite turn to make water a major issue in its future development. A metropolis of 800,000 inhabitants, ranked fifth in France, with a world-renowned built heritage and continuous demographic growth, it benefits from a high quality of life. As part of a regional research project (Adeqwat program, 2018-2020), a multidisciplinary team of hydrogeologists and sociologists combined an analysis of the resource (functioning of aquifer systems in the Nouvelle Aquitaine region) and an analysis of its governance based on the stakeholder plays in water and urban planning policies (sociological approach).

The main question is to know how these actors envision the future of the resource in 2050 from a solid experience and the current diagnosis. Thirty-three stakeholders belonging to public authorities and their agencies, private water companies and territorial planning departments were interviewed (interviews, observations, participatory workshops).

The interviews not only reveal the objective of "securing" the resource but also its sustainable management to guarantee the living conditions of city dwellers in the long term. Three main results are advanced: first, water management follows technical progress, integrates environmental protection and adjusts to the new needs of the final users. Secondly, it penetrates into more general urban planning policies, shaking up the ways of thinking and designing the city.

Finally, it is becoming the basis for a change in local governance that is more open to the metropolis' neighboring territories and to its inhabitants in order to consider a collective fate beyond the urban perimeter.

Keywords

Water resources; metropolization; climate change; hydro-urbanism; urban planning; water uses

01

Introduction

This chapter addresses the results of research, conducted in the territory of Bordeaux and Gironde in France (2018-19). Its main objective was to understand the reconfigurations of relations between water and territorial planning stakeholders, under the influence of climate change and the resulting harmful environmental and social effects (Le Treut 2018). Locally, a renewed policy reinforces the predominant role of Bordeaux metropole, a major organizational body for planning policies, integrating water issues in a transversal way (adaptation to climate change, risk prevention, improvement of the comfort of city dwellers).

This new policy also reveals oppositions and tensions between city and country or, conversely, cooperation with other actors (Brown, Godier, Gonzalez, Reix 2020), such as the department's neighboring cities, departments (departmental water schemes), and regions (territorial planning). Building on from the idea that a new form of governance is emerging, this chapter examines how, in the name of the preservation of the resource, the boundaries between water and territorial planning stakeholders are becoming more flexible.

The research was based on an original collaboration between sociologists and hydrogeological engineers, combining the two points of view to understand the issues surrounding the resource and the terms of the debate.

This multidisciplinary approach was innovative because the sectors were not accustomed to communicating at the time the research started. Another original aspect of the survey was the organization of workshops which gathered stakeholders of water (engineers, hydrogeologists) and urban planning (urban planners, experts, elected officials), discussing the current and future challenges of local policies. The results of the workshops led to the co-construction of prospective scenarios around themes that appeared significant: the alliance of water and urban planning; availability and access to the resource; grey water reuse; and levels of governance.

The chapter is divided into four sections: the first introduces the history of water in Gironde to contextualize the role of the stakeholders and the issues that animate the current debates around the resource. The second section highlights the main arguments used to improve the management of the resource, specifically water saving and technological advances. The third section discusses how contemporary urban projects incorporate water as a more central theme of their conception. The fourth section addresses water governance by highlighting the role of the Bordeaux metropolis in the context of inter-territorial dialogue (Bouba Olga 2019).

1-1. Methodology

The Adeqwat research program involved a team of researchers from the engineering sciences (hydrogeology) and social sciences (sociology, architecture) to collaborate on a shared analysis of the future of drinking water in the Nouvelle Aquitaine region. Funded by the Nouvelle Aquitaine region and the Bordeaux metropolitan area's drinking water service delegate, Suez Eau France, the research was collectively conducted by the Bureau de Recherches Géologiques et Minières (BRGM), the Suez research and development center (LyRe) and one of the laboratories of the Bordeaux national school of architecture and landscape, PAVE (Profession Architecture Ville et Environnement).

This chapter is based on the results of the sociological survey conducted between 2018 and 2019. The originality of this survey resides in the fact that the sociologists were integrated into the research and development laboratory of the drinking water operator (Suez) and a team of hydrogeological engineers. This privileged access to water stakeholders (managers, technicians) facilitated the organization of field visits (concerned with drinking water production, telecontrol) and the implementation of a campaign of semi-structured interviews. In addition to the analysis of documents and urban projects, thirty-three experts in water resource management and land-use planning were questioned about past and future transformations in these two distinct fields. These stakeholders were then invited to participate in a seminar to collectively elaborate scenarios to take into account climate change and the challenges of socio-economic development of territories.

This chapter uses some excerpts from interviews and comments collected during the workshops, to illustrate or support the arguments of the analysis. The sources are anonymized, while maintaining the institutions of affiliation.

02

From Ancient River Traffic to the Capital of Modern Hydrogeology

Water policies have a very long history. As is the case for most towns and cities, the birth of Bordeaux in the third century BC is related to the presence of water and the river.

The river Garonne was one of the commercial corridors for heavy metal. Traders found refuge and settled on the highest point of the city, Place Gambetta, with its many springs and watering places. The advantages of the site appealed to the Romans, who built aqueducts to provide the town with running water. These were destroyed during the Barbarian invasions in the Middle Ages, although some remains are still visible today. From that point on, up to the Second World War, the city's water supply was a constant concern: demand increased as the population grew, even as the city's expansion polluted the resources and the city had to look for water beyond its walls. In the summer of 1850, the city was unable to supply more than five liters of water a day to each inhabitant.

In the late nineteenth century, several major infrastructure works (aqueducts) were the forerunners of the present-day public utility. Shortly before the start of the Second World War, drilling techniques used in the oil industry began to be accessible in order to looking for water. In the Gironde Department, anyone who drills deep enough into the ground will eventually reach an abundant supply of good quality water. The decision-makers of the time felt that this solved the age-old problem of supplying water and drilling increased as soon as the war was over. The production of drinking water by drilling became the norm generally, and more specifically in the Gironde Department. At the time, while drilling in search of oil, the official national geological and mining research bureau (Bureau de la Recherche Géologique and Minière - BRGM) collected information on every type of rock it analyzed, but instead of finding oil, it discovered a large quantity of fresh water.

In 1955, Professor Henri Schoeller, one of the founding fathers of hydrogeology as a science on a global scale and the leading figure in the discipline, settled in Bordeaux. He immediately raised the question of the risk of overexploiting water tables because of constantly increasing the number of drilling sites and the volumes of water being extracted. Monitoring of piezometric levels developed and an increasing number of studies were carried out by the BRGM and the University of Bordeaux, making Bordeaux a pole of attraction for the water sector. In 1996, the local public authorities (the Gironde Department and the Bordeaux Metropolitan District) adopted a master plan for the drinking

water supply in the Department, having observed that some aquifers were being over-used. It was decided to elaborate a Water Development and Management Scheme (Schéma d'Aménagement et de Gestion de l'Eau - SAGE), and to create a Multi-level Syndicate for the Study and Management of Water Resources in the Gironde Department (Syndicat Mixte d'Étude et de Gestion de la Ressource en Eau du Département de la Gironde - SMEGREG). Together with the private-sector operators, these public institutions created a network for delegating the operation of the water facility in terms of extraction and distribution.

For the officials responsible for regional planning and development, operation of the water facility has become a priority issue due to the risks of both a shortage of water and an excess of water through flooding. The heatwave in 2003 in France highlighted one of the effects of global warming – increased temperatures – with urban heat islands demonstrating the unsuitability of artificialized urban areas and the serious consequences to the health of their

inhabitants. The danger of a water shortage also challenges farmers and industrialists, who are both massive consumers and influential players – they form a long-standing coalition that is crucial for the local economy.

In the Nouvelle Aquitaine Region, however, the water crisis is not of topical importance, and indeed is not likely to become so even in the distant future. The situation there is very different from that in areas suffering from severe 'water stress', such as Australia, California, South Africa and, nearer to home, Barcelona.

The devastating effects (fires) and the extreme water shortages suffered by some populations are very visible in the media. In Bordeaux, the image of drought in a landscape near Seville (in southern Spain) in 2050, encouraged everyone in the sector to rethink both their visions of the future and their strategies.

“ Even though the water sector has developed a body of proven expertise, it is nevertheless faced with an urgent need to change ”

Even though the water sector, meaning all the parties involved in terms of knowledge, operation, and distribution, has developed a body of proven expertise, it is nevertheless faced with an urgent need to change, quite simply because of the likelihood of a shortage and the consequences this would have. Firstly, endogenously, the sector is modernising itself by making use of technology and a greater knowledge of water and its management (Roche, Molle, 2015); secondly, by positioning water as a more central feature of urban planning, the sector is incorporating other policies, leading to a reconfiguration of the traditional set of players (Petitet, 2015); lastly, governance is expanding, implying cooperation and transactions on a much larger, interconnected territorial scale (Boutelet and al., 2010).

03

Economising the Resource: Technical Modernisation

From the end of the 1990s up to around 2005, the trend favored economical water use while ensuring use-related quality. The experience, knowledge, and competence of the stakeholders are decisive. Considerable efforts have been made already: in the space of twelve years, Bordeaux has gone from withdrawing 2 million cubic meters of water per day to 200 000 cubic meters per day. In the past half-century this has also been the case elsewhere in Europe and in other western countries. There are several reasons for the drop (Barraque et al., 2011): the reduction and rationalization of consumption in the non-residential sector (factories, major public infrastructure); the economic crisis, de-industrialization and the shift toward a tertiary sector with less demand for water (Rinaudo 2013); the rehabilitation of distribution networks, which minimizes losses. The impact of the economic crisis may positively stimulate investments in "water-friendly" innovations and technologies.

Considerable reductions in domestic consumption (Montginoul, 2013) have been observed: -11% between 2001 and 2014 in the Bordeaux Metropolitan District for example, despite a 32% increase in the number of users (Salinas, Enault, 2017), which has moreover made it essential to review the price charged for the service being delivered. The modernization of domestic appliances has had a positive effect on the amount of water being saved. Users are also more aware of the efforts that need to be made because of the more frequent, longer heatwaves and the encouragement to limit their use of water (washing vehicles, agricultural use). Numerous information campaigns have encouraged people to use water responsibly, and children are being taught from

a very young age to behave in this way. Water is perceived as being of increasing importance in the society of the future. The aim is to change the user from being the passive consumer of a service to a person with a sense of civic responsibility who is keen to protect the environment (Barbier, 2013). SAGE's policy upholds the straightforward idea that safeguarding the resource necessarily means economical use, whatever the ultimate changes in demand at the level of the Department (Fig. 1).

The SMEGREG director outlines his strategy in 3 points:

"1) rational use, 2) track down network leaks and save water at every level of use, and 3) seek substitute resources. For the past fifteen years, the SMEGREG has been active, including in conjunction with the European authorities, in distributing water-saving kits and appliances. Eventually, the individual user's drop in consumption will reach an incompressible limit." (pers. comm., Director of the SMEGREG, 2019)

In water environments, technology is a major driver of modernization: the digital and robotic revolution is its main instrument (Behra, 2015). The aim is to gain control over both extraction (remote readings, individual metering) and final consumption, minimizing leaks (detection, sensors) and applying the reasoned management of uses (sectorialization¹, drip irrigation, water-saving industrial equipment, and household appliances). Algorithms simultaneously identify volumes, stocks, yields, projections, effects of variations in the weather, consumption, data relating to security (pollution, trespassing) and quality with regard to health. This is one of the routes currently being used to improve managerial efficiency. Metering water by type of use (showers, baths, dishwashing, household tasks, beverages, watering) in order to regulate and use better is already being considered

1 "Sectorialization" means dividing up areas of the territory to better regulate leaks. About fifty sectors have been divided in Bordeaux Metropolis to manage the flows.

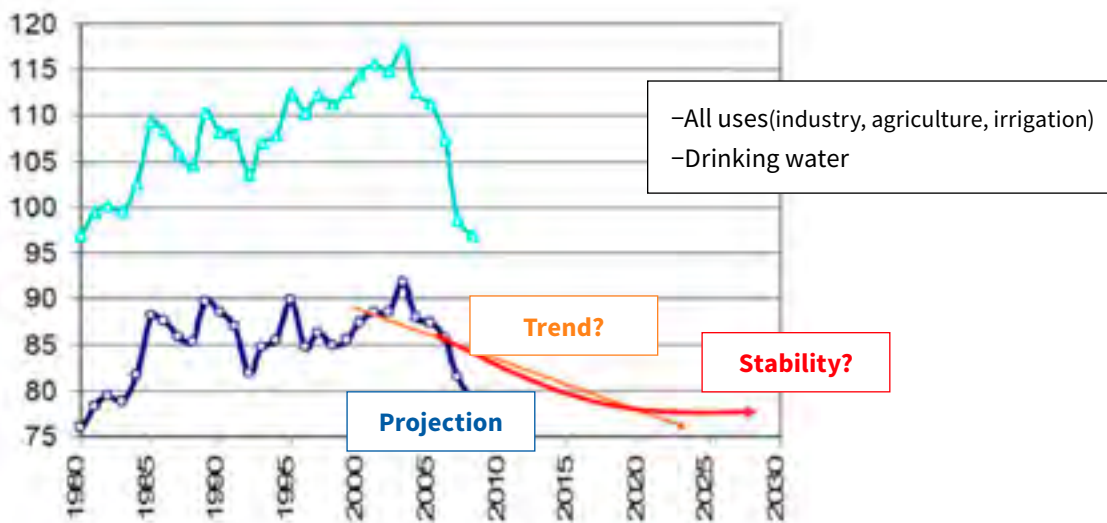


Figure 2-1 Assumptions of unitary withdrawals from the deep aquifers of Gironde for drinking water use (m³/year/inhabitant) (Source: SMEGREG)

by the metropolitan officials. A system of this kind centralizes data and measures what each person, household and/or dwelling consumes, but there are some concerns regarding the ownership of the data and how it would be used: many respondents see this as a freedom-destroying intrusion. The cost of installation is less of an obstacle than the social acceptance of having one's privacy breached or, at the very least, monitored. Operators often have good reasons for having an increasingly refined knowledge of consumption: "creating alerts that warn if something happens in a user's home" (pers.comm., Water and sanitation director of Bordeaux Metropole, 2019), which is what the Linky electricity meter does (and which stirred up controversy when it was introduced).

The Linky meter records consumers' electricity consumption in real time. Its installation has been badly received in France, perceived as an act of intrusion in the private life of the inhabitants: "The positions taken against Linky are organized around four themes. First, there is the issue of the exploitation of personal data and the vulnerability of infrastructure. There are also socio-economic risks – fears of over-billing for consumers, and job losses linked to the automation of data collection. The safety of equipment is also an issue: interference with other electronic devices in the home and the risk of fire are concerns. And, finally, the environmental impact.... [since] the ecological benefits of this operation remain to be demonstrated" (Institut Mines-Telecom, 2018).

By managing data according to its initiators, motivational pricing will encourage reduced consumption during droughts, reward the most economical users and encourage the proposal of pricing packages of the 'low-season' type. However, nobody knows whether users will accept these technologies and utilize them, and thereby gain the upper hand by finely monitoring their consumption. An "à la carte" service for drinking water has yet to be invented, although the future public authority has announced that it would like to introduce one in the very near future (pers. comm., water and sanitation director of Bordeaux Metropole, 2019). This service would differentiate the uses and associate different tariffs.

In addition to the economic aspect, another avenue being envisaged is the reuse of wastewater and rainwater. Unlike many other countries (Australia, Israel, India), France has not embarked on this reuse route, and a number of reasons for this have been put forward. The first is that historically the production of water has been more concerned with drinking water, hence treated water: "There is a fear that bacteria could be spread" (pers.comm., engineer at the Lyre research and development center, 2019) if untreated recycled water were used for flushing toilets or for watering trees and grass, for example. The fear of an epidemic is rarely expressed, but it is taken into consideration. Nor is reuse profitable, although the technology, which has already been tested, will surely be adopted more readily as the resource becomes scarcer (as in Spain) (Lorrain, 2018).

In the face of increasing fears about the harmful effects of viruses, bacteria, and pollution (by medicines, micro-pollutants, plastics), there is a strong desire to ensure healthy water (Lévy, 2012). In France and in Europe, the hygienist movement during the 19th century emphasized the importance of making cities healthy, and this was done by guaranteeing the quality of drinking water. The quality of the resource will, however, differ depending on whether the water is taken from the surface water or deeper. The first option is affected by the excess of a productivity-driven consumerist system (i.e., water quality degradation), whereas the deeper water table offers slowly regenerated purity: "The water people drink in Bordeaux is between 5 and 15 000 years old - it has had plenty of time to be filtered" (pers. comm., engineer lecturer in hydrogeology, ENSEGID, 2019). One basic constant is nevertheless "that there will be less water, and as a result its quality will decline" (ibidem.). The surface water table is increasingly affected by the combined detrimental effects of urbanisation, agriculture, and tourism (Flörke et al., 2018).

Mankind is not alone in being affected by water pollution: the environment, flora and fauna are also affected, as are biodiversity and ecosystems in general. Some experts believe it is still possible to "start out with poor-quality water and improve it before it is used". Others do not want to change the established policy of extracting water from the deep aquifers in the Gironde Department – water that is by nature of excellent quality – because, currently, processing water is not expensive. "That raises the question of consent to paying, and the model for providing drinking water" (pers.comm., Vice-President of the Departmental Council, 2019). In Gironde, the groundwater extraction model remains the most economical. It is difficult for the stakeholders to consider other extraction and distribution techniques, which are still too expensive. By multiplying the sources of extraction, the distribution system techniques used must also be adjusted in order to avoid inequitable access to the resource, which would be reflected in the final price. Thus, an economic model of cost sharing has been designed on a departmental scale, so that all drinking water consumers pay an identical price. A cost-sharing arrangement between the metropolis and the neighboring territories is now in place (Barraqué, 2018).

Water security is a major challenge for public water policies to make it a "common good" (Ostrom, 1990) and a leitmotiv shared by all stakeholders. It results from the capacity to adapt to the aspirations of users and the availability of the resource. In developed societies such as France, security often takes the form of all-out technical progress. If the health issue dominates, treatments are perfected; if there is a shortage, consumption must be reduced; if the price exceeds the capacity of the inhabitants, the public authorities take over from private service providers.

04

Incorporating the Issue of Water in Urban Projects in the Metropolitan District

Water has traditionally been a priority in town planning. Originally a basic urban utility, clean water provided a level of well-being and countered epidemics. It then received increased attentions whenever there was a risk of shortage or a source of danger for the population (such as flooding). In Bordeaux, violent storms in 1982 forced the local elected representatives to act quickly, and they created the RAMSES remote control system which manages, in real time, the various rainwater retention basins throughout the city. The massive investments (equivalent to those of the city's first two tram routes in 2005) remain invisible and unknown to local residents, even though they brought flooding under control (Vaucelle, 1999).

Buried underground and channeled during the twentieth century, the water of the twenty-first century is increasingly becoming a driving force in the programming and devising of many planning projects (Rode, 2017). In increasingly urbanized societies and territories, the trend is to return to the sources of a naturalist model. Cities such as Malmö and Växjö in Sweden have become international examples of how to integrate stormwater in urban planning (OIEau, 2017). Water has always been, and will always be, a fundamental element of nature, well-being and spirituality – meanings that

have been played down in comparison with access to comfort and commercial use.

In the last two decades, the natural areas of the city have appeared to be just as valuable as the architectural heritage. Their preservation became central in public town planning and development policies, working in favor of maintaining biodiversity and retaining permeable soils in response to the challenges of climate change (Euzen, 2017).

In France, the very recent objective of “zero net artificialization” set in the 2018 biodiversity plan was reinforced in 2019 by an official communiqué accentuating the mobilization of local players. The objective is to stop artificializing in the long term, while leaving the possibility of compensating for artificialization. This requirement, in addition to the densification of existing urban areas (‘Solidarity and Urban Renewal’, ‘Access to Housing and Renovated Urbanism and ‘Grenelle II’ legislation), engages a radical transformation of the way of developing urban projects, mobility networks and urban services. Moreover, every plot of land that was or had become free had to incorporate a commercial circuit in the urban economy – it had to be built on in order to sell housing, offices and facilities. The change in paradigm is spectacular, given that the land and housing market is extremely strained. Between 1999 and 2012, the redevelopment of the left-bank riverside, referred to as “gardened quays” (quais jardinés), was a key project in Bordeaux (Godier, 2018); it marked the start of the introduction of nature into the city, emphasizing the landscape and plants rather than the tradition of Bordeaux as a ‘city of stones’ and concrete public spaces.



Figure 2-2 Eco district Ginko, Bordeaux Metropolitan District 2020. ©2022 - BLP & associés, agence d'architecture depuis 1984*

The project has been a definite success among residents, city dwellers and tourists. More generally, parks and gardens, promenades, tree-lined walks, fountains, ponds, and tree planting will inject new life into the city. Revegetation is seen as an anti-stress factor, countering increasingly intense living conditions (Susca, 2011). From the mid-1990s onwards, in Bordeaux's geography and town planning, the place occupied by the river has been the source of major new storytelling about the Metropolitan District and restored it to its historic role.

In the Bordeaux Metropolitan District, the local town planning scheme (Plan Local d'Urbanisme - PLU) – an essential tool for urban planning and the management of new construction – advocates maintaining a constant urban footprint from now until 2030, without urbanizing any new greenfield areas. New urban projects now focus on using existing wasteland (brownfield sites), refurbishing old properties, and densification, on the basis of the assumption that “90% of 2050's buildings are already standing” (pers. comm., town planner at the Bordeaux Metropolitan District, 2019). Using what already exists and preserving natural areas are the watchwords for ‘renewal’ town planning. Other tools specific to the Bordeaux Metropolitan District are directly aimed at preserving and magnifying nature in the city in order to encourage new projects. Thus the ‘55 000 hectares’ project’ (i.e., the total area of the Metropolitan District), in 2012, “expresses the ambition for nature to be omnipresent and the desire to pay the same attention to urbanized areas as to the major natural landscapes that surround the urban area (...) Demographic growth and densification must not be pursued

to the detriment of this balance” (Bordeaux métropole, 2016). An ‘ecologised’ type of town planning is emerging and taking shape, dramatically changing visions of urban development and the practices of operators and professionals.

In operational terms, eco-neighborhoods have become very frequent in Bordeaux. Priority is given to building affordable, comfortable housing with the necessary public utilities. The housing is also designed to combat energy waste, reduce the perceived heat of the city, and provide a calming environment, with the planting of trees and the creation of shared gardens. Apart from residential and infrastructural buildings, canals, basins, ponds, rainwater retention basins, and almost wild flora form part of the landscaped framework of these new residential areas, and this specifically promotes biodiversity. [Figure 2 - Ginko] Revegetation in the city is a remarkable process. It is becoming one of the most profitable development solutions in terms of improving both comfort and health: “Even though planting, watering and looking after a tree costs money, revegetation is the cheapest and most profitable tool for combating heat islands. In Quebec, it is estimated that for every dollar invested, one tree delivers five or six dollars’ worth of services: it removes pollution from the air, provides shade, and stores carbon.” (pers.comm., engineer professor in hydrogeology, ENSEGID, 2019) There has nevertheless been an unpleasant experience recently: an invasion of mosquitos has had an adverse effect on urban dwellers’ recreational practices, and has heightened fears of an increase in the transmission of diseases (e.g., Zika, dengue).



Figure 2-3 87 housing at Bègles, Terre Sud, Bordeaux Metropolitan District 2012. ©Michel Dubeau/LLTR architects urbanists*

An increasing number of major urban projects incorporate the water cycle in Bordeaux: the 'Euratlantique' operation (covering 750 hectares), with its management of rainwater using alternative techniques rather than buried networks (EPA Bordeaux Euratlantique 2019); the 'Terre Sud' concerted development area in Bègles, with the restoration of an old agricultural grid of drainage ditches (in a project designed by Alain Charrier, urban architect in the 'Terre Sud' eco-neighborhood). A current development, the 'Brazza' neighborhood, on the banks of the Garonne in an area liable to flooding, will construct housing on stilts that should be able to withstand any flooding that occurs. The roads in the neighborhood are kept to a minimum to limit the artificialization of the ground and promote efficient permeability. [Fig. 3 - Terre Sud] Every new urban operation now includes a study of its impact on the drinking water resource, and new construction projects incorporate water-saving features.

In increasingly urbanized societies and territories, planning policies and urban projects tend to rely on a more ambitious naturalist model. In these conditions, urban water uses serve some positive virtues, reflecting representations such as territorial roots and human well-being. These same values were reducing in the last decades in favor of access to comfort, commercial use and generalized consumerism. As a human and environmental value, water resource now supports and legitimizes in vogue concepts in contemporary urban projects, such as renaturation, vegetation, "de-mineralization", resource saving, urban agriculture. With the protection of the planet in mind, water saving provides a new mindset for designers (architects, engineers, urban planners), to deploy innovations on a domestic, city and territory scale.

05

Extending Territorial Governance

The Bordeaux Metropolitan District concentrates people, activities, and demographic growth. It has constrained and dominated the development of territories that are increasingly distant from the urban nucleus and gradually becoming more marginalized, impoverished, and dependent on the power of attraction of activities in the Metropolitan District (i.e., employment, facilities, shops). This relationship is changing as a result of the pressure of several phenomena: global warming and the consolidation of environmental concerns are obliging the Metropolitan District authority to look beyond its own administrative borders. On the scale of the Department, where farming and tourist activities are extremely important, peri-urbanisation - an exodus from town to country - is creating a more visible interdependence between the Metropolitan District and its surrounding area. The balance of power that has favoured urban dynamics for the past half-century is shifting, and rural areas that were previously divided from urban areas have learned from their experience of inter-municipal activities and assessed what they stand to gain from a move toward a common future shared with urban centers. Water, like food, housing, and the preservation of natural sites, is on the negotiating table for the Metropolitan District authority and the other territorial authorities (Departments, municipalities, inter-municipal bodies, region).

For water, territorial cooperation is already being encouraged in terms of legislation: the European Union (EU) Water Framework Directive (2004) requires planning documents to be mutually compatible. Water agencies join forces with metropolitan town planning agencies when these documents are drawn up: territorial coherency plans (Schémas de Cohérence Territoriale); inter-municipal local urban planning schedules (Plans Locaux d'Urbanisme Intercommunaux); SAGE; water development and management master plans, SDAGE). Dedicated guides have been produced by the Water agency and the urban planning agency since 2010. The trend is for movement toward a better quality of environments (combating different types of pollution), protection for biodiversity, and the anticipation of risks, of which major incidents are the manifestations (fires, flooding, shortages of resources, pandemics). Water policies have shifted to a different scale: "Our water management tool changed, for three reasons: changes in the regulations; the growing importance of adapting to climate change; and the pressure of demographic growth" (pers.comm, engineer at the Adour-Garonne Water Agency, 2019). The role of governance is fundamental to integrating the stakeholders and the important territorial reforms: the expansion of digital technology; democratic pressure; the aftershocks of the economic crisis and its consequences for public investment (Akhmouch, 2017).

Inter-territorial dialogue takes the form of agreements that encourage inter-municipal cooperation and territorial sharing with a view to creating a different way of using environmental resources, including water. It involves “agreeing to stop artificializing the ground, changing the way we look at things; it means paying more attention to those places that should not be built on. Changing from a Promethean desire to a desire for a shared territory. Questions on resources, nature, forms of energy, and climate change are being raised at just the right time to help in the construction of a new model” (pers.comm., town planner at the Bordeaux Metropolitan District, 2019). It is no surprise that the inter-municipality scale drives territorial development and town planning regulations, and hence the action of drinking water utilities (Pezon & Petitet, 2004). It addresses the present-day issues of controlling land use and combating urban sprawl, as well as preserving and enhancing the environmental, landscape, and architectural heritage. This is even more valid in those areas where water resources are fragile, are in deficit, or subject to the pressure of urbanization, mainly because of housing.

Before becoming a responsibility for the Metropolitan District, water was in the hands of the Departments. The Gironde Department continues to be very present, representing rural areas and the countryside. With the support of the town planning agencies, it accompanies small municipalities, medium-sized towns, and rural inter-municipal bodies, as they include clauses on water in their town planning documents. The Departments also publish guides. This is an opportunity to set up a form of governance that is more multi-disciplinary and ensure increased responsibility on the part of players who have hitherto had relatively little to do with these issues (e.g., town planners, elected representatives, citizens), and it is becoming a reality in operational terms: the Gironde Department created the ‘Water Planning’ mission (2006-18) to boost relations between water specialists and urban development experts. These transactions are tending to soothe the historic tensions between town and country, as is the subsistence of the territories. The players in the water sector are redefining the way they function and cooperate in carrying out diagnoses, mobilizing final users, regulating decisions, launching innovations, and projecting themselves into the future.

Inter-territorial cooperation continues the existing movement that interconnects humans and activities in a single but not necessarily standardized territory. Each territory is able to put forward its own specific features. Some have water, others have fertile soil, others are a source of employment. Governance remains a work in progress, since if cooperation is to prevail without producing tensions (dominant/ dominated territories), it is necessary for the parties involved to be on an equal footing with territories that have resources in terms of engineering and equivalent skills. This would make governance more efficient, although it would not preclude

disputes over the perimeters of the areas of competence of each: “There’s the matter of the river, but there’s the tide too. As flooding becomes more extensive, they say we need land upstream to absorb flooding so that it wouldn’t impact Bordeaux – only the territories upstream, they say, ‘yes, but we don’t just want [this]... , you’re going to take areas away from us, just to protect yourselves” (pers.comm., a representative elected to the Bordeaux Metropolitan District, 2019). Thus, some institutional parties are dreaming of a new management perimeter, a syndicate that would overarch the Metropolitan District and the rural areas, rather like a new style of Department with a broader perimeter of enhanced responsibilities: “Above all, it’s pragmatism, given the major challenges facing society - climate change, demography, digital issues -, defining possible futures or horizons shared with all the parties concerned.” (pers.comm. Town planner at the Bordeaux Metropolitan District, 2019)

“In rural and agricultural areas, environmental protection is generally considered a secondary concern”

The involvement of users in water governance seems disconcerting to experts, engineers and technicians. They believe that users do not necessarily have sufficiently solid and relevant knowledge to grasp the complexity of the issues, costs and techniques. These stakeholders rarely enter into agreements with the general public directly, and doubt this publics’ interest in getting involved in an extended dialogue “as long as the water comes out of the tap and it is not too expensive” (pers. comm., Engineer at Suez, 2018). Opening up projects and decisions to all parties often raises the concern that only critical opinions or opponents may actively express themselves (environmental protection associations, consumer associations).

Moreover, the power of multinationals in the water sector and the pressure of lobbyists on public authorities seem equally compelling the users’ involvement, because of the colossal economic and financial stakes involved.

On a territorial scale, even though environmental protection is recognized as a major national and global cause, in rural and agricultural areas, environmental protection is generally considered a secondary concern due to a limited amount of territorial engineering. Local elected officials prioritize the maintenance and development of economic activities, seeking the optimization of their practices, rather than changing their (productivity) model. However, in the metropolises, urban planning practices have been implemented for twenty years. Inhabitants have become recognized players, systematically solicited, and environmental protection is the key value of all urban projects. Urban planning represents a long tradition in users’ participation (Bacqué, Sintomer, 2005). In terms of method, this tradition could inspire the water sector. The increasing collaboration between the two sectors will probably enable the collective development of professional and citizen practices.

06

Conclusion

In conclusion, this research on Bordeaux's public water policies addresses the ongoing adaptation of an established industrial system. This system is changing under the influences of an increased metropolization process, the effects of global warming and further concerns about resource availability. The research has revealed a notable shift in the way the future of this industry is prepared by the stakeholders. Politicians, operators, scientists and other experts, all agree on (and debate) the changes already underway and those to come.

The first change is the socio-technical optimization of water production and use: primarily, the reduction of consumption (particularly due to technological developments) (Barraqué 2011) and the user's empowerment (Barbier 2013); and an increased control of the resource's quality, to protect it against damaging health effects (Lévy 2012).

“Water is no longer a secondary or marginal component in the design of future living spaces”

The second change consists of the diffusion of water issues to territorial planning sectors. Contemporary urban and architectural projects (development of public spaces, creation of new neighborhoods, rehabilitation of existing buildings) make water a more central player in the design and implementation of projects. Architects and urban planners have now taken into account that

water is no longer a secondary or marginal component in the design of future living spaces; these professionals are inventing new ways for buildings to incorporate water and vegetation.

The third change concerns the perimeters of water governance (Boutelet 2010) and the involvement of users. Bordeaux metropolis area negotiates with neighboring territories to agree on access to the resource and its quality. On another level, more numerous and violent environmental conflicts require regulation methods that lead to global debates on "environmental democracy" and go beyond the boundaries of the water policy sector.

Under the challenges of health, climatic and social risks, new terms have recently appeared around the lexical field of "transition", such as resilience (Talandier 2019), adaptation and preservation. This vocabulary reveals a new metropolitan culture that foresees a future in which nature and urbanism coexist more interactively to improve the living conditions of

users (health, cohabitation, well-being).

In this future, resources gradually cease to be considered as constraints only (buried networks, infrastructure) and are improved and enhanced (circular economy, energy loops, water recovery, river enhancement).

Thus, an impulse to naturalize cities is at work, taking forms as diverse as renaturation, desilting, and revegetation, actions that necessarily lead to the use of water resources.

The expansion of nature in the cities and of cities in the countryside still needs to be viewed at the macro level of basins and watersheds in order to consider an enlarged governance of water. This vision, extended to the largest territorial issues and levels, would correspond to the idea of water as a common good (Ostrom 1990), managed around the principles of solidarity and sustainability.

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List of personal communication

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