Service Provision Governance in the Peri-urban Interface of Metropolitan Areas Research Project

AN OVERVIEW OF THE WATER SUPPLY AND SANITATION SYSTEM AT METROPOLITAN AND PERI-URBAN LEVEL: THE CASE OF CARACAS

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ABOUT THE PROJECT

This report is one of several outputs from the project *Service provision governance in the peri-urban interface of metropolitan areas*. This is a three-year project run by the Development Planning Unit, University College London in collaboration with a number of institutions from developing countries and with support from the UK Government's Department for International Development (DFID).

The purpose of the project is to improve guidance on governance and management of water and sanitation in the peri-urban interface (PUI) of metropolitan areas, in order to increase access by the poor and promote environmental sustainability. Presently there is a gap in the operating knowledge of implementing agencies on the specific problems that arise in the PUI. A premise of the project is that greater knowledge of the social, environmental and governance issues arising from changes in the management of water supply and sanitation in the PUI, and more specifically of the impact on these of different and changing regulatory frameworks, would be beneficial not only for the poor but also for these agencies and other local agents.

The project examines the cases of five metropolitan areas, each with different and changing service management regimes influencing the governance of basic service provision: Chennai (India), Dar es Salaam (Tanzania), Cairo-Giza (Egypt), Caracas (Venezuela) and Mexico City.

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INTRODUCTION

The metropolitan expansion of Caracas[1] has given place to the conformation of the Caracas Metropolitan Region, composed by the Caracas city and its Peri-urban interface (PUI), which is formed by four discontinuous but functionally related segments. A socio territorial and institutional fragmentation with sectors globally connected and others with different levels of exclusion characterise this expansion.

Within the PUI we have selected the segment corresponding to Valles del Tuy Medio (PUI-Tuy) since it is the one that presents a bigger growth related to the availability of lands and the housing and infrastructure works that are taking place in the area. Additionally, within the PUI-Tuy we have chosen the urban axis Charallave - Santa Teresa since there the problems related to the objectives of this project are represented. The localities chosen for this study are Paso Real 2000-Charallave and Bachaquero–El Cartanal, where lower-income populations with severe problems of access to the WSS are concentrated[2].

The PUI-Tuy became mainly urban after the transformation in the land use from agriculture to residential and industrial occurred in the sixties and seventies. Its relevance for this research lies on the fact that about half of the water intake of the metropolitan water supply are located in this area and at the same time presents strong deficits of coverage of the WSS, which means that the problems related to the environment are important, especially in the settlements where the poor sectors are concentrated; such is the case of the Paso Real 2000 and Bachaquero settlements.

The main features and problems of the area are the fast growth of population, the concentration of poor sectors, the deficit of the WSS, high rates of unemployment and informal occupation, the concentration of public and private investments in infrastructure and housing, the great social heterogeneity and the appearance of new stakeholders.

The catchment area includes two basins, the basin of the rivers Tuy and Guárico. The CMR is located in the basin of the river Tuy, which supplies 50% of the water of the metropolitan water supply system. The other 50% comes from the Guárico River basin, and specifically the Camatagua reservoir, which is located outside the PUI-Tuy. The two basins are connected through a canal that carries water from Camatagua to the treatment and purification plants in the PUI-Tuy. One of the main problems is the water intakes are at 200m above sea level and the water must be pumped up to 1,500m above sea level to reach Caracas.

The problems of the WSS include technical, economic, environmental and social ones: lack of frequency in the supply, low billing and high unaccounted for water, low quality of water, lack of disposition of served waters, and coverage socially differentiated. These problems are even more acute in the chosen localities.

The new institutional framework represents an opportunity. Hidrocapital, the hydrological company that serves the CMR has developed a kind of relationship between community and company, through its Department of Community Affairs, which is called "Water Forum" (Mesas

[1] Hereafter, Caracas will also be called the primary or capital city, being comprised in administrative terms of five municipalities and a metropolitan district.
[2] Paso Real 2000 is adjacent to the city of Charallave and Bachaquero is adjacent to El Cartanal.

Técnicas de Agua) built up on the contents of the participative democracy, settled down in the Constitution of 1999 and in the new organic law of water (LOPSAPS) of 2001 that institutionalises this mechanism[3]. This is a good opportunity for the development of a participatory style of governance that will open up opportunities for private sector participation in the process of transfer from the WSS to the municipalities, as prescribed by the LOPSAS.

This is an ongoing process and not all the communities are included. The number of successful cases is small in relation to the number of initiatives. Through them the communities have achieved good water supply and sanitation services with high quality and efficiency. Not only that, but in several cases the action has spread to embrace other services (electricity, education, health, urban rehabilitation) as well as other problems of the community like work and environment. This process is strengthening collective action while at the same time supporting the building up of citizenship in the lower-income sectors of the population.

The water supply management system in the CMR can be viewed as characterised by "good governance" in association with the legal and institutional changes, consensus and citizen participation in decision making.

1 OVERVIEW OF THE METROPOLITAN REGION

. Demographic and Socioeconomic Characteristics

Caracas is a small metropolis. The 2001 census put the CMR's total population at 4.2 million, 65.5% of whom live in the primary city. The latter's growth has been very slow; indeed it came almost to a halt in the 1990-2001 intercensal period. As a result, its proportion of the national population and that of the CMR has been declining. The CMR, for its part, has been growing, but has also lost ground as a proportion of the national population (Tables 1 and 2).

The Caracas peri-urban interface is comprised of four major geographic areas, which have developed in different time periods but always in close linkage to the primary city. The first to develop were the Central Coast and the Miranda Highlands; then came Guarenas-Guatire, and now, the Middle Tuy Valleys (MTV), which we call PUI-Tuy. Though there is no continuous built-up zone because the subregions are separated from the city by natural barriers (mountains), their functional interactions permit the identification of the CMR (Map 1).

The peripheral subregions comprising the Caracas peri-urban interface have grown substantially, with the exception of the Central Coast which was devastated by a natural disaster in December 1999. The PUI-Tuy's population, on the other hand, expanded by 50% in the 1990-2001 intercensal period, raising its share of the total CMR population from 9.6% to 12.7% (Table 2).

[3] As a proposal for organization, the Water Forums can be trace to the municipal government of Aristobulo Istúriz (1993-1996) in the Caracas City Hall (Arconada 1996).

Table 2
Caracas Metropolitan Region
Population Trends %

Años	Axis CST / PUI-Tuy	PUI-Tuy / CMR	CARACAS / CMR	CARACAS / Venzuela	CMR / Venezuela
1971	14.5%	1.1%	79.1%	20.1%	25.5%
1981	17.4%	1.9%	72.4%	17.8%	24.6%
1990	18.3%	3.5%	64.2%	14.8%	23.1%
2001	19.1%	4.3%	57.6%	11.9%	20.6%

Source: Own based on CENSO 2001. INE

The CMR has a total area of 6,207 km^2 and a population density of 680 inhabitants/km^2. A striking aspect is the high density of the city of Caracas: 3,556 inhabitants/km^2 in a valley with an area of 777 km^2 (Table 3).

Table 3
Caracas Metropolitan Region
Population Density

AREAS	Population	Area	Density
	2,001	SqKm	Inhab / SqKm
RMC	4,260,771	6,239	682.93
Caracas	2,762,759	777	3555.67
PUI-TUY	534,752	1,694	315.67
Eje CST	204,256	404	505.58

Source: Own based on CENSO 2001. INE

The CMR, with a total area of 6,207 km^2, has a density of 680 inhabitants/km^2. A striking feature is the high density in the city of Caracas, 3,556 inhabitants/km^2, in view of the valley's 777 km^2 area; the lowest density is 315 inhabitants/km^2 in the PUI-Tuy area (Table 3).

The population of RMC is very young; 27,9% is under 15 years; 18,6% is between 15-24 years whereas 47,5% is in between 25-64. The people over 65 years only represent a 5,9% of the total. 52% are women and the 48% left are men (Table 4).

Table 4
Caracas Metropolitan Region
Population Sex and Age
2001

CMR			Municipalities	2,001		Sex		Age			
				Nº	%	Male	Women	< 15	15-24	25-64	65 +
CMR		Caracas		2,762,759	65.5%	47.3	52.7	25.8%	18.5%	48.9%	6.7%
CMR	PUI	Guarenas - Guatire		340,557	8.1%	49.0	51.0	31.5%	18.3%	46.7%	3.6%
CMR	PUI	TUY	Cristobal Rojas	77,257	1.8%	49.5	50.5	32.6%	19.5%	44.1%	3.8%
CMR	PUI	TUY	Independencia	126,999	3.0%	49.3	50.7	36.6%	19.5%	41.0%	2.9%
CMR	PUI	TUY	Lander	108,970	2.6%	49.4	50.6	35.2%	19.1%	41.3%	4.4%
CMR	PUI	TUY	Paz Castillo	83,976	2.0%	50.2	49.8	38.0%	19.2%	39.4%	3.4%
CMR	PUI	TUY	Simón Bolívar	31,944	0.8%	52.0	48.0	33.9%	19.6%	42.0%	4.5%
CMR	PUI	TUY	Urdaneta	105,606	2.5%	49.1	50.9	34.7%	18.7%	42.9%	3.7%
CMR	PUI	TUY	Total	534,752	12.7%	49.6	50.4	35.4%	19.2%	41.7%	3.6%
CMR	PUI	Altos Mirandinos		283,491	6.7%	48.6	51.4	28.3%	18.7%	47.7%	5.4%
CMR	PUI	Vargas		298,109	7.1%	49.8	50.2	29.5%	19.2%	45.9%	5.4%
CMR	PUI	**Total**		**4,219,668**	**100.0%**	**48.0**	**52.0**	**27.9%**	**18.6%**	**47.5%**	**5.9%**

Source: Own based on CENSO 2001 Tabulaciones prioritarias. INE

The proportion of households headed by women in the CMR is 28.3%, and reaches its peak in Caracas (29.5%) (Table 5). There is a high female unemployment rate (8.2%), associated with the *additional female worker* pattern which reflects the incorporation of several family members into the labor market regardless of prevailing conditions, since family livelihood strategies rest on the sum of incomes, the family being the basic unit of reproduction (Table 6).

Table 5
Caracas Metropolitan Region
Water supply and Wastewater Services
2001

Caracas Metropolitan Region		Municipalities		Household	Water			Wastewater		
					Networked Water	Water - Trucks	Other	Networked sewerage	Septic Tank	Other
CMR	PUI	CMA		680,196	97.38	0.47	2.15	97.21	1.31	1.47
CMR	PUI	Guarenas - Guatire		82,110	92.38	2.99	4.63	91.74	2.76	5.50
CMR	PUI	TUY	*Cristobal Rojas*	*18,318*	*92.21*	*3.35*	*4.44*	*70.32*	*17.67*	*12.01*
CMR	PUI	TUY	*Independencia*	*27,947*	*95.19*	*2.06*	*2.75*	*83.87*	*9.95*	*6.17*
CMR	PUI	TUY	Lander	24,486	88.97	2.41	8.62	74.08	11.99	13.93
CMR	PUI	TUY	Paz Castillo	19,375	74.82	18.38	6.80	44.23	33.61	22.16
CMR	PUI	TUY	Simón Bolívar	7,171	92.23	2.69	5.08	56.99	27.79	15.21
CMR	PUI	TUY	Urdaneta	24,405	92.88	3.21	3.91	72.51	16.92	10.56
CMR	PUI	TUY	*Total*	***121,702***	***89.61***	***5.19***	**5.20**	***69.69***	***17.74***	**12.57**
CMR	PUI	Altos Mirandinos		69,479	90.71	0.62	8.67	76.91	17.54	5.55
CMR	PUI	Vargas		71,260	87.35	3.13	9.52	84.89	9.75	5.36
CMR	PUI	*Total RMC*		***1,024,747***	***94.91***	***1.43***	**3.67**	***91.27***	***5.07***	**3.66**

Source: 2001 Census

The CMR's labor market is territorially segmented. The largest proportions of the labor force (69%) and employment (70%) are concentrated in the Caracas city. Activity rates in the CMR are high, for both the total labor force (59.9%) and for men (74.5%) and women (46.2%). But both the unemployment rate (7.3%) and the percentage of occupation in the informal sector (33%) reflect the metropolitan economy's inability to productively absorb the entire labor force, despite the presence of globalized segments which operate largely in the Caracas business district and a strong concentration of public employment (Table 6).

Table 6
Caracas Metropolitan Region
Labour Market Indicators
2001

CMR			Municipalities	Activity Rate			Unemployment Rate			Labor Market Sector	
				Total	Male	Women	Total	Male	Women	Formal	Informal
CMR	CARACAS			60.8	74.3	48.4	7.0	7.9	5.9	68.0	32.0
	PUI	Guarenas-Guatire		62.7	77.9	48.2	7.9	8.5	6.9	68.9	31.1
		TUY	*Cristobal Rojas*	*58.6*	*76.8*	*40.8*	*8.8*	*10.2*	*6.3*	62.6	37.4
			Independencia	*55.1*	*73.9*	*37.1*	*8.9*	*10.5*	*5.9*	60.2	39.8
			Lander	55.0	74.3	36.3	9.3	10.5	6.9	57.2	42.8
			Paz Castillo	53.8	74.4	32.9	8.2	9.2	5.9	57.1	42.9
			Simón Bolívar	53.5	69.2	35.3	8.9	10.1	6.4	57.8	42.2
			Urdaneta	56.7	75.0	39.1	7.8	9.0	5.7	61.2	38.8
			Total PUI-Tuy	**55.6**	**74.4**	**37.2**	**8.6**	**9.9**	**6.2**	**59.6**	**40.4**
		Altos Mirandinos		59.2	74.8	43.9	6.1	6.6	5.2	66.1	33.9
		Vargas		55.6	72.4	38.9	8.2	9.4	6.1	67.0	33.0
		Total CMR		**59.9**	**74.5**	**46.2**	**7.3**	**8.2**	**6.0**	**67.0**	**33.0**

Fuente: Cáculos propios con base en: CENSO 2001 Tabulaciones prioritarias. INE

The 2001 Census reflects the formal public utility coverage but there is still no assessment of quality and frequency; in many cases service is substandard and service and irregular. Water supply is by pipe in 84% of the cases, but water may be available only every other day or even every two weeks according to informants (residents and authorities), and even the President of Hidrocapital (Farías 2002) admits service is not regular. The Census indicates that 2.6% of the population relies on tank trucks for water, but it has been shown in practice that the proportion using that alternative is in the neighborhood of 20%. Furthermore, 78.5% of housing units are connected to sewer systems and 13% to septic tanks, but waste water is not treated because there is no treatment plant in the area. Hidrocapital only collects and disposes of waste water dumped into the Tuy River at different points. Garbage is collected by the urban sanitation service from 80% of the households, while 5% throw their garbage into collective disposal recipients (Table 7)

Table 7: Caracas Metropolitan Region, Household Characteristics 2001

CMR			Municipalities	Households	Household Head		Households Type			
					Female	Male	One person	Nuclear	Extended	Compose
CMR	Caracas			696326	29.5%	70.5%	9.1	52.7	34.9	3.3
	PUI	Guarenas Guatire		83,378	25.2%	74.8%	6.9	60.2	30.3	2.6
		TUY	Cristobal Rojas	*18,510*	*26.7%*	*73.3%*	*7.1*	*60.9*	*29.1*	*2.9*
			Independencia	*28,233*	*31.1%*	*68.9%*	*5.8*	*58.7*	*33.0*	*2.5*
			Lander	24,657	29.5%	70.5%	7.4	57.4	32.1	3.1
			Paz Castillo	19,540	27.9%	72.1%	8.1	61.3	28.2	2.3
			Simón Bolívar	7,234	28.2%	71.8%	9.2	56.7	30.9	3.2
			Urdaneta	24,572	29.8%	70.2%	7.3	59.0	31.2	2.4
			Total PUI-Tuy	**122,746**	**27.7%**	**72.3%**	**7.2**	**59.1**	**31.0**	**2.7**
		Altos Mirandinos		70,196	26.2%	73.8%	7.6	60.0	29.7	2.8
		Vargas		72,086	22.3%	77.7%	8.4	54.0	34.8	2.7
		Total CMR		**1,044,732**	**28.3%**	**71.7%**	**8.6**	**54.6**	**33.7**	**3.1**

Fuente: Cáculos propios con base en: CENSO 2001 Tabulaciones prioritarias. INE

As measured by the poverty line indicator, 35.2% of the households in the CMR are poor; 14.9% are living in extreme poverty, having incomes insufficient to buy the entire standard food basket, and 20.3% are deemed structurally poor, their incomes falling in the range of one to two times the cost of the standard food basket. Among the non-poor sectors of the population is a vulnerable group whose incomes vary from double to triple the cost of the food basket and whom labor market conditions threaten to transform into new poor (Table 8).

Table 8: Caracas Metropolitan Region, Population and Poverty Line

Caracas Metropolitan Region			POOR		NO POOR			Total
			Extreme Poverty	Structural Poverty	Vulnerable middle sector	Middle Sector	High Sector	
CMR	**CMA**		298650	447251	467876	1160651	262524	2636952
	%		11.3	17.0	17.7	44.0	10.0	100.0
	PUI	Guarenas Guatire	77751	69608	45841	102600	13006	308806
		%	25.2	22.5	14.8	33.2	4.2	100.0
		Valles del Tuy	**133587**	**159461**	**93677**	**117210**	**6799**	**510734**
		%	**26.2**	**31.2**	**18.3**	**22.9**	**1.3**	**100.0**
		Altos Mirandinos	55275	76533	53705	105363	23971	314847
		%	17.6	24.3	17.1	33.5	7.6	100.0
		Vargas	32515	61788	46953	101468	8334	251058
		%	13.0	24.6	18.7	40.4	3.3	100.0
		Total	**597,778**	**814641**	**708052**	**1587292**	**314634**	**4022397**
		%	**14.9**	**20.3**	**17.6**	**39.5**	**7.8**	**100.0**

Fuente: Cáculos propios con base en: CENSO 2001 Tabulaciones prioritarias. INE

. Institutional profile

The CMR embraces 17 municipalities belonging to three political-administrative entities (the Metropolitan District and Miranda and Vargas States). Five of those municipalities (Libertador, Baruta, Chacao, El Hatillo, and Sucre) form the Caracas and the other 12 are located in peripheral regions (Map 1).

The CMR has no single political and administrative authority. The region's institutional framework of government is the country's most complex one, and the central, metropolitan, state, and municipal levels of government all interact in it. A Metropolitan District, two states, and 17 municipalities comprise the area, which in addition to containing the capital city (Caracas), the seat of national government institutions (the executive, legislative, and judicial branches), also houses the country's political, economic, social, and cultural elites.

The decentralization process was launched in 1989 under a reform of the Organic Municipal Government Act and the promulgation of an Election of Governors Act providing for the first nationwide direct election of state governors, mayors, and municipal councilmen at the end of that year. The local government law reform administratively divided municipal functions into the executive category, entrusted to the mayor's office, and the legislative category, left in the hands of the Municipal Council. The new local autonomy allowed municipal authorities to regulate and control growth in their urban jurisdictions, as well as authorizing them to provide local public utilities and services including sanitation, water supply and wastewater disposal, health care, education, housing, and public safety.

But the strengthening of this new institutional structure was achieved at the expense of metropolitan-scale coordination or government (Paiva 2001). In 1989 the capital city began to subdivide and fragment, partly in response to local demands but also to satisfy political and electoral interests. In 1992, five mayors and two governors have managed the Caracas city, in the absence of coordination arrangements of any kind.

This municipal "mitosis" (Ibid) contributed to the city's division into increasingly differentiated segments, ranging from self-produced shanty towns reflecting a kind of "apartheid" –the extreme form of segregation experienced in the city- to globally integrated ghettos of wealth and growing peripheries at the boundaries of the metropolis which coincide with specialized local institutional fragments: "rich" municipalities and "poor" ones. In addition, political/party fragmentation makes matters worse because each municipality is governed as political fortress in which a leader or a political ambition is nurtured.

Urban fragmentation was also the mechanism by which the economic elite of Caracas ensured itself a particular physical space and government. The creation of Chacao Municipality, which houses the city's current Central Business District, with an area of just 7.5 km^2 and a population representing a mere 2.5% of the CMA's total population, made it possible for the higher-income groups to wall themselves in (Myers & Diez, 2002) within a kind of privileged enclave or niche that enjoys good public utility and service provision and a police force of its own. Local economic activity is spurred by investments in real estate and construction. Chacao has five-star hotels, residential and commercial real estate geared to upper-income buyers, and recreational and consumption offerings for the local and global elites. Chacao provides the kind of services and comforts demanded by the activities linked to the new information economy (Sierra 2002).

The metropolitan region's administration became even more complex following the constitutional reform process of 1999. The Metropolitan District was created, responsible for coordinating the five municipalities comprising the CMA and mandated to promote a unified vision of the city. But though the opportunity to write a new constitution made it possible to give the long-awaited legal recognition and metropolitan status to the capital city, there were several indicators of institutional weakness in the new arrangement, that would keep it from effectively addressing the metropolitan-scale problems: a) little clarity regarding the metropolitan government's functions; b) a major budget deficit inherited from the previous state administration and a poorly qualified bureaucracy; and c) political/party fragmentation and acute rivalry among the five municipalities comprising the metropolis. Worse still, the new Metropolitan District's geographic and administrative boundaries did not reflect or incorporate the peripheral areas into which the city is expanding in a process of enormous dynamism during the last several decades in response to the saturation in the Caracas Valley. This unquestionably leaves the metropolitan region without a planning forum capable of ensuring orderly growth in the future.

. Key development trends

The great economic and social transformations set in motion by the globalisation and restructuring process steadily generate changes in urban configuration, livelihood strategies, and ways of life, as our cities expand toward their peripheries reflecting a complex and dynamic city-region model characterized by high levels of socio-territorial inequality. This complexity springs both from the new functions and relations the metropolis takes on and from the social and cultural diversity represented by the population groups that are integrated into the globalized system and which unequally share the city and its urban benefits with other groups subject to varying degrees of exclusion.

Caracas has overflowed its urban boundaries and spread out toward its periphery. New dynamics and forms of urban segregation, linked to the restructuring processes under way in the globalisation framework, superimpose themselves on the historical processes that created today's Caracas under an oil-dependent rentier model, resulting in an increasing socio-territorial inequality and a growing metropolitan fragmentation. Expansion toward the periphery occurs as a result of a progressive diffusion of population, activities, functions, and differentiated relations into a larger territory in response to the primary city's relative saturation and constantly rising land prices. Functional specialization of the different urban segments reflects their greater or lesser articulation into the global network of economic relations (Ciccollela & Mignaqui 2000) and an institutional fragmentation intensified by administrative decentralization.

The Caracas Metropolitan Region (CMR) cannot be understood in terms of the "Global City Region" concept put forward by Scott et al (2001), because a look at its productive structure tells us that: a) there are no clusters of productive activities in it that are connected to the global economy, as the authors suggest; b) this "Caracas Metropolitan Region" is not one of the mosaic of global city-regions which are essential spatial nuclei of that global economy; and c) it is not a leading political player on the world scene. Caracas is a small metropolis, and though it is included in the hierarchy of global cities, from the perspective of the global economy as an economy of flow[4] it is outside the core of the global economy. Its inclusion in that hierarchy has been, is, and will continue to be inextricably lined to oil and to its role as the capital of a major

[4] See: Beaverstock, J. Smith, R.G. and Taylor, P.J. 1999, “A Roster of World Cities. GaWC Research Bulletin 5”. University of Loughborough, Department of Geography. At http://www.lboro.ac.uk/departments/gy/research/gawc/rb/rb5.html.

oil-producing country, even though the nature of that link changes over time and generates varying effects (Lacabana & Cariola 2003).

Above and beyond the considerations on the city's form of insertion into the world network of cities and the global economy as a whole, we understand the CMR as a functionally integrated area in which there is a primary city and its peri-urban interface or peripheral subregions toward which the city is expanding. In fact, the traditional urban-rural distinction is disappearing and the entire set is coming to be described as urban, despite a clear differentiation into the primary city and its peri-urban interface. We are definitely in the presence of a new kind of urban landscape (Friedmann 2001).

The metropolitan expansion is chiefly related to the logic of accumulation of real capital and the dynamic of housing construction, which has opened up new housing options in the periphery for downward-mobile or vulnerable middle sectors unable to afford housing closer to the center; this stimulates the expansion of commercial and recreational capital to the periphery, which helps generate new suburban centralities, as well as the development of transportation systems and infrastructure such as roads and highways, affording mobility to the population living in the interurban zones. In this respect, the metropolitan rail system now under construction is one of the key investment projects for the consolidation of metropolitan expansion toward the Middle Tuy Valleys[5].

The metropolitan centre is consolidated as a main labor market serving the entire region and even populations living outside its boundaries, providing employment in both the more specialized and globalized activities and the informal activities tied to the economy of poverty.

The CMR's composition includes a territorial economic differentiation in which the primary city specializes in the more dynamic and competitive economic activities such as the higher-level tertiary ones linked to the role of emerging global metropolis in the Caribbean region, while the periphery is largely devoted to material production functions and to the residential activity characteristic of metropolitan peripheries. As a clear expression of this socio-territorial differentiation, Caracas reserves to itself the higher-income segments of the population, while the peripheral subregions serve chiefly as residential areas for the downward-mobile and vulnerable middle sectors (Cariola and Lacabana 2001).

A variety of conflicts accompany the metropolitan expansion, and especially the rapid changes occurring in the Middle Tuy Valleys. The demands of old and new actors intersect and grow in a framework of local institutions too weak to provide a full-fledged response to them. However, in the context of the Constitution of 1999 a new institutional structure and new forms of organization of the different social sectors –from business to the lower-income populations- is emerging, to contribute to the local development process, improvement of quality of life, and reduction of inequalities.

These socioeconomic trends have a physical expression in the metropolitan expansion, wherein the PUI-Tuy plays a key role as described below.

[5] The Caracas-Charallave train is a short-distance train that Hill have two stations in Charallave and a terminal in the southern part of Caracas, providing a connection to the Caracas Metro system. The trip will take 20 minutes and traffic is expected to amount to 60,000 passengers daily. The rail line has a length of 41.4 kilometers, including 20.1 kilometers of tunnels to cut through mountainous terrain, 13.0 kilometers of embankments on nearly flan lands, and approximately 8.3 kilometers of bridges and viaducts.

2 PROFILE OF THE PERI-URBAN LOCALITY

2.1. Brief Introduction and Justification of the Case Study

The metropolitan expansion and creation of the Caracas Metropolitan Region (CMR) has induced new manifestations of the socio-territorial inequalities associated with both internal restructuring processes and the impact of globalisation. While the Caracas Valley is reserved for the higher-income groups, its "traditional" periphery (the Miranda Highlands, Guarenas-Guatire, and the Central Coast) have reaffirmed their role as a residential alternative for vulnerable middle-income population groups, while a new "emerging" periphery (PUI-Tuy) not only provides an additional option for those vulnerable middle sectors but also houses a downward-mobile population and a large part of the region's poor.

The "traditional" periphery's saturation drives the metropolitan expansion into the PUI-Tuy area. Infrastructure and public utility improvements, mass transit initiatives, and private and public housing construction projects for vulnerable middle-income and downward-mobile groups are giving the PUI-Tuy a more heterogeneous social profile in contrast to the merely lower-income identity it used to have as a poverty-concentrating zone. However, it is still characterized by generalized poverty linked to the absence of local sources of employment, while the city of Caracas continues to provide the principal job market for its residents. Undoubtedly, the metropolitan level is important to an understanding of what is happening in the PUI-Tuy and vice versa, in view of the strength of the interactions and relations between the two.

The PUI-Tuy can be defined as a complex system with intense change processes that include protected natural areas, some of the CMR's most important water catchment sources, an urban subsystem affected by an unequal exchange of diverse flows with the primary city (commodities, commuters, solid wastes, water), and a productive subsystem strongly concentrating in services with a smaller component of manufacturing industry and an absence of agricultural activities. In socio-economic terms it is characterized, as said above, by dynamism, complexity, and social diversity by no means free of socio-political conflicts, and by the appearance of new stakeholders with differentiated interests. Some of those conflicts are linked to the overlapping of jurisdictions (municipal, state, national, public utility companies, etc.) and the absence of coordination among them.

The PUI-Tuy area participates in the metropolitan WSS as a producer of water (50% of the water sources on which the CMR relies are located within it), but is also subject to low levels of water supply and has major problems relating to disposal of wastewater of all kinds. These problems tend to worsen over time, as a result of rapid population growth.

The PUI-Tuy area includes six municipalities (Map 2). The Charallave-Santa Teresa (CST) axis (Map 3) has been selected, since it has a socio-economic and socio-environmental diversity which justifies its use for our case study. It includes two municipalities with cities that play important roles as local service centres and bedroom communities for Caracas. Though the most important economic sector is services, there are some industrial zones which have survived the de-industrialization process. In addition, this axis is the most dynamic part of the PUI-Tuy area, having strong linkages to the primary city through the flows of people, goods, and services, and it will receive a large proportion of the impacts of the new metropolitan commuter rail system because Charallave is its terminal. Supply of drinking water and disposal of waste

water is a crucial problem for the poorer segments of the population. Moreover, local initiative has resulted in the creation of Local Public Planning Councils, especially in Charallave; these are channels of citizen participation with considerable importance in the current institutional structure, and there are experiences of community water supply initiatives.

The two chosen localities, Bachaquero-El Cartanal and Paso Real 2000-Charallave[6], are representative of the change processes now taking place in the PUI-Tuy in general and in terms of the WSS in particular. (Maps 3 and 4).

. Chosen Localities

Bachaquero and Paso Real 2000 are two communities born of illegal land occupations by poor families that are excluded from the formal housing market and have lived their entire lives in poverty and with a constant shortage of water.

a. Bachaquero

Bachaquero is a lower-income settlement that originated in an illegal occupation of public lands in 1981. The community was organized for this occupation by an agrarian union because the lands were not urban, but rather, agricultural plots. However, not long after the occupation an agrarian judge ruled that the lands were suburgan (houses on plots), so the organization changed and a civil association was formed[7]. It has fought for local demands (water, electricity, streets, etc.) under a traditional patronage-oriented leadership exercised by one of the families that organized the occupation. After experiencing repeated conflicts with the local and national institutions, the settlers won the authorities' approval for permanent residence.

Unlike El Cartanal, which is a lower-income development built by the State, Bachaquero conserves its suburban characteristics, having large plots of land, some family gardens, a large number of trees, and unpaved streets. But it does have a certain urban order; the street layout is incomplete but blocks and plots can be recognized - even though no land has been set aside for recreational and community service purposes. The plots have been subdivided since the original occupation, for sale or due to the growth of the resident families, and there are now an estimated 800 housing units (Map 5). The settlement is lacking in many public services, the streets are unpaved making movement difficult in the rainy season, the utility networks are precarious, pure drinking water does not arrive every day, there is no sewer system, and the electric power grid is inadequate.

This is a heterogeneous community with a very well ordered lower part, where there are consolidated houses, and a more precarious upper part. Recently (in 2000) there was a new occupation of private lands by residents of Bachaquero, people from nearby settlements, and some people from Caracas, who came together to create the so-called "Barrio Nuevo" (New Neighborhood). The occupation was orderly and the people negotiated with the owner over payment for the land. It was then subdivided into 43 plots of equal size, streets were laid out with the aid of machinery provided by the municipal government, and illegal taps into the electricity and water supply systems were made. This is an extremely precarious sector in terms of

[6] We identify the cosen localities by their belonging to the city or parish. Paso Real 2000 can be considered "urban," while the choice of Bachaquero in El Cartanal (included in the first versión of this paper struck us as appropriate because it still has some suburban characteristics.

[7] Interview with Neighbourhood Leader 1 of Bachaquero.

material conditions of life, and its development is a reflection of families' long-term livelihood strategies, involving progressive self-construction of housing and habitat.

Bachaquero has established strong functional relations with El Cartanal. Transportation, elementary and secondary schools, health care, and commerce all depend on the latter to a considerable extent, since there are no public services in the settlement itself.

b. Paso Real 2000

Paso Real 2000 is an unregulated settlement that came into being in the year 2000 as a result of a spontaneous occupation of lands that had been set aside for an industrial park to the south of Charallave, the most important city from the standpoint of the change processes that define the PUI-Tuy[8], with which the settlement maintains strong functional relations as regards education, health care, commerce, etc. Most of the settlement is built on lands belong to a public financial institution (the Deposit Guarantee Fund – FOGADE), and some parts are built on private lands[9]. This industrial park, whose lands have a high urban value and an advantageous location, came with a basic urban layout consisting of 11 terraces of irregular shape, bounded by streets with sidewalks and a main avenue with two access points, as well as an incomplete sewer and rainwater drainage network, but it had no pure drinking water supply system. At the time of the occupation, the land and streets were covered with vegetation and full of refuse and debris, since the area had been abandoned for about 20 years due to multiple tenure disputes between private banks and FOGADE (Map 6).

The occupation was carried out spontaneously by homeless poor families from the PUI-Tuy and Caracas, who found there a chance to solve their housing problem. From the outset they formed a grass-roots community organization known as Civil Assocaition, which guided the settlers' struggle to remain in the area permanently and win the official recognition needed to obtain services from the different State agencies. After an initial phase marked by confrontation with the municipal government, which tried to negotiate the settlement's relocation to another place (not possible in view of the lack of public lands in the municipality), the settlement received the tacit acceptance of the official institutions. But full official recognition is still pending and will only be forthcoming once the land tenure problem has been solved, since this is a basic requirement for legitimating institutional attention for the settlement[10].

The disorderly occupation of the lands and the subsequent process of subdivision have resulted in an anarchic style of urban development that poses the principal obstacle to the settlement's regulated consolidation. Plots of varying size were defined and appropriated, and their later subdivision increased density; unstable lands on sloping ground were occupied, no standards

[8] This is the largest land occupation in Cristóbal Rojas Municipality, the municipality with the smallest number of unregulated settlements in the PUI-Tuy (Interview with the Director of Urban and Rural Planning of Cristóbal Rojas Municipality).

[9] According to information provided by the Director of Urban Planning of Cristóbal Rojas Municipality, the owners of these lands are companies that participated in the construction of the industrial park and received the lands as payment for their services.

[10] In this case it is a complex process, since FOGADE cannot sell the land on credit and a middleman is needed to buy it and then resell it to the occupiers. The situation is simpler vis-à-vis the private owners, since they can negotiate directly with the community. The municipal government is approaching a number of institutions to raise the funds needed to acquire the lands. (Interview with the Director of Urban and Rural Planning and the President of the Municipal Habitat Institute, Cristóbal Rojas municipality government).

for secondary street layout were respected, and no spaces were set aside for public purposes. The settlement's population has grown with the subdivision of the plots, from the 800 families counted in the initial census to more than 900 at the present time.

This kind of development not only makes the settlement more of a slum and impedes the introduction of public services, but it also consolidates unfair relations among the settlers themselves, based on the size and condition of the plot each one received[11]. We may associate it with a "culture of informality" in which the slum vision prevails over that of an orderly and regulated neighborhood (the original idea of many of the occupiers) and regulation or standards are spurned; this has provoked problems with the WSS as well.

2.2. Demo-geographic and Socio-Economic Characteristics

. Demo-geographic trends

The population of the PUI-Tuy area (534,752 inhabitants) comprises 12.7% of the total CMR population and 37% of that of the subregions comprising the Caracas peri-urban interface. This is an area with no indigenous population, which can be viewed as ethnically homogeneous. Its gender breakdown is 49.6% male and 50.4% female. It has a concentrated urban spatial distribution with virtually no rural population, and the population density is 316 inhabitants/km^2. This segment of the Caracas peri-urban interface has recorded the highest population growth rate in the last 30 years (Table 1,2,3; for Table 1 see Appendix 3).

The selected municipalities of the axis (CST), with a combined population of 204,506 inhabitants, reflect the same urban spatial distribution. They house 4.8% of the CMR's total population and the 37% of that of the PUI-Tuy area; 49.7% of the inhabitants are male, and 50.3% female. The age breakdown tells us that this is a young population, 35% of it below 15 years of age and 20% between 15 and 24 years; those over 65 account for a mere 3.2% (Table 4).

Its average growth rate over the last 30 years was 19.4% per year. Population grew at a 3% per year average rate during the 1990-2001 intercensal period, and the selected municipalities are among those expected to experience the highest growth rates in the coming decade, in view of the housing and infrastructure investments planned or currently under way (Table 1; see Appendix 3).

Most of that growth is generated by urban-urban migration, largely by lower-middle and vulnerable middle-income groups from the Caracas looking for a solution to the housing problem, and poor populations, some taking up residence in public housing projects but most illegally occupying land; the latter groups are attracted by the employment prospects generated by the construction under way in the zone. 50% of the inhabitants of the PUI-Tuy area were born elsewhere; the proportion of in-migrants in the CST axis is 57%. In the municipalities selected the illiteracy rate is 4% while in Caracas is just 1% (2001 Census).

The average household size in the CST axis is 4.4 inhabitants/residence, slightly above the average for the CMR as a whole (4.0 inhabitants/residence). Nuclear families comprise 60% of the total, while extended households represent 31%. This tells us about the zone's housing

[11] While at the outset there was an appropriation of the lands, the subsequent subdivisions were carried out through sales, with which the new residents had to bear a cost that the iniial occupiers did not.

need, for one thing, and for another, about family livelihood strategies. Women are the household heads in 27.7% of the cases, a proportion similar to the average for the entire CMR (Table 5).

. Chosen Localities

Bachaquero has about 3664 inhabitants, mainly nuclear families with an average of 4.6 persons per household. There is a female majority (52.8%) and 39.3% of the residents are under 15 years of age. Bachaquero is characterized by a high proportion of female-headed households (30%), higher than the average for the CST axis and the CMR (Tables 4a and 5a).

Table 4 a
Chosen Localities
Population Sex and Age

Localities	2.003		Sex		Age			
	Nº	%	Male	Women	< 15	15-24	25-64	65 +
Bachaquero	3.664	100,0%	47,2%	52,8%	39,3%	17,9%	39,7%	3,1%
Paso Real 2000	4.122	100,0%	52,4%	47,6%	42,4%	18,8%	38,0%	0,9%

Source: Field 2003

Paso Real 2000 has approximately 4122 inhabitants. Average household size is 4.6 persons; most of the families are nuclear, and the settlement's growth has been based on the subdivision or sale of lands. 52.4% of the population is male, and predominantly young; 42.4% of the inhabitants are under 15 years of age. The proportion of female heads of household is low (16%) in comparison with the CMR average, the average for the CST axis, and the Bachaquero community (Tables 4a and 5a).

Table 5a
Chosen Localities
Household Head
2003

Localities	Households	Household Head	
		Male	Female
Bachaquero	800	70,0%	30,0%
Paso Real 2000	900	84,0%	16,0%

Source: Field 2003

. Socioeconomic trends

Venezuela does not compile Gross Regional Product (GRP) statistics, nor are there recent original and destination surveys to underlie a reliable estimation of the flows of people and merchandise. The PUI-Tuy area steadily lost importance as an industrial zone in the 1990s, and merchandise flows became increasingly restricted to exchanges of final consumer goods, construction materials, and to a lesser extent, industrial products. This zone and the CST axis in particular were increasingly transformed into residential areas, largely serving as bedroom communities for the primary city; hence, the most important flow is that of workers making their daily commutes.

The populations' economic activity rate in the PUI-Tuy area (65.3%) is low compared with those of the Caracas (70.9%) and the CMR (69.6%). The differences are greatest for women, reflecting an absence of employment opportunities and the lower-income neighbourhoods' territorial enclosure. Men's activity rate does not differ significantly from those for the CMA and CMR. The female and male activity rates in the PUI-Tuy area are 49.2% and 80.1%, respectively, compared to 59.5% and 82.8%, respectively, for the Caracas and 57.9% and 81.4%, respectively, for the CMR. The "discouraged worker phenomenon" is considered to be present in the PUI-Tuy area, making a significant contribution to the low rate of economic activity by women. (Table 6)

The labour market's segmentation indicates a higher rate of informal occupation in the PUI-Tuy area (47.4%) than in the Caracas (39.4%) and the CMR (41.4%). Consistent with the characteristics of the local market, the female labour force tends more toward informal occupation (56.1%) than does the male labour force (43.9%). (Table 6). In a previous study on the PUI-Tuy area we asserted that: "*the local market's expansion allowed many women to leave their low-quality jobs and switch to independent informal small-scale selling activities in their homes, on the street, or door to door. These activities, like work in the employer's home, are unstable and generate low incomes, but give the workers time to simultaneously do their housework and take care of their children, which is positively valued in the context of insecurity and daily violence prevailing in the area*" (Lacabana & Cariola 2001).

The local labour market's limitations are reflected in the population's poverty. The poverty rate in the PUI-Tuy area, as measured by the poverty line, is 57.4%, higher than Caracas (28.3%) and the CMR (37.6%). The extreme poverty rate (households whose income is lower than the cost of the standard food basket) is 26.2% and the structural poor (those whose household incomes are equivalent to 1 to 2 times the food basket's value) account for 31.2% of the population.

There are no substantial quantitative differences between men and women in the poor population, though there are qualitative differences relating to roles, domestic organization, and water supply. Accordingly, we can speak of the "water poor" among these groups, and especially among women.

A share of the population that reaches 18,3% in the PUI-TUY is classified as vulnerable middle sector, with incomes not far above the poverty line but having a built up social and cultural capital which allows the members of this group to keep poverty at bay, and which is reflected in their consumption patters and their links to the global lifestyle[12]. The remaining 24.3% of the population are classified as non-poor (22,9% middle sectors -households whose incomes are equivalent to 3 to 10 times the food basket' food- and 1,3% high sectors –households whose incomes are more than 10 times the food basket's food-). The poverty in the PUI-Tuy is more extensive and intensive than Caracas and the rest of the CMR.(Table 8)

The income distribution in the PUI-Tuy area is more regressive than in the Caracas and the CMR as a whole. The household income for the highest decile is 36 times higher than for the lowest decile in the PUI-Tuy area, compared to gaps of 12 times for the CMA and 15 times for the CMR.

[12] See appendix with Definitions of poverty measurement methodology.

. Chosen Localities

The labor status of the inhabitants of both localities is extremely precarious. The rate of activity is very low and that of unemployment is higher than for the PUI-Tuy as a whole. (Table 6a) That is to say, there is a low incorporation of working-age residents (> 15 years) and a great many unemployed. Our remarks on the precarious labor conditions in the PUI-Tuy are even more applicable to Bachaquero and Paso Real 2000, especially as regards the "discouraged worker phenomenon" and the exclusion of women from the labor market. In this respect, note the very high unemployment rate among the female residents of Paso Real 2000 (43.5%) and their very low rate of activity (38.5%). (Table 6a)

18% of the Bachaquero labor force and 19% of the Paso Real 2000 labor force work in the public sector, and 45% and 40%, respectively, in the private sector. Total formal sector employment amounts to 63% of the labor force in Bachaquero and 58.8% in Paso Real 2000. Informal occupation is lower than the average for the PUI-Tuy in both locations, reflecting the low participation in the labor force in response to the meager prospects offered by the periurban economy and the population's low income levels, insufficient to generate an attractive market for informal activities.

Table 6 a
Chosen Localities
Labour Market Indicators
2003

Localities	Activity Rate			Unemployment Rate			Labour Market Sector	
	Total	Women	Male	Total	Women	Male	Formal	Informal
Bachaquero	59.7%	47.1%	76.0%	21.7%	29.7%	15.2%	63.0%	37.0%
PasoReal 2000	56.8%	38.5%	72.0%	22.7%	43.5%	13.5%	58.6%	41.4%

Source: Field 2003

One indicator of the absence of labor market opportunities, as well as of some forms of self-exclusion, is the high proportion of young people (15 to 24 years old) who neither study nor work (48% in Bachaquero and 44% in Paso Real 2000), This phenomenon may also be linked to the strong socioterritorial confinement that prevails in these communities (Lacabana & Cariola 2001). In addition, low salaries provide an indicator of precarious labor conditions: 45% of the working residents of Bachaquero and 59% of those in Paso Real 2000 earn less than the monthly minimum wage.

These labor conditions influence the population's living conditions and degree of poverty. Given the shortcomings of all kinds in the housing units and public services in both localities, all the households are classified as poor according to the Unmet Basic Needs (UBN) Method. On the other hand, when the Poverty Line Method is applied a small proportion of the households turn out to have incomes above the poverty line and can be considered non-poor: 12% in Bachaquero and 8% in Paso Real 2000.

The combined method for measuring poverty[13] allows us to conclude that all the households in both localities are poor, even though a small percentage may have incomes above the poverty line. Both are structurally poor communities. 64% of the households in Bachaquero and 72% of those in Paso Real 2000 live in extreme poverty, having incomes below the cost of the standard

[13] Idem note 11

food basket. Another 24% and 22%, respectively, are classified as structurally poor, with incomes varying from the cost of that basket to double its cost, and the remaining 12% in Bachaquero and 8% in Paso Real 2000 are moderately poor.

Table 8 a
Chosen Localities
Poverty

Localities	POOR			Total
	Extreme Poverty	Structural Poverty	Moderated Poverty	
Bachaquero	**512**	**192**	**96**	**800**
% Households	64,0%	24,0%	12,0%	100,0%
Paso Real 2000	**648**	**180**	**72**	**900**
% Households	72,0%	20,0%	8,0%	100,0%

Source: Field 2003

. Livelihood patterns, changes and their implications on poverty

It can be said that the convergence of national economic trends with the metropolitanization process in Caracas and the major national infrastructure and housing projects in the area, as well as local responses, is making the PUI-Tuy area increasingly heterogeneous in economic and social terms. It is turning into an arena for conflict over jobs, land, and utilities and services, due to the local governments' lack of input into national projects and these governments' inability to satisfy the population's expectations and demands.

The initial hypothesis, attributing to this social heterogeneity a positive influence that would attenuate socio-territorial inequality and the phenomena of oversegregation and territorial enclosure of the lower-income population, is gradually yielding to a more complex view according to which the latter phenomena –in conjunction with expressions of territorial isolation by the middle-income population- tend to reproduce the CMA's pattern of fragmentation in the periphery (Cariola & Lacabana 2002).

Caracas continues to be the leading source of jobs and the local social problem continues to be unemployment. The de-industrialization process continues to operate in the PUI-Tuy area as companies shut down, and construction activity creates few jobs for local residents because the construction firms bring in their own workers from outside the area[14]. The service sector is growing, partly due to the expansion of informal activities, and is becoming more complex and differentiated in response to the population's growth and social differentiation. The government's minimal employment plans have created few local jobs, and those tend to be unstable and to pay low salaries.

For both the new and old lower-income inhabitants of the Tuy area, changes in livelihood strategies in response to the advancing social crisis are also associated with their peripheral location and the cost of living far from the metropolitan centre. The distance factor affects

[14] The deindustrialization process which accelerated in the 1990s as a result of the adjustment and opening of the economy is under way nationwide. In areas such as the Middle Tuy Valleys where sources of employment are few, its effects have been very intense, increasing unemployment and adversely impacting the local population's living conditions.

livelihood strategies in view of the higher unemployment rate in the area, the high economic and time cost of working in the city, for which prevailing salaries do not compensate, and the difficulty of incorporating all potentially active members of the household into the labour market in order to increase household income (the additional worker strategy). Moreover, families are forced to accept uncomfortable and conflict-inducing domestic arrangements in order to simultaneously fulfil the different obligations of work, child care, study, and others in geographically distant locations.

The residential strategies followed by these poor populations to solve their housing problem and/or generate alternative sources of income are characterized by a short-term orientation. The leading residential strategies in the PUI-Tuy area contribute to an increasing concentration of the lower-income population, as a result of illegal land occupations and consolidation involving expansion of housing units in older lower-income neighbourhoods, as well as settling in lower and middle-income housing built under new government policies in the periphery. The growth of these lower-income neighbourhoods has turned them into markets for developing commercial and service activities, both formal and informal, which have changed the urban image. But territorial enclosure and concentration of poverty still persist, along with an absence of opportunities, leading to reliance on livelihood strategies having meagre ability to ensure family reproduction[15]. This short-term orientation and the precarious living conditions reproduce themselves intensively in the chosen localities.

Urban growth, both formal and informal, will affect the provision of public utilities and increase the current deficit thereof. It will also increase the risk associated with the absence of safe disposal of wastewater and garbage, and intensify the impingements on natural areas and agricultural lands.

. Water-related health trends

The most frequent water-borne diseases in Venezuela are diarrhoea, amibiasis, cholera, and acute Type-A Hepatitis. Epidemics of gastroenteritis occur routinely during the rainy season. Though the incidence of these diseases rose over the 1993-1997 period, qualitative official information indicates a partial improvement. The mortality rate for diarrhoea in people under 5 years of age declined by 59% between 1990 and 1996 (from 217,5 to 89,1 per 100.000 live births) and mortality due to acute respiratory diseases declined by 36%. As regards morbidity, for 1998 and 1999 diarrhea and respiratory diseases take the first two places (OPS 2003). The PUI-Tuy is part of Miranda state, where the incidence of diarrhea in children under one and five years has increased between 1999 and 2000, from 13,296 to 16,381 and from 30,192 to 35,113, respectively, while the mortality rate from acute diarrhea continues at 0.3/1000 (MSDS, 2001).

At the municipal level the most striking statistic is the high rate of diarrhea in children under 1 year of age. Cases of diarrhea equivalent to 27% of the population in this age group were reported in Cristóbal Rojas Municipality (Charallave), and cases equivalent to 25% of the under 1-year population were reported in Independencia Municipality (Santa Teresa), both in the CST axis, during the first nine months of 2003. The comparable proportions fall to 9.6% and 8%

[15] But it should be noted that the inauguration of a set of uninstitutionalized social policies called "Missions" and other forms of community participation have put an end to the territorial confinement. (See Report: WSS practices and living conditions in the peri-urban of Metropolitan Caracas Region: the cases Bachaquero y Paso Real 2000 in the Valles del Tuy Medio"

among children in the 1 to 4 four-old group. Parasitic diseases are also very common in both municipalities. (Following table)

Water and Food-Borne Diseases
Cristóbal Rojas Municipality (Charallave) and Independencia Municipality (Santa Teresa))
January – September 2003

Diseases	Total Charallave*	% Population	Total Sta.Teresa*	% Population
Cholera	0	0,00%	0	0,00%
Amibiasis	180	0,25%	574	0,37%
Diarrhea (under 1 year)	494	27,00%	916	25,00%
Diarrhea (1 to 4 years)	730	9,60%	1158	8,00%
Diarrhea (5 years and over)	636	0,90%	714	0,50%
Giardiasis	87	0,12%	90	0,06%
Helmintiasis	366	0,51%	675	0,43%
Typhoid fever	0	0,00%	35	0,02%
Other water-borne diseases	14	0,02%	11	0,01%
Acute Hepatitis	0	0,00%	16	0,01%
Total Water and Food-Borne Diseases	**2507**	**3,48%**	**4189**	**2,67%**

* Municipios Cristóbal Rojas e Independencia
Source: Ministerio de Sanidad y Desarrollo Social: Distrito Sanitario Nº 2.

According to the qualitiative information provided by the resident physicians in both of the chosen localities, they are subject to a range of water-borne diseases:

> In Paso Real 2000, "it is true that there are water-borne diseases … down here we have a house through whose land sewage flows, and the clean water supply pipe passes nearby. That alone cannot fail to be contaminating, because due to increased pressure in the pipe when it loses water, everthing is vacuumed into the pipe, and then when the water comes again, it is subject to contamination." … "The problem is not the water, most of it has nothing to do with the water, and even we (the doctors) are striving, through our examinations and house calls, to get the residents to take precautions, to take measures. In fact, many children come in for diarrhea … it is because of transmission by water or food." (Resident physician in Paso Real 2000, November 2003).

More skin diseases than diarrhea are reported in Bachaquero. In our interviews there we did not detect a substantial number of diarrhea or gastroenteritis cases, but many cases of parasitic and skin diseases were reported: scabies, piodernitis, atinasis, micosis, dermatitis, boils, that the doctors link to both the water shortage and the improper storage of water, which helps to encourage a proliferation of mosquitoes. Other sources of contamination include garbage and collapsed septic tanks. Most of the residents do not treat or boil the water that reaches them, though it is murky and of poor quality.

These differences in the types of diseases as between the two chosen localities are reflected in the data generated by the survey we took, as the following table indicates:

Frecuency of diarrhea

Frecuency	Paso Real 2000	Bachaquero
Monthly	24%	8%
Quarterly	8%	4%
Semiannually	-	8%
Never	68%	78%
No answer	-	2%
Total	100%	100%

Source: Field 2003.

2.3. Environmental Characteristics and Processes of Change

With the exception of the Central Coast area, the CMR as a whole is included in the Tuy River Basin. The Middle Tuy Sub-basin, in turn, is in the Tuy Valleys (PUI-Tuy) area, on which our study focuses (Map 7). The two principal functions performed by the Tuy River Basin, and especially the Tuy Valleys, in regard to Caracas are water supply and provision of a zone of expansion to accommodate urban growth.

The Tuy River Basin is characterised by diversity, heterogeneity, and vulnerability. In addition to discontinuous urban areas that include industrial zones and correspond to the primary city and the cities located in the different segments of the PUI and some agricultural areas, 14 ABRAES (Areas Under Special Legal Regime) have been created. These include two national parks, two natural monuments, two protected areas, one agricultural development area, and three recreational areas.

The chosen localities in the Charallave-Santa Teresa urban axis (Paso Real 2000 and Bachaquero) are located in the Middle Tuy River Basin, and specifically in the valley portion thereof.

In hydrographic terms, the Middle Tuy Basin is defined by the section of the Tuy River from upriver of Tacata to El Vigía, with a length of approximately 61 Km. It has an area of 1,307 Km^2 and its principal population centers are Charallave, Cua, Ocumare del Tuy, Santa Teresa, Santa Lucía, and San Francisco de Yare, belonging to Cristóbal Rojas, Urdaneta, Lander, Independencia, Paz Castillo y Simón Bolívar municipalities of Miranda State. A large part of Guatopo National Park is located within this sub-basin.

Topographically, the Middle Tuy Basin has two types of landscapes: one of middling relief in which the interior valleys lying between mountain ridges (200-400 meters above sea level) and a hill area (400-600 meters above sea level) are located, and an area of rugged relief comprised of the mountains of the Interior Range where foothills (200-1000 meters above sea level) and the mountains themselves (400 to 1400 meters above sea level) are found. The landscape of the Middle Tuy Valleys has an area of 669 Km^2. Its boundaries are defined by the 400 meters above sea level contour on the north, the 200 meters above sea level contour on the south, the juncture of the Guaire and Tuy Rivers on the west, and the Tuy River's juncture with the Taguaza River on the east.

In geological terms, the Middle Tuy region is a sedimentary succession, comprised mainly of upper tertiary and quaternary sediments. There are outcroppings of the Las Brisas, Camarapa, Las Mercedes, Paracotos, Peña de Mora, Tuy, and Villa de Cura formations, and tertiary alluvial formations.

These geological formations from which the Tuy River and its tributaries obtain the material they wash downstream and deposit, result in the predominance of several types of rock, which in terms of its chemical composition, the position of the alluvial deposits, and the climate, give rise to certain types of soil.

The fluvial accumulations in the valleys are arrayed on rolling terraces; the first terrace level is characterised by alluvial soils subject to annual flooding, and generally fertile with good drainage. The second and third terraces are at higher elevations, free of flooding and with slopes in the 1% to 4% range, having poor drainage and moderate fertility.

There is little agricultural land in the PUI-Tuy area. The land inventory indicates that 75% of the land is of low quality, unfit for agricultural uses other than permanent crops and forests with medium or severe restrictions. Only 8% of the land is of medium to good agricultural quality. But these lands are being increasingly impinged upon by urban growth. Indeed, a large part of the land with agricultural potential has already been occupied for urban or industrial purposes.

This explains why the agricultural productive subsystem is of small importance. There is very little agricultural activity, and what there is tends to be organised in very small plots, some of them defined as "week-end farms" because city dwellers cultivate these lands for largely recreational purposes, though their productivity also contributes to livelihood strategies and they may sell small surpluses. Commercial operations, chiefly including pig and some rabbit farms, are of greater importance.

In spite of their differences, these agricultural and livestock raising activities have one problem in common: access to water. Agriculture sometimes uses treated (pure) water for irrigation, which is a waste of a scarce and costly resource needed for household consumption. The pig farms also use purified water, but in addition they dump their untreated effluents into the water courses, polluting them and burdening the water supply company while increasing the cost of treatment. This is a particularly serious problem because the pig farms are located upstream from the points where the metropolitan water supply system draws its water.

There is strong competition for access to use, as well as improper use, of water in the Middle Tuy Basin. Formal and informal residential use has top priority for access to pure drinking water, while agriculture is an activity of little importance in the Tuy Basin and the metropolitan region as a whole. As regards sewage, in view of the absence of effluent treatment, the pig farms have consolidated the "right" to dump their effluents into the water courses, as do virtually all the cities, towns, and industries in the Tuy Basin. The regulatory agency (the MARN) is conspicuously absent in this respect; it does nothing about the industries and pig farms of the upper basin, even though Hidrocapital is fully aware of the problems these effluents pose for its operations.

It is also necessary to mention a tendency in State policy toward "revaluation" of agricultural activity in urban areas. So-called "organoponic" farms are being set up in the center of Caracas and in Charallave beneath one of the railroad viaducts under construction, while hydroponic farms are under development in Ciudad Guaicaipuro, a community located in the Charallave-

Santa Teresa axis, and there is information according to which the La Virginia Agricultural-Food Production Cooperative project, supported by the National Lands Institute and the Ministry of Production and Commerce, is putting 10,000 hectares of land into production in the vicinity of Santa Lucía. These initiatives, on which there is no information regarding their viability and economic and inter temporal sustainability, may make the competition for water use in the area even more complex and difficult to manage. In a basin where water is scarce, one can only wonder about the origin (water supply system, wells, illegal taps) of the water used for these new agricultural developments.

They Tuy Basin has historically been an area subject to human intervention, and especially the valleys, which have been used for settlements and agriculture since pre-Colombian times. The natural vegetation, mainly tropophyllic and gallery forest, was first removed in the valleys to make way for cultivation, and then the vegetation on the hillsides was exploited for wood or removed to permit small-scale subsistence farming. At present there are groves of trees on the hillsides near the junctures of natural drainage systems, while the rest is covered by brush of low density accompanies by grassy species.

In the second half of the 20th Century the Middle Tuy Basin was subjected to pressure from the constant metropolitan expansion that is a key factor for understanding the urban subsystem's functioning. This expansion into the Tuy Basin has had to adapt to a very hilly topography, with the cities growing up essentially in the intramontane valleys of varying altitudes which interrupt the mountainous relief characteristic of the basin. The occupation of areas with hilly topography adjacent to the valleys in Caracas has thus spread to the Middle Tuy Basin, where the hill areas near the valleys are experiencing increasing illegal occupations and the development of squatter settlements.

The sustained process of occupation described above explains why the area in which the chosen localities are located (Map 4: Charallave-Santa Teresa Urban Axis), in the valley landscape area, *is a fundamentally urban space* in which the few rural activities are insignificant and tend to disappear under the pressure for appropriation of flat or moderately rolling land to build housing (formal and informal). The spaces not yet occupied for urban use are hills and mountains which have been increasingly occupied illegally, and that trend is expected to intensify still further; it has provoked problems of erosion and landslides.

Though most of the land is private, there are still some urban lands belonging to local governments and national or state-level public agencies, as well as by public-sector enterprises.

In the environmental situation described above and in the context of sustained growth of the urban areas, it is necessary to stress the deterioration of the hydrographic network, in use for two mutually exclusive purposes: *extraction of water for consumption and disposal of sewage or waste water*. The Tuy River is the water source that supplies approximately 50% of the drinking water, not only for the PUI-Tuy zone but also for the CMR as a whole. But its tributaries are used both directly and indirectly as sewers or collectors of waste water from cities and industries.

The Tuy River's water quality has deteriorated because of contamination by sewage from factories, pig farms, and urban areas. Its turbidity comes mainly from erosion in the upper basin. This contamination explains why the Tuy water has high levels of coliform organisms and heavy metals, is grey-brown in colour, looks dirty, and smells bad.

Industrial effluents produce organic contamination, toxic contamination (heavy metals), and turbidity. The effluents from the pig farms are organic contaminants and turbidity. Contamination from urban areas is produced by domestic sewage, one of the major sources of organic pollution representing 47% of the total DBO effluent load flowing into the Tuy River[16].

All these factors result in serious environmental problems in the Middle Tuy Basin's urban system. Most of its inhabitants receive irregular water supply service and some must make do with unhealthy water. Though this situation may worsen in the near future due to the rapid urban growth of the PUI-Tuy, there is also reason to hope that the new policies and forms of water management will help overcome the deficiencies to some extent and improve water service.

To sum up, the interactions among the natural subsystem, the agricultural and productive subsystem, and the urban subsystem which define the change processes in the PUI-Tuy indicate the following:

- An intense process of human intervention of the few unprotected natural areas by formal and informal urban growth;
- The disappearance of agricultural activities and misuse of pure drinking water in the productive activities (chiefly vegetable agriculture) that remain active;
- A degradation of the urban areas due to impacts on public spaces and water courses, and landslides;
- A strong impact on secondary and principal water courses, stemming from residential, industrial, and livestock-raising effluents;
- Problems for the water supply company which must treat water heavily polluted by the effluents dumped into the Tuy River;
- Poor quality of the water that supplies some populated zones in the PUI-Tuy, as a result of insufficient treatment capacity, competition with water supply for Caracas, and the quasi-informal solutions applied in response to pressures and conflicts mounted by the local residents and institutions against the water supply company;
- Large numbers of illegal taps and informal distribution networks in the irregular settlements.

As said above, the problems associated with the current changes are basically linked to the brown agenda as a consequence of rapid urban growth and absence of wastewater disposal. But water courses and some natural areas will also come under greater pressure in the future, giving rise to problems related to the blue agenda and green agenda. Hence, bridging the green-brown agenda (Allen and You 2002) acquires increasing importance in this case.

2.4. Legal and Institutional Framework

Venezuela is divided into States (the provincial level) and Municipalities (the local level). They are autonomous entities with equal political status and full legal personality (Art. 159 of the Constitution of the Bolivarian Republic of Venezuela (CBRV).

The urban periphery of the Middle Tuy Valleys (PUI-Tuy) embraces the territory of six municipalities: Cristóbal Rojas, Independencia, Lander, Paz Castillo, Simón Bolívar, and

[16] Most of the pig farms and food processing industries in the Tuy Basin are located in its upper part. The principal population centres are in the middle part, and the entire basin is without sewage or wastewater treatment facilities.

Urdaneta, all belonging to Miranda State which, together with the Capital District and Vargas State, comprise the Capital Region of Venezuela, of which the CMR is a part.

Pursuant to the CBRV, the States are responsible for organizing the municipalities and for their political-administrative subdivisions. They are also responsible, among other things, for the creation, legal regulation, and organization of the state-level public utilities and services (Art. 164). The same Constitution, however, restricts the States' powers and fiscal resources; most of their funding comes from central revenue sharing. The states must transfer the services and powers for which they are responsible to the municipalities insofar as the latter are in a position to operate them.

The state and local government's revenue comes mainly from the following sources: a) revenue sharing *(Situado Constitucional),* whereby a portion of the central government's ordinary revenue must be equally distributed to the states and *municipalities* and regarding its population; b) a share in Value Added Tax (VAT) revenues (collected by the central government and then transferred to the sub national governments); c) transfers under the Special Allocations for States Derived from Mining and Hydrocarbons Act (legislation enacted under pressure from the governors of mining and oil-producing states which calls for the distribution of a percentage of the national revenue gleaned from those activities to the municipalities and states in which they are performed, as well as to the states in which there is no mining or oil extraction); d) transfers for responsibilities assumed; e) own revenues collected by the state and municipal governments; and f) transfers from the Territorial Compensation Fund.

The principal source of funding is the *Situado Constitucional*. This is "a budget item equivalent to a maximum of twenty per cent (20%) of the total ordinary revenue estimated each year by the National Treasury, which shall be distributed among the States and the Capital District as follows: thirty per cent (30%) in equal portions and the remaining seventy per cent (70%) in proportion to each such entity's population. In each fiscal year the States shall allocate a minimum of fifty per cent (50%) of the funds so received to investment. The Municipalities of each State shall receive a share not lower than twenty per cent (20%) of the *situado* and all other ordinary revenues of the respective state in each fiscal year. In the event of variations in the National Treasury's revenue which require a modification of the National Budget, a proportional readjustment of the *situado* shall be effected (Art. 167, CBRV). A recent reform of the Organic Decentralization and Transfer of Powers Act in September 2003 ordered the distribution of an additional 20% of state revenue, hereinafter to be known as Municipal *Situado*. This strengthens the municipalities' fiscal capacity to the detriment of state budgets, despite their dependence on the *Situado Constitucional* and their very limited ability to raise revenue of their own. All this implies an enormous dependence of the States, and in subsidiary fashion, the Municipalities, on the Central State.

The Municipalities are the primary political unit of national organization, with legal personality and autonomy that empowers them for: the election of their authorities; management of the activities falling under their authority; and the creation, collection, and investment of their revenue. Pursuant to the Constitution of 1999, "the Municipality's actions in the scope of its authority shall be performed with the incorporation of citizen participation into the process of definition and execution of public policy and the control and evaluation of its results in an effective, sufficient, and timely fashion in conformity with the law" (Art. 168).

The Municipalities have powers of their own in the environmental sphere: protection of the environment and co-operation in environmental reclamation. They are also responsible for urban

and household sanitation, control of disturbing noise, water supply, and treatment of waste water. Further, the Municipalities must promote parks and gardens, plazas, beaches and resorts, as well as other recreational and sporting installations. A specific function touching on vigilance and control over environmental offences is the exercise of environmental police powers in the localities.

Though the municipal governments have a number of taxing powers spelled out in the Constitution and the Organic Municipal Government Reform Act of 1989, their budgets are funded chiefly by revenue-sharing transfers and two local taxes: the industrial and commercial license tax and the urban real estate tax (González & Mascareño, 2000). Revenue from these traditional sources declined between 1986 and 2000, but was offset by new intergovernmental transfers. The percentage of municipalities that have diversified revenue structures in which local tax collection plays a significant role was much smaller by 2000. This review of the sources of funding on which the sub national governments rely, which is not exhaustive, suffices to reflect the heavy fiscal dependence of the states, and to a lesser extent that of the municipalities, on the central government.

. The new local institutional structure

The new Constitution approved in 1999 incorporates a set of legal instruments and governmental and non-governmental institutional arrangements designed to advance the process of democratic decentralisation and creates new channels of negotiation and consensus-building.

Strong stimulus is given ton the national planning system and new structures are created at the different territorial levels of government. A new local institution, the Local Public Planning Council (LPPC) is responsible for the local government's comprehensive planning and for ensuring co-ordination and popular participation in the drafting and monitoring of the Municipal Development Plan and the programs and actions taken in the municipality. The LPPC must draw up the Local Investment Plan, which is according to law the most important management instrument for setting municipal priorities. This investment plan, which must be drawn up in participatory fashion, is aimed at achieving the municipality's human, social, cultural, and economic development, with attention for the population variables and the prevalence of poverty in each community, and must cover the following:

1. The top-priority projects, submitted by the organised communities.
2. The general plans on urbanism, infrastructure, services, and road and highway construction.
3. The emergency fund, to cope with natural disasters, public calamities, and unforeseen events.

This fund shall be managed by the Mayor, with prior approval by the Municipal Council and the participation of the Local Public Planning Council, the organ responsible for monitoring the fund to see that its funds are properly invested.

Moreover, the mayors are obligated to carry out the projects submitted by the organised communities, funded by the allocations for said projects pursuant to the laws which appropriate and transfer funds for the organised communities.

The LPPC shall be comprised of the Mayor, who shall chair it, the Councilmen and Chairmen of the Parish Forums, and representatives of the neighbourhood and community organisations or indigenous peoples, who must exceed the number of official representatives by one.

The LPPCs are a channel for consensus building and management of local conflicts. They are intended to foster a change of attitude among the different actors, permanently reinforcing by legal obligation:

Stimulus for the conclusion of Cupertino agreements between the public and private actors.
Co-ordination with other LPPCs for the creation of service communities.
Stimulus and planning for transfer of powers and resources to the communities.

The creation of the LPPCs has been fraught with conflict, and there is unequal development of their implementation; the reason is that many mayors see this new institution as a parallel and competing political space, leading to a loss of power for them. The communities are awaiting their organisation, viewing them as providing an opportunity for playing a leading participatory role in the definition and solution of their problems. But some experiences have already taken place, including one in Cristóbal Rojas Municipality of the PUI-Tuy where the LPPC is now in process of creation.

At the state level, the governments must create the Planning Councils and Public Policy Co-ordination Councils (PC and PPCC) prescribed in the Organic Planning Act. These bodies are responsible for drafting and executing a State Development Plan, under guidelines similar to those applicable to the LPPCs. The planning system is completed at the national level with the Federal Government Council, the highest organ of planning and co-ordination of policies and actions for the development of the process of decentralisation and transfer of powers from the National Government to the States and Municipalities. The latter organ is comprised of the Vice President of the Republic, the Cabinet Ministers, the State Governors, a Mayor from each State, and representatives of organised society.

. Chosen Localities

Bachaquero has a Civil Association that represents the community's demands vis-à-vis the public institutions in a traditional patronage-based fashion, as well as other emerging organizations that aspire to provide a more democratic style of representation.

In addition to the religious organizations present in all the communities, Bachaquero has an NGO, Comprehensive Educational Improvement, which provides preschool education to the community. Also present are organizations linked to the current public health (the Inside the Slum Plan) and literacy education (the Plan Robinson) policies.

Hidrocapital is responsible for supplying water to Bachaquero. Attempts to form technical water forums to improve service failed for lack of consensus in the community on the potential benefits of this kind of organization. Both the municipal government of Santa Teresa (where Bachaquero is located) and the state government are involved in the provision of public works for the community, according to a patronage-oriented style which has undergone no significant change to date. The Urban Land Committees have organized and completed all the steps required for them to able to approach the authorities.

The Community Planning Council has been formed in Paso Real 2000, and has operated somewhat intermittently due to a variety of internal community problems. Much the same has happened with the technical water forum; it was initially formed but never actually operated, and some time later a number of community members revived the project. Representation before the

Local Planning Forum at the municipal level goes beyond the community, because that agency covers a larger area embracing six other communities near Paso Real 2000. Charallave Municipality was the first one in the country to inaugurate this Council. Though the mechanisms provided for in the new Constitution to channel participatory democracry are in operation, the application of that style of governance is subject to problems of every conceivable kind.

Some of the community's legal problems are closely linked to the uncertainty of land tenure. The Urban Land Committees, intended to formalize land tenure in lower-income settlements, have operated in part, but are torn by many political conflicts. Though this community's legal status is very precarious, the Charallave municipal government has given it de facto recognition in the form of the contruction of parts of the sewer system, and it is negotiating for the purchase of the land and a housing plan to go into effect once the land tenure problem is overcome. A similar situation occurs with Hidrocapital; though the taps into the drinking water supply pipes are illegal, the company provides advising for the construction of the settlement's internal network and the improvement of the pure drinking water supply service. Other problems are more closely related to the absence of community participation in the community -based organizations.

The principal community-based organization is the Paso Real 2000 Civil Association, which was formed at the start of the occupation and was the leading source of the community's achievements. There are also some religious organizations, as well as organization operating with State support, mainly the Inside the Slum Plan (providing medical care) and the Plan Robinson (for literacy education). No other kinds of NGO were reported in this settlement.

2 CHARACTERISTICS AND TRENDS OF THE WSS

2.1. Environmental Conditions and Water Resources

The catchment area embraces the Tuy River Basin and the Guárico River Basin. The first is located within the CMR and includes the PUI-Tuy area and the second is outside the CMR. (Map 7)

The Tuy River Basin is located in the central region of Venezuela, administratively falling with the Capital District and Miranda and Aragua States. It has a total area of 6,823 km^2 and is physically a part of the Coastal Mountain Range. It is an elongated strip of land running west to east lying between the Caribbean Sea and the Plains Depression. It is divided into two parallel segments: the Coastal Range and the Interior Range, separately chiefly by the Lake of Valencia Depression and the valley through which the Tuy River runs. In hydrological terms, it embraces five sub-basins.

Tuy River Basin
Sub-basins and Area

Sub-basin	Km^2
Middle Tuy	***1307***
Upper Tuy	1006
Lower Tuy	2481
Guaire River	1192
Grande o Caucagua River	837
Total	**6823**

- *The Upper Tuy Sub-basin*: This sub-basin is comprised of the source of the Tuy River, a set of narrow V-shaped valleys. It has a 1,006 km^2 area and is crossed by the stretch of the river running from its source near Pico Codazzi mountain (2,400 meters above sea level – m.a.s.l.) to a location upstream from the town of Tácata (400 m.a.s.l.), with a length of approximately 56 kms. The principal population centres in this sub-basin are Colonia Tovar, Las Tejerías, and El Consejo, belonging to José Félix Ribas, Tovar, and Santos Michelena municipalities, respectively, of Aragua State. Its areas under special administrative regime are the Colonia Tovar tourist zone, the Pico Codazzi natural monument, the portions of Macarao National Park and the Caracas Metropolitan Area Protection Zone.

- *Middle Tuy Sub-basin*: This sub-basin is a narrow alluvial plain defined by the stretch of the river running from upstream from Tácata town to the site known as El Vigía, with a length of approximately 61 Kms. It has an area of 1,307 km^2 and its principal population centres are Charallave, Cúa, Ocumare del Tuy, Santa Teresa, Santa Lucía, and San Francisco de Yare, belonging to Cristóbal Rojas, Urdaneta, Lander, Independencia, Paz Castillo, and Simón Bolívar municipalities, respectively, of Miranda State. A large part of Guatopo National Park is located in this sub-basin.

- *Guaire River Sub-basin*: This sub-basin is comprised of the Guaire River, one of the Tuy's principal tributaries on its left bank at El Vigía. It is 73 km long, and has a 1,192 km^2 area. This is where the Caracas Metropolitan Area (CMA) is located. The areas under special administrative regime lying within this sub-basin are the La Pereza, El Algodonal, Los Teques, and Cerro El Volcán reservoirs, as well as parts of El Avila National Park, Macarao National Park, and the Caracas Metropolitan Area Protection Zone, which coexist with the critical area receiving priority treatment in the Tuy River Basin.

- *Lower Tuy Sub-Basin*: This sub-basin runs from the point where the Guaire flows into the Tuy to the latter's mouth on the Caribbean Coast at a place known as Boca de Paparo, with a length of approximately 134 km and an area of 2,481 km^2. It most important population centre is San José de Río Chico, belonging to Páez Municipality of Miranda State. The areas under special administrative regime located in this sub-basin are portions of Guatopo National Park, the Barlovento agricultural zone, the tourist-recreational zones at the Río Chico Canals, and the Barlovento coastline.

- *Río Grande Sub-basin*: This sub-basin is comprised of the Río Grande or Caucagua River, another major tributary of the Tuy on its left bank. It is 80 km long and 837 km^2 in area. Its leading population centres are Guarenas, Guatire-Araira, and Caucagua, located in Plaza, Zamora, and Acevedo Municipalities, respectively, as well as less important centres, in Miranda State. The areas under special administrative regime lying within this sub-basin are the Chuspita River Protection Zone, parts of El Avila National Park, parts of the Caracas Metropolitan Area Protection Zone, and parts of the Barlovento Agricultural Zone.

The Guárico River basin is located to the south of the Coastal Mountain Range and covers parts of Aragua, Carabobo, and Guárico states. The river is born near the town of Belén in Carabobo State and empties into the Apure River. The Guárico River is dammed in its middle section to form the Camatagua Reservoir, which supplies nearly 50% of the water for the CMR, and in its lower section for the Calabozo Reservoir, whose waters are used for irrigation and provison of drinking water to the local communities. The basin is affected by cutting and burning of vegetation in the headwaters and beds of the rivers and streams, which are subject to overgrazing, as well as cultivation on steep slopes, soil erosion, and sedimentation of the

reservoir. The unregulated urban settlements and agricultural activity provoke contamination of the water with agricultural chemicals and urban and industrial wastes. Vera (2000) asserts that if the current trend toward expansion of extensive cattleraising continues, there will be increasing environmental degradation and a resulting deterioration of the Camatagua basin's principal function: the production of water for human consumption.

The Tuy River Basin has a mean production capacity of 11.47 m^3/sec, which represents 50.15% of the principal water sources that chiefly supply the CMA and the other cities of the CMR. The remaining 49.85% comes from the Guárico River Basin, which contributes 11.40 m^3/sec.

This volume of water is enough for the Capital Region (the CMR plus the Barlovento system), but there is little left over to support the production that now uses these resources, estimated at 20.75 m^3/sec. Nevertheless, serious water supply problems recur during the dry season because of a low volume of water in the river and the reservoirs, a 35% loss rate, and mechanical and electrical failures in the water supply system. Though there are no plans to make use of alternative sources of water in the near future, the fragile balance between supply and demand poses the need for a new expansion of the Tuy IV Project.

Both basins (the Tuy and Guárico) are subject to strong seasonal variation, leading to water shortages during the dry season. The climate is classified as rainy tropical, with two distinct periods, a dry season from December through April and a rainy season from May to November; precipitation peaks in July. Solar radiation is constant and intense all year round, and the average temperature is 26ºC with an average annual variation of less than 5ºC. The recorded temperature extremes are 37ºC and 12ºC. Since altitude ranges from 140 to 400 m.a.s.l., temperature variation is minimal. The prevailing winds are the NE trade winds. The "El Niño" phenomenon predicted in the 2002-2003 period will have a stronger than usual impact on the reservoirs, which are now at their lowest levels in the last 16 years.

3.2. Characterisation and Trends of the Water and Sanitation Services

Ninety eight per cent of the CMR's population is connected to pure drinking water, but frequency of service can vary from every other day to every 27 days (J. Farías 2002). Accordingly, the real service deficit should be determined in terms of frequency of supply. Part of the population's needs are met by municipal and private water trucks, which impose high costs on the population, and especially on the poorer groups in the CMR's cities.

The following table presents the most important indicators of drinking water service coverage, as well as production, employment, and planned investment.

Table 9
Metropolitan Water Supply System Indicators

Water Supply Systems	Geographic Coverage	Population	Production (M3/year)	Direct Jobs	Indirect Jobs	Investment in 2001 (US$)*
Metropolitan System	CMA	3,222,966	604,760,160	183	906	3.726.000
Coast System	Vargas Coast	309,134	2,986,159	65	270	7.571.000
Fajardo System	Guarenas-Guatire	364,702	45,894,000	51	102	4.506.000
***Losada–Ocumarito System **	***Tuy Valleys***	***700,000***	***102,226,239***	***63***	***103***	***6.250.000***
Panamerican System	Miranda Highlands	337,877	30,584,096	69	169	895.000
Total	**CMR**	**4,934,679**	**786,450,654**	**470**	**2207**	**22.918.000**
Barlovento System	Barlovento	420,000	32,988,762	39	187	2.183.000

* Both chosen localities Bachaquero and Paso Real 2000 are in this area.
Change rate: 1US$ = Bolívares 1.600
Source: Own, based on data from Hidrocapital 2003.

In general, the six cities lying in the Middle Tuy Basin have the same water supply and sewage problems, since all of them depend on the Losada Ocumarito System and share the same extraction sites, treatment plants, pipes, pumps, etc. As far as sewage or waste water is concerned, though the cities have public sewer systems, household sewage from the formal urban residential areas and many industries is dumped without treatment. Since there are no treatment plants in the area, sewage is dumped in the vicinity of Santa Teresa, into the waters of the Guaire and Tuy Rivers upstream from the extraction stations. There is also waste water that flows directly into the streams and rivers because many of the informal residential areas (squatter settlements) dump their waste water into the cities' streets and lands. Another source of sewage is industrial effluents that are not discharged into the public sewer system. This problem is so serious that all the streams in the Middle Tuy Basin that cross or adjoin the main cities are polluted by sewage and industrial effluents (Map 5).

To this situation of exploitation of the Tuy River in its middle section must be added the situation prevailing in the upper basin, where waste water or sewage is dumped from the cities of Colonia Tovar, Tejerías, and El Consejo, as well as by the chemical, meat processing, rum, galvanised metal, and other industrial plants. To all this must also be added the dumping of pig farm effluents, household waste water, and suspended solids resulting from erosion.

The impact on water quality in the upper and middle sections of the Tuy Basin stems from three major groups of pollutants: organic materials, toxic (heavy) materials, and materials rendering the river's water turbid. The sources of the organic pollutants are chiefly industrial plants and pig farms (68%), with residential sewage playing a secondary role. The main source of toxic materials is industry, including motor vehicle spare part factories, tanneries, faucet plants, and textile plants. Finally the suspended solids are produced mainly by erosion of the basin (84%).

The foregoing analysis shows that there is a competition for *the use and abuse* of water, whose maximum form of expression is the intense competition among the different actors participating in formal and informal residential activities, industrial production, pig raising, and to a lesser extent, agriculture.

The competition for drinking water expresses itself in a range of situations and at different levels:

In the CMR as a whole, there is competition for drinking water between the cities of the Middle Tuy and Caracas. The metropolitan water supply system's top priority is to supply Caracas, meaning that it sometimes limits service to the Middle Tuy cities. The best expression of that preference is that some areas in the Middle Tuy cities receive untreated water, which is not the case anywhere in Caracas.

In the PUI-Tuy region, the cities compete for drinking water. Due to the explosive growth of these six cities, the construction and operation of the water supply system has not been planned and has in practice reflected pressures and conflicts expressed through street demonstrations and occupation of institutions by residents, as well as the demands of the six municipalities' local governments.

At the level of the individual cities, the competition for drinking water takes place between the middle and lower-income neighbourhoods that comprise them. Since water supply is interrupted for hours and days, pressure varies and this gives rise to competition between the neighbourhoods occupying higher elevations and those in the lower areas.

The water shortage also stimulates competition among the residents of individual neighbourhoods, since some residents break into the pipes or install pumps that keep water from continuing to flow, thereby depriving their neighbours of supply.

There is a competition between the formal construction firms and irregularly established settlements and the water supply company (HIDROCAPITAL) stemming from illegal taps, which impair water supply system facilities and depress quality of service. That occurs in Paso Real 2000 and the Valle de Chara neighborhood, where HIDROCAPITAL has identified illegal taps.

The competition as regards sewage or waste water has the following forms of expression:

There is competition between the formal residential neighbourhoods and the irregular settlements for disposal of sewage. The formal neighbourhoods are damaged by dumping of waste water from other formal neighbourhoods and their residents must bear the bad odours and the proximity of unhealthful waters. To this must be added the dumping of sewage from the irregular settlements into the streets, which provokes unhealthy conditions.

Competition between the industries located in the Upper Basin (Tejerías, El Consejo), which dump their waste water, on the one hand, and the water supply company (HIDROCAPITAL), the residents of the Middle Tuy Basin downstream, and their local governments, on the other.

As regards water consumption, the Caracas Strategic Plan Foundation (FPEC) has estimated the following average per capita consumption rates for domestic and non-domestic use as of 1997:

Table 11
Pure Drinking Water Consumption 1997

Caracas Metropolitan Region	Per capita Consumption Rates		
	Total Litres pp/pday*	**Domestic Litres pp/pday***	**Non-domestic Litres pp/pday***
Caracas Valley	309.8	232.3	77.5
Miranda Highlands	201.5	151.1	50.4
Middle Tuy Valleys	***260.9***	***169.6***	***91.3***
Guarenas – Guatire Valley	227.6	136.6	91.0
Vargas Coast	200.5	120.3	80.2
Metropolitan Region	283.4	205.8	77.6

*Litres per person per day
Source: FPEC 1998

However, these figures are not reliable, in view of the Hidrocapital authorities' assertions and because other studies report consumption levels of 400 to 450 litres per day per person, far above the 250 litre per person per day standard (Franciso 2002, Corrales 1997).

3.2.1. The WSS in the chosen localities

The cities and localities chosen in the axis CST are articulate to two sectors. On the one hand, El Cartanal (including Bachaquero) and the towns lying along the Santa Teresa highway, including Santa Teresa itself, belong to the Losada System, whose principal source of water is the Tuy III (Camatagua) system. Its treatment plant is at Caujarito, from which the water is sent to two 2000 m^3 tanks which feed the Caujarito-La Raisa pipeline. The latter runs alongside the Cartanal-Santa Teresa-Santa Lucía highway, having 24 intakes whose diameter varies from 4" to 10". This system supplies a number of sectors, including formal urbanization areas but mainly the settlements created by illegal land occupations that have become permanent over time. Among these areas are Caujarito, El Manguito, Soapire, Dos Lagunas, Brisas de Cartanal and **Bachaquero**. (Map 6)

In Bachaquero the condition of the WSS is precarious and it is characterized by the presence of a public network of mains that was built in parts and where service does not reach all the sectors with the same frequency and pressure. The principal water main was installed by Hidrocapital. The principal network has been extended in sections with funding from the state government and many of the household connections are informal, some of them relying on flexible hoses that are exposed to the air rather than embedded pipes.
.
The networks are in a state of collapse and service has deteriorated in response to the population growth in the settlement and its environs. Sanitation is also an extremely serious problem because there are no sewers in most of the settlement and the residents use septic tanks whose useful life is coming to an end; there are even a certain number of houses with no connections of any kind.

There is a great deal of variation regarding water distribution within the settlement, in terms of the frequency of service and water pressure. Some sectors receive water six days a week, some receive it every other day, and some receive a severely rationed service every fourth day; the families living there have to store water in tanks. There are also sectors of the community that are subject to the same rationing but where the water arrives at very low pressure and must be

lifted with small electric pumps. In some sectors the families must depend on public tank trucks sent by the municipal government when regular service fails

On the other hand, Charallave belongs to the Ocumarito System and obtains its water from the Tuy III complex, fed chiefly by the Ocumarito reservoir, where the water is treated at the treatment plant of the same name. From there the water goes through the Cúa-Charallave and Ocumare. Charallave pipelines, specifically through a 20" diameter outlet to the city of Charallave, from which sub-pipelines with diameters ranging from 16" to 4" branch out. The Cúa-Charallave pipeline ends at the Alvarenga Lagoon. Charallave is also supplied by the Tuy III system through an interconnection with the outlet of Pumping Station 32 (E/B 32) and by the Tuy I system through the La Peñita pipeline[17]. (Map 9)

The water taps in Paso Real 2000 are illegally inserted into the Cúa – Charallave and Ocumare – Charallave mains. Hidrocapital does not directly participate in the network's construction and operation, but only provides advising on the formation of the technical water forums. The distribution networks are self-built by the community, starting from informal connections to the mains, one of which runs alongside the Cúa highway in the upper part, adjacent to the Dividivi sector. Originally there was only one tap, from which the entire settlement was supplied. But as the settlement's population became denser with the subdivision of plots, this source became insufficient and the residents diversified by informally tapping into to the main running along the national highway in the lower part, and by making the distribution networks by terrace and for the smaller sectors independent of each other.

Water supply is especially critical in two terraces of the settlement where a number of factors interact: landslides provoked by the dumping of sewage on slopes, which have broken the informal pipes connected to the main, the difficulty of lifting water with pressure from the taps, and the poor technical quality of the water distribution network self-built by community groups. Most of the sectors receive water according to Hidrocapital's regulation of the main to which they are illegally connected, 5 or 6 days a week for 12 hours during the day. But in the problem sectors the water arrives at very low pressure, so many houses only receive water once a week.

The sewer network – still incomplete because of the lack of certain household connections – is frequently obstructed, so sewage is constantly dumped into the streets even though there is a sewer system built for industrial use to which the municipal government added some sections in an attempt to put it into operation and allow the families to embed their household connections. The municipal government was trying to prevent the frequent landslides provoked by the dumping and leakage of sewage from the septic tanks built by the community as provisional solutions. This resulted in an emergency in the settlement, and one of the landslides broke a Hidrocapital main (running along the Ocumare – Charallave national highway), in response to which the company had to make a very large investment to restore water supply service.

It can be said in preliminary fashion that the Middle Tuy water supply system, and specifically the one serving the localities under examination, is the outcome of isolated initiatives that have been undertaken in response to specific demands. That can explain why the network is so inefficient; it is comprised of multiple branches, built one after another with no apparent concern

[17] Water supply to Charallave through the La Peñita pipeline is not the most desirable solution from either the operational or the sanitary point of view; not only does it reduce water supply to Caracas by 80 to 100 lt/sec, but the water is not of high sanitary quality because it is untreated.

for pumping constraints and in some (a few) cases even a neglect of the water's sanitary condition and of good electric power distribution and consumption performance.

3.3. Techno-infrastructural Development

In the CMR the HIDROCAPITAL company is the agency responsible for all phases of the WSS. The latter is organized into six subsystems: the Metropolitan, Coast, Panamerican, Fajardo, Ocumarito-Losada (PUI-Tuy), and Barlovento (outside the CMR) Water Supply Systems.

The principal sources on which these six water supply systems rely are the Tuy and Guárico Rivers. Water is moved through three main pipelines called Tuy I, Tuy II, and Tuy III. Among their most prominent features is that the intake sites are located at altitudes far below those of the cities they supply.

- *Tuy I La Mariposa Sector:* This sector is located 70 km from Caracas and has a 28 km length. It begins at the Lagartijo reservoir in the Middle Tuy Valleys and runs as far as the La Mariposa reservoir. It went into operation in 1957 and its current sources are two intakes on the Tuy River and the Quebrada Seca, Lagartijo, and Ocumarito reservoirs. It supplies water to the Metropolitan, Panamerican, and Ocumarito-Losada water supply systems. Its sources lie at an altitude of 132 m.a.s.l. and the water is pumped by five pumping stations; its highest point is 947 m.a.s.l. at the La Mariposa treatment plant.

- *Tuy II***:** This sector begins near Santa Teresa and ends at the La Guairita treatment plant. It is 33 km long. Inaugurated in 1968, it uses water from the Tuy River, the Lagartijo reservoir, and the Taguacita River. There are five pumping stations. The water flows to the La Guairita treatment plant. Maximum capacity stands at 8000 lt/sec.

- *Tuy III*: This system commenced operation in 1969 and uses the Guárico River as its source of production. The pipeline has a 56 km length. The source is at 260 m.a.s.l. and the water is pumped from there through the Las Ollas tunnel to the Caujarito treatment plant at 340 m.a.s.l. in the Tuy Valleys. After being purified it is pumped by two pumping stations to two lagoons (Los Morochos) in Caracas (1,080 m.a.s.l.), to be sent by gravity to the CMA distribution networks (mainly the East and West Caracas networks). It has a 12000 lt/sec capacity.

- *Tuy IV*: An interconnection was built from the Taguaza reservoir to the Taguacita pumping station in 1998. using 21 km of pipeline which carries water by gravity without the need for electric pumping. This connection is called Stage I of Tuy IV, though it is really a modification of the original plan, which called for the construction of an interconnection to the Caujarito treatment plant to allow the Taguaza reservoir to contribute water to the Tuy Valley towns as well. This Stage I supplies water only to the eastern part of the CMA.

In addition to contamination of the reservoirs, the water supply system's most important problems are:

- The network is subject to massive losses, estimated at 35% of production.
- There are problems due to deterioration of the physical facilities and operating difficulties provoked by the fluctuations in the quality of the raw water arriving at the La Mariposa and City of Caracas treatment plants.

- There are problems of synchronization and hydraulic balance at the pumping stations.
- The pipelines' 18 m^3/sec traffic capacity currently in use (the combined capacity of the TUY I, II, and III systems) is slightly lower than the demand from the areas served (18.25 m^3/sec). The upshot is little operating flexibility and inability to fill the compensating reservoirs, which interferes with preventive maintenance.

The treatment capacity of the plants that supply Caracas (17.2 – 19.4 m^3/sec) is lower than the demand for production from the areas served, or just barely equals that demand (19.2 – 19.3 m^3/sec). In view of the volume of water loss in the treatment process, it becomes clear that treatment capacity is insufficient and there is a lack of flexibility.

The situation as regards disposal of wastewater is as follows. The system should be comprised of three components: the collection networks, the treatment plants, and the final disposal of the treated water. All three components are either deficient or nonexistent in the Caracas Metropolitan Region. The sewer networks and stormwater drains dump their contents into water courses and there are no treatment plants. In the great majority of the areas characterized by unregulated development, not one of the necessary components is present. In addition to the obvious health and environmental sanitation problems that this situation poses, there is a high frequency of landslides, many of which cause loss of life because of the collapse of unstable slopes. The average rate of coverage is 60%, but only for collection. Treatment is by oxidation lagoons and extended aeration in the urban population centres, and stabilization lagoons, septic-filters, septic-absorption fields, and filter lagoons in some rural population centres. As a general rule, most untreated effluents contaminate the coastline, in view the major population centres' proximity to the sea or because wastewater is directly dumped into rivers that flow into the sea.

3.4. Economic and Financial Aspects

Venezuela has one of the highest ANC (unaccounted-for water) rates in Latin America; approximately 50% of the water produced is not charged for (Franciso 2002). Estimates indicate that 55% of the population has water meters but only 33% of them are in proper working order. In addition, the real estate census is out of date and more than 20% of users are not registered. To the low rates of measurement of service rendered must also be added the low propensity to pay and the meagre legal support for penalizing fraud.

Service and infrastructure cannot be funded with the system's own resources, because billings cover only 40% of cost. In view of the pumping needs posed by the altitude differences, the WSS's largest cost component is electric power. It receives a direct subsidy from the national government equivalent to 40% of the power cost, amounting to approximately US$ 53 million in 2002 (Farías 2002). *"Service tariffs have lagged and in some cases do not even cover the cost of operation and maintenance, much less can they finance replacement of assets or, naturally, new investments. All this has made it difficult for the operating companies to generate funding of their own, which is essential to maintain the existing infrastructure in good condition"* (González 2000, 83).

The service's dollar value at average water price has gone down as a result of the bolivar's devaluation, and has never exceeded 0.38 $/$m^3$ at any time in the last 10 years.

Table 12
Changes in Average Price of Water
1993-1999

Year	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
Bs./m3	13.4	19.7	34.8	71.8	140.0	192.0	232.0
$/m3	0.147	0.132	0.197	0.164	0.174	0.350	0.370

Bs.= Bolívar (Venezuelan current)
Source: González 2000, HIDROVEN .

Since a great many users are not listed in the Cadastral Survey, there is no accurate measurement. And the users who are so listed are billed for estimated values; very few are billed for their real consumption.

The tariffs are designed to barely cover operating and maintenance expenses, but the percentage of collection is also very low.

The tariff structure was as shown below as of January 2003:

Table 13
Current Tariff Structure

	Social tariff *	Tariff 4	Tariff 5	Tariff 6
Bs. / m^3	224	384	401	583
$ / m^3	0.140	0.240	0.251	0.364

*The social (subsidized) tariff is applicable throughout the region, for the lower-income consumers.
Tariff 4 is applicable to the Barlovento (residential) and **Losada – Ocumarito** systems.
Tariff 5 is applicable to the Coast and Fajardo systems.
Tariff 6 is applicable to the Panamerican, Metropolitan, and Barlovento (tourist) systems.
Source: Own calculations based on data from Hidrocapital 2003.

In the immediate future "tariffs will have two brackets, one based on sanitary consumption and the other penalizing excess consumption or waste" (Franciso 2002, 19). As regards subsidies, there is an indirect cross-cutting subsidy whereby some sectors (commercial, industrial, and high-income residential) normally subsidize lower-income residential consumption.

The new WSS law provides for a Sectoral Financing System *"which will embrace different forms of financing in terms of conditions and time spans, reflecting the characteristics of the investments to be funded, including the possibility of transferring non-reimbursable funds. Financing under the best conditions will be reserves to fund, on the one hand, expansion of pure drinking water coverage and purification for the rural areas and the unregulated development zones, and on the other, treatment and disposal of wastewater"* (Báez 2002, 33). The financing scenarios for the year 2005 reflect a nationwide financing need on the order of US$ 300 million to provide pure drinking water to urban population centres and approximately US$ 10 million to do the same for rural areas. As part of the policy of improving short-term water company finance, among the planned investments is the purchase of 100,000 water meters with Eximbank financing.

The impacts on employment will stem from the transfer of service provided for in the LOPSAPS law, with will affect the current structure of regional water supply companies by moving the service to the municipal jurisdiction. However, most current employees are expected to continue working in the new structure. The investment plan will create indirect jobs in construction and some related manufacturing industries.

As far as the consumers are concerned, the improvement in billing and in the company's cost-benefit ratio will directly increase the cost of water, but should also induce a rationalization of water use that will offset the higher cost.

3.5. Policy-institutional Environment

3.5.1. Legal and regulatory environment

A modernization of the water supply and sanitation system was launched in the late 1980s, coinciding with the application of the economic adjustment program and opening of the economy to the outside world, as well as with the reform of the Venezuelan state. This process begun in 1990 was intended to adapt the sector to the new political climate of regional and local decentralization and restructuring of the state water supply company by introducing market dynamics and business criteria into the operation of the only water supply enterprise operating in the country at the time, the Instituto Nacional de Obras Sanitarias (INOS). In connection with the Public Enterprise Restructuring Loan (PERL) taken out by Venezuela in 1990 and financed by the IDB, the World Bank, and the Eximbank, the country committed itself to restructuring and privatising a set of public sector enterprises including the one responsible for providing pure drinking water and sewage disposal (Corrales, 1997).

INOS, created in 1943, had played an important role in Venezuela's modernization, having built the great water production, transport, treatment, and distribution systems in the country's major cities, keeping pace with the rapid urbanization Venezuela experienced in those decades. Moreover, the nationwide extension of pure drinking waster and wastewater disposal networks made a key contribution to overcoming the health crisis that had plagued the country in the early part of the 20th Century; "between 1958 and 1968 Venezuela achieved First-World levels of excellence in provision of drinking water" (Hitcher 2002, 8). But the centralized operation of water supply services and the accumulation of functions (construction, operation, maintenance, and marketing) ultimately led to the company's breakdown, taking the form of recurrent deficits and low levels of efficiency in service rendering, in the framework of a severe fiscal crisis that favoured disinvestment in the sector and deteriorating service quality.

To overcome that crisis, a new water supply management model was adopted in 1990, with centralized and regionalized facets, on a transitory basis. C.A. Hidrológica de Venezuela (HIDROVEN) was created as the parent or holding company, with 10 regional water companies operating under its framework, responsible for providing service prior to its gradual transfer to the local and state governments pursuant to the Constitution of 1961 and two laws enacted in 1989: the Organic Municipal Government Act and the Organic Decentralization and Transfer of Government Authority Act.

The new system called for local operating companies to be incorporated with community and private sector participation, while the parent company would retain the regulation, planning, and technical-financial assistance functions. The restructuring process had advanced as far as the complete liquidation of INOS and settlement of all its financial obligations by 1999, but the transfer to the state and local governments had gotten stuck. Except for the incorporation of seven state and two municipal water companies involving private operators' participation, there were no major advances in the decentralization of water service to the local government levels, nor in the degree of coverage of water service, the statistics for which were extremely

unsatisfactory: "at least 4.9 million inhabitants of the country have no access to pure drinking water and 9 million have no formal system for disposal of wastewater" (HIDROVEN 1998: 8). The private sector's effective participation took the form of concessions to third parties, the only legal option available under the Organic Municipal Government Act; hence, there was no privatisation in the strict sense of the term.

A new arrangement was created in 1999. The national political agreement to draft a new Constitution, which was approved by referendum that year, brought about a major change in the rules of the game that had prevailed since 1961. In the framework of the new institutional structure and the guiding principles of participatory democracy enshrined in the recently adopted Constitution, an Organic Pure Drinking Water and Sanitation Service Act (LOPSAPS) was enacted for the first time in December 2001.

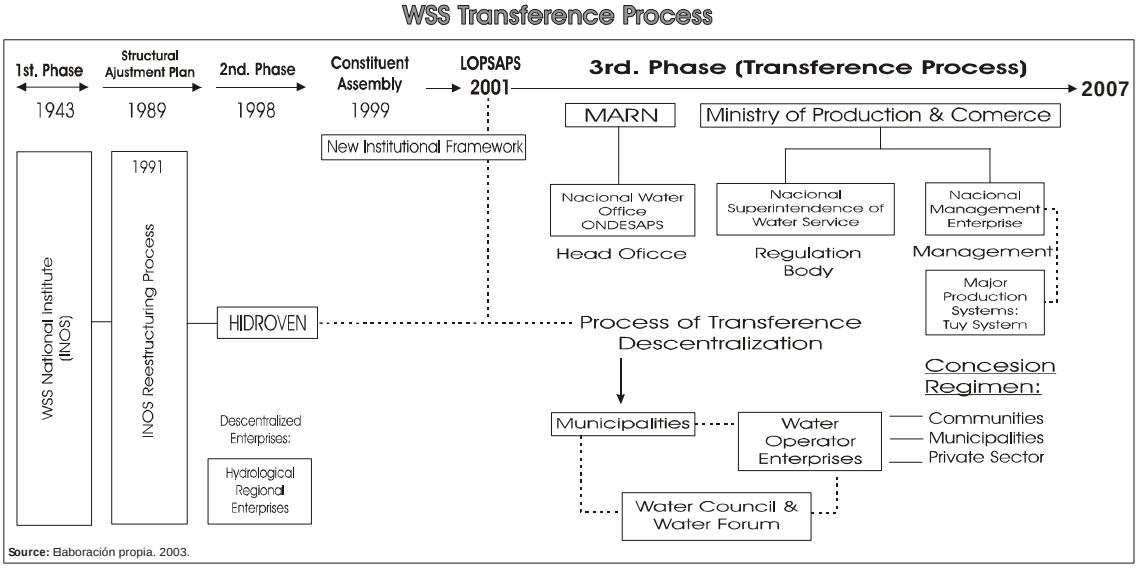
The new institutional model implied a basic change in how water service was envisioned and provided. The Constitution contains an intensely debated and highly controversial principle, that of ownership of the natural resource. "All waters are **goods in the public domain** belonging to the Nation and indispensable for life and development. The law shall prescribe the provisions required to ensure its protection, utilization, and recovery, with respect for the phases of the hydrological cycle and the legal criteria for land use regulation" (Article 304 of the Constitution of the Bolivarian Republic of Venezuela).

Under the new arrangement set up in the Organic Drinking Water and Sanitation Service Act (LOPSAS) of 2001 and published in Official Gazette Nº 5568, the new management scheme calls for the creation of the following units:

- **The National Office for the Development of Drinking Water and Sanitation Services.** An agency of the Ministry of the Environment and Natural Resources (MARN), it is responsible for designing and approving the sectoral policies and the rules governing subsidies for water and sewer services, defining the sources of funding for the expansion and maintenance of the water supply and other water installations' coverage (Article 13, LOPSAS).
- **The National Superintendency of Drinking Water and Sanitation Services.** An agency of the Ministry of Production and Commerce (MPC), it is the highest-level regulatory and supervisory agency for the sector. Among its powers are those of resolving disputes among the Municipalities, the water supply companies, and the customers or users; adopting the general regulations governing provision of the services; supervising and controlling the quality of the water supplied; and designing the general models for the service provision contracts. It may impose monetary penalties on both subscribers and service companies, and may likewise decree their official takeover for inefficient or unprofitable management, as well as rescind their contracts.
- **The National Management Company**. The Company, reporting to the Ministry of Production and Planning (MPC), shall be responsible for "producing and selling untreated or treated water en bloc and treating waste waters in the systems determined by the National Office for the Development of the Water Supply and Sanitation Services as a responsibility of the National Executive Branch (Art. 60, LOPSAS). For strategic and security reasons, the Tuy Production System, which covers a large part of the Caracas Metropolitan Region and where the area on which this study focuses is located, is under the responsibility of the

regional water supply company, HIDROCAPITAL. HIDROCAPITAL[18] is currently working on the process of transferring the service and transforming itself into the operating company for the 23 municipalities of the Capital District, Vargas State, and Miranda State.

This institutional scheme is to be completed by transfer of water service to the municipalities, a process scheduled to conclude in 2007. To ensure sustainability and economic solvency in the local provision of service, HIDROVEN (the enterprise responsible for the transfer process) is charged with designing the Operating Units, which bring together the production, distribution, collection, and disposal processes that can be technically or economically handled in any of the following ways: directly by a municipality or metropolitan district, by associations of municipalities, or by public, private, or mixed enterprises. In line with the Organic Municipal Government Act, water service can only be given under concession for a limited time period.



3.5.2. Institutional Map

The institutional map reflects the fact that the WSS is in a transitional phase toward decentralisation of the service to the municipalities, and stresses the pre-eminence of Hidrocapital and the public sector in all phases of the CMR water service provision. In addition, it makes it possible to understand and judge the new management scheme based on growing community participation, especially through the "Water Forums"[19] and other forms of community organisation, as well as the possibilities for official take-over of private companies involved in the process.

Under the current transitional scheme, environmental management in general and that of water in particular is concentrated in the Ministry of the Environment and Natural Resources (MARN) HIDROVEN and HIDROCAPITAL. Consistent with the world-wide debate on the environment

[18] Hidrocapital, a subsidiary of HIDROVEN (the holding of the regional hydrological companies) , was incorporated in 1991. Its main purpose is the administration, operation, maintenance, expansion, and reconstruction of the drinking water distribution systems and the sewage collection, treatment, and distribution systems in the CMR.
[19] Water Forums (Mesas Técnicas del Agua) is a kind of grass-roots community organization (CBO) intended to solve problems related to the WSS in the communities covered by the LOPSAS. For more details see 3.6.1.

that has become prominent since the 1970s, Venezuela was the Latin American country that went furthest in the creation of an environmental management organ, through this Ministry. From the outset, the organisational model around the Ministry concentrated the Venezuelan State's environmental policy –and especially, its water policy- in this agency.

The MARN is not only the national water authority, it is also responsible for building, operating, and maintaining the water supply and sewer services and the treatment of effluents through its decentralised entities. It also has the policies regarding flora and fauna, conservation of basins, and administration of the 43 national parks and 45 natural monuments comprising the Venezuelan National Parks System under its purview. From the environmental point of view this Ministry is a powerful tool for management of the environment, but it is also a "macroministry" which needs large amounts of funding and a professional bureaucracy characterised by a strong service orientation and high-level management capabilities.

However, the attribution to the Ministry of functions relating to pollution control (the brown agenda), i.e., control of air, water, and soil pollution, authorisation for the establishment of activities capable of degrading the environment, control over hunting and fishing, etc., environmental research, information, and education, in addition to the blue agenda (water), imply an enormous profusion of powers and functions that it cannot fully handle. Its ability to act is overwhelmed by the large number of powers, meagre budget, and weak institutional structure.

The LOPSAS introduces a new management model whose three components (National Water Office, Superintendence, and Company) are under the shared responsibility of the MARN, which is responsible for sectorial policy, and the Ministry of Production and Commerce, responsible for regulating and controlling the service through the Municipalities and Operating Companies. The aim is a balance redressing the former excessive concentration and fostering competition for provision of water.

. Phases Of The Metropolitan Water Cycle. Institutional Actors (Annex: Matrix)

- Extraction

Given the need to invest large amounts of funds, the Extraction phase of the Metropolitan Water Cycle is financially centralised in the MARN, HIDROVEN, and HIDROCAPITAL. The projects and constructions to make use of water resources must be carried out by the Ministry of Infrastructure (MINFRA). Depending on their specific nature and cost, major hydraulic projects are funded by the Venezuelan State, without private participation. Large-scale hydraulic construction projects, in the absence of a Venezuelan counterpart, have been entrusted to transnational corporations, which carry them out, often with multilateral funding (CAD, IDB). The local and state governments through local revenue transfer arrangements or the *Situado* for each state, participate with HIDROCAPITAL in investing for basic infrastructure (local water supply systems, construction of adduction facilities, pumping stations, etc.) in their localities.

HIDROCAPITAL is responsible for extraction of water from the Tuy River, doing so at points located within the PUI-Tuy. Some labour cooperatives[20] created in the framework of the company's restructuring (outsourcing) participate, and other indirect participants include

[20] Cooperatives are fostered by multiple spheres of the government to strengthen a social economy within the economy as a whole

industries and agricultural producers that pollute the river upstream, provoking difficulties and costs in the adduction and subsequent treatment of the water.

- Treatment and Storage

Treatment and storage of water falls under the purview of the MARN, HIDROVEN, and the Ministry of Health and Social Development (MSDS). The legal rules governing the provision of water supply service and the collection, treatment, and disposal of sewage, as well as those governing classification of water and the physical-chemical parameters of water discharged into bodies of water and sewage, are adopted by the MARN. The MSDS is responsible for the drinking water quality health standards. HIDROVEN participates in the design and implementation of national and regional reclamation and sanitation policies, and in the control and vigilance functions. Major water storage facilities whose cost or specific nature goes beyond the State's capacity are funded by transnational corporations that obtain financing from banks and foreign institutions. Water storage works involving smaller cost, such as ponds, are co-also funded by the municipal and state governments.

In the Metropolitan Region, HIDROCAPITAL is responsible for maintenance and operation of the Metropolitan System, which includes the Losada-Ocumarito system in which Independencia and Cristóbal Rojas Municipalities are located. Purification of drinking water is HIDROCAPITAL's function.

- Distribution

Public institutions, private companies, and the communities interact in this phase.

At the present time the state and municipal governments fund, build, and maintain the service distribution networks, in conjunction with HIDROCAPITAL. The absence of urban planning and the proliferation of irregular settlements has led the communities themselves –in an anarchical form at first and then in organised fashion through the CBOs, Neighbourhood Associations[21] and Water Forums (Mesas Técnicas de Agua) - to build water precarious supply facilities which are often nothing more than illegal "connections" to water taps from the main network. Thereafter, the state and municipal governments and Hidrocapital must invest in the repair and refurbishment of this precarious and insufficient infrastructure. At time, Water Forums organised as cooperatives provide water service in peri urban neighbourhoods, with municipal or state assistance.

As regards this phase it is important to stress the possibilities for private sector participation in provision of water services, as envisaged in the new regulatory framework. Private participation is limited by the "public good" definition of all water under Art. 304 of the Constitution. The "privatisation" concept is therefore not applicable; instead there is room for arrangements under which a private company can participate, especially that of Concession contemplated in the Organic Municipal Government Act (1989) and the LOPSAS. This arrangement allows the Municipalities, Metropolitan Districts, or Communities of Municipalities to assign a private or public enterprise, through public competitive bidding:

> "the obligation to build, operate, and maintain a project, including performance of the activities required for its adequate operation, at its own cost and risk, and under the

[21] There are few CBOs and Neighbourhood Associations in both localities. See 2.4. Chosen localities.

> supervision and control of the proper authority, in exchange for the right to exploit the project and receive the proceeds of the rate for service during a prescribed time span, long enough to recover the investment and operating costs it has incurred and reap a reasonable return on its investment" (Art. 58, LOPSAS).

Stages of service provision can also be assigned under mixed concessions involving both public and private entities. All aspects of the Concessions Regime are subject to the "Organic Decree with the Rank and Force of Law on Promotion of Private Investment Under the Concession Regime," approved in October 1999, which lays down the rules, legal protections, and incentives for promotion of private investment in the operation of public services.

The available contracting schemes under the Concession Regime pursuant to the Decree include:

a) Execution of complete projects whose design, funding, and construction are borne by the concession holder in exchange for its participation in the capital or earnings of the company incorporated to operate or manage the public work or service in question;
b) Exploitation, administration, repair, conservation, or maintenance of existing works, to raise the funds needed for the construction of new ones having a physical, technical or other kind of link to the former;
c) Complete execution of infrastructure works, with the contractor's remuneration stemming from exploitation under the concession regime of a work or service other than the one executed;
d) Any others which, in accordance with their nature, characteristics, and operating or management system, can be executed under the Concession regime.

The State and Municipal governments are responsible for organising the competitive bidding procedures and awarding the contracts, as well as for supervision, vigilance, and control over their execution. The law provides a number of tax incentives and legal protections to be shared with the concession holder.

In the current process of transfer of powers for the provision of service to the Municipalities, HIDROCAPITAL has made use of private sector participation, especially for the maintenance and operation o the water distribution network, through the Tertialisation model whereby HIDROCAPITAL enters into Service Contracts with private companies. Under this arrangement, HIDROCAPITAL contracts with companies and pays the payroll for the personnel the company needs to perform the service. This arrangement has been used increasingly since the liquidation of HIDROCAPITAL's predecessor agency, INOS. These contracts, generally short-term and for the performance of activities such as reading water meters, invoicing and collections, and operation and maintenance of the facilities, make it possible to retain multiple companies whose skills, abilities, and experience in the field are deemed desirable.

Fleets of water tank trucks, generally owned by the municipal governments, do water distribution in uncontrolled or irregular settlements. They fill public tanks operated by HIDROCAPITAL, from which the water is then distributed to the lower-income neighbourhoods. Individual truck owners also sell water to commercial establishments at times of strict rationing.

Secondary actors also participate in the provision of funding for this stage. Strikingly, in the framework of rapid change in the PUI-Tuy, a Trust has been set up among HIDROCAPITAL, the Miranda State government, and the agencies responsible for housing policy (CONAVI, the National Housing Council; INAVI, the National Housing Institute; and FONDUR, the Urban

Development Fund) for the execution of construction works for water supply and sanitation services to the large residential neighbourhoods that have recently sprung up in the Tuy Valleys. The Trust amounts to US$ 200 million. There is also US$ 7 million of financing from the CAF (Andean Development Corporation for major infrastructure works.

- Consumption

HIDROCAPITAL regulates water consumption in the Caracas Metropolitan Region. At present, following a long period of drought provoked by the "El Niño" weather phenomenon, the reservoirs that supply water to Caracas are at their lowest level of the last 15 years. The water-rationing plan adopted by the water supply company (consisting of scheduled suspensions of service to different areas of the city for up to two days a week) and the educational campaigns on rational use of water represent an attempt to reduce waste of the resource. .Average daily consumption is estimated at 450 litres, while world consumption is under 200 litres, per person. The water rate system under debate contemplates the future application of two kinds of rates: one based on a standard consumption level (250 litres per person per day) and another designed to penalise consumption beyond that parameter.

The "Water Forums" participate in the regulation of water consumption. The channels for consultation between the water supply company and the consumers include instruments for evaluation and regulation of consumption by both parties, and especially in the irregular settlements.

At the present time the State gives HIDROCAPITAL a subsidy for 40% of the electric power it consumes. But in the future, following conclusion of the transitional stage during which management of the service is being transferred to the municipal governments; the regional companies will have to live entirely on their collections.

The LOPSAPS also provides for a set of subsidies for families unable to pay the entire cost of their water supply service (a social residential rate). Subsidies are legally contemplated for demand and supply, as well as cross-cutting subsidies (Art. 96). These policies, currently formulated by HIDROVEN, will come under the authority of the National Office for the Development of Water Supply and Sanitation Services in the future.

HIDROCAPITAL and private operating companies, staffed in large measure by former white and blue-collar employees of HIDROCAPITAL’s predecessor, the National Institute of Sanitary Constructions (INOS), do billing in the Caracas Metropolitan Region.

- Disposal

Regulation of water disposal is centralised in the Ministry of the Environment and Natural Resources, which adopts the technical and environmental parameters. HIDROCAPITAL makes major investments in water collection infrastructure, achieving 80% coverage in the Metropolitan Region. It will subsequently invest in wastewater treatment infrastructure, which currently accounts for only 10% of the water collected. Municipal and State governments also participate in the construction, maintenance, and operation of the waste water disposal infrastructure.

In the uncontrolled or irregular urban settlements, CBOs and private users participate to a lesser extent and with very low impact in the collection of waste water, by building precarious networks carrying sewage to streams or natural water courses flowing alongside the neighbourhoods.

Disposal of waste water includes that of residual water of industrial origin, which is discharged into the sewer collectors, secondary water courses, or directly into the Tuy River.

. Stakeholders and Actors

The principal stakeholders in the process of change currently under way regarding water service are the users. They must be differentiated as primary actors because the position they hold in the process, as beneficiaries or injured parties, differ.

The poor population, which has always suffered from a shortage of water, views the new institutional structure –and especially the new community management arrangements- as an opportunity to improve service, not only in terms of frequency of delivery but also in official recognition of them as legal customers. Among these poor sectors, the new inhabitants of the PUI-Tuy, illegal occupants of urban lands for the most part, also have an opportunity to accede to the service. In addition, as these groups organise they generate practices that become consolidated and give rise to a new water culture, involving rights and obligations that result in forms of social inclusion and citizenship building.

The non-poor sectors of the population also benefit from the regularity of service, even though they have less of an interest because they have the means to overcome their water shortage, using storage facilities or through direct purchase.

The builders and new residents of the new formal residential neighbourhoods are likewise interested in the process, since they benefit from the improvement of service. The former obtain legal permits for delivery of housing units to their purchasers, and the latter can count on receiving water on a regular basis.

In the public sector, both the water supply company and the local and state governments benefit, first from the reduction of open conflict that had characterised their relationship with the population and second from the reduction of the costs of providing water by tank truck. HIDROCAPITAL in particular benefits by coming into a position to enhance productivity of service and collections.

Among the secondary actors in this process are:

Those who act at the consumer level, such as CBOs and the water forums that participate in the organisation of the process.

Those who engage in construction, maintenance, etc. of the different phases of the water cycle, such as the labour cooperatives (related to HIDROCAPITAL) and the construction firms.

Those who contribute financing for the construction of WSS projects, including national institutions (the National Government, the Tuy Valleys Trust), and international or multilateral agencies (CAF, IDB).

The universities (UCV) and other interested organisations (ASOTuy), which are doing studies on the area and submitting proposals to the decision makers.

Among the groups adversely affected in an indirect fashion are the companies operating water tank trucks and the people who make illegal taps that interfere with the system's operation.

There is no question that all these actors and especially the industries and pig farmers that pollute the basin, cannot be viewed as stakeholders. They have no interest in, nor do they believe they will benefit from an improvement of the service, on the contrary, they contribute to its deterioration. In the short term there is a need for a policy that involves them as interested actors, because that will improve the WSS's performance, reduce pollution of the water courses and improve the population's quality of life.

Finally, it can be asserted that the key actors in the process are HIDROCAPITAL, the CBO, the Water Forums, and the financial institutions. But the first of these undoubtedly is the party that determines a large part of the current processes and has the changes now being implemented for the future in its hands.

3.6. Socio-political Aspects

3.6.1. Community participation in WSS

According to certain studies (González 2000), there were few cases of citizen participation in water service. Some of these were related to irrigation water. One of the most innovative, and perhaps even unprecedented, experiences of community participation was institutionalised in the framework of the institutional and social change set in motion under the Constitution of 1999 and the new Water Act: the " Water Forums" (Mesas Técnicas del Agua).

These forums for public-private sector articulation had been promoted by the HIDROCAPITAL regional water company in the CMR and had been developing as a model for a style of service provision that harmoniously articulated communities' knowledge of their water supply systems, networks, needs, etc. with the information and technical qualifications of the water company's workers, mid-level technicians, and professionals to improve the quality of service. This is, in a sense, a legal and social acknowledgement of a new experience in the successful participatory management of a public service in Venezuela, but in addition, it is an effective way to build citizenship among the lower-income population.

"These organisations have emerged with encouragement from Hidrocapital's Community Management office, with the aim of articulating public action with the communities. The core idea underlying the proposal is that "the solution is built with the people," meaning that public policy is a process in which the institution and the communities interact to generate responses to water problems that are jointly identified and defined. It requires co-responsibility by the community as an organised participant whose effort is a key component of the solution to problems that have gone unsolved by the government authorities at the different levels for years. 'You are part of the solution' is more than a mere slogan, it is a shared principle emerging from all the water table experiences carried out in the different communities of the CMR and the rest of the country during the years in which the program has existed." (Cariola 2003, 1).

The main problem encountered at the outset is community distrust of the public institutions, reflecting successive frustrations in previous failed attempts to solve problems. Another is lack of confidence in the communities' own ability to participate.

Hidrocapital and the communities jointly define the project to be carried out. The community's role is indispensable at every stage of the process. The projects engendered differ greatly in technical difficulty, cost, and complexity. They cover the entire gamut from small-scale water

distribution systems to large-scale systems complete with pumping stations, rural water supply systems, wastewater collectors, and others. One problem is funding, which sometimes requires the participation of different institutions.

The communities' most important accomplishment, even when the water tables have been implemented in middle-income residential areas, is *"obtaining the service while building citizenship"* (Cariola 2003, 3). The institutional change brought about a change in the approach to community work under a citizen development perspective. Solving the water problem has provided a way to strengthen community organisation and lay the basis for the solution of other problems; fundamentally, it has allowed the participants in these experiences to develop citizen values such as tolerance, tenacity, and attachment to their neighbourhoods. *"The program's political identification was expressed as a problem that had been addressed and overcome in most cases: 'water has no political identity,' said one of the participants. Following the organisational proposal there is a conception of search for unity within the community, on the basis of a common interest: water"* (Cariola 2003, 3).

3.6.2. Socio-economic and cultural values attached to water

Research done on the value that population attributes to water indicates that it is perceived as a service the state is obligated to provide; the mercantile nature of the service is not acknowledged by the population, which ignores the economic value involved in its provision. This results in high levels of consumption, a low propensity to pay, and an absence of incentives for rational consumption (tariffs, subsidies, standards, and penalties), all of which reinforces the absence of a resource conservation culture (Corrales 1997).

However, the water shortage and rationing that has been chronic since 1990-1991 as a result of natural factors and sustained disinvestment in the sector because of the country's economic crisis has helped both the hydrological authorities and the general community to internalise the value of water as a resource and to understand the implications of its waste. Excellent educational campaigns and programs are reaching more and more people as time goes on, engendering a culture among users who value the resource more and more highly.

The new framework for service provision, which relies on the municipality-operating company association to ensure good service while earning profits, poses an opportunity to make progress toward the necessary cultural change. The anticipated improvement of metering, billing, and collection systems implies that both users and companies will soon be forced to rationalise costs and consumption of water, in order to improve water storage capacity to cope with natural contingencies in the future, among other things.

Incorporation of the communities in social control over the service, now under legal mandate, will help in the institutionalisation of this process. Communities' experience of participation in the provision and regulation of waster service, through the Technical Water Tables, has become a driver of civic awareness regarding water, and it is to be hoped that it will continue fostering effective (and efficient) behaviours by companies and citizens in connection with the value attributed to the resource.

3.6.3. Social and political conflicts around WSS

Until the transfer of authority is completed, the regulation and dispute resolution functions will continue to be performed by HIDROVEN, the parent company. But the supervisor and judge of

service under the new model is the National Superintendence of Pure Drinking Waster and Sanitation. Article 26 of the LOPSAPS gives it the following powers:

- “Settle the disputes that may arise regarding tariff setting between the municipal governments and the service providers.
  Settle, at the parties' request, disputes between service providers and municipal authorities in relation to non-fulfilment of the basic conditions for service provision, substantiating the penalisation procedures if necessary.
- Act as a forum for resolution of disputes between service providers and subscribers in connection with fulfilment of the basic conditions for service provision, substantiating the penalisation procedures if necessary.
- Declare temporary or permanent intervention of service providers in conformity with this Act and its Regulations."

This cultural change undertaken by Hidrocapital in the CMR was a key step toward resolution of conflicts over water, especially in the lower-income communities. Frequent breakdowns of service were settled by activating growing protest mechanisms that ranged from blocking roads and highways to violent occupation of water company facilities. A reactive management model which sought only to keep problems under control was replaced by a mechanism –now a formal one- of public action: the Water Forums. Through that mechanism, HIDROCAPITAL and the communities articulate responses to solve service problems and anticipate new demands and solutions. The success of this experience, without precedent in the country, has turned these water tables into forums for negotiation and resolution of disputes, not only on provision of water service (construction, maintenance of facilities, management of the service) but also regarding other problems involving community life. The incorporation of this experience into the LOPSAPS is an acknowledgement of these forms of shared and democratic negotiation.

CONCLUSION

Caracas is a city immersed in the globalization process, characterised by an intense socio-territorial heterogeneity that expresses itself not only in the primary city but also throughout the metropolitan region. The processes of economic restructuring and restructuring of the State that took place in the 1990s adapted the country's internal institutional arrangements to the patterns of globalisation, but had a negative impact on the majority of the population. While poverty intensified, expanded, and became more heterogeneous, some segments of the population engaged in activities related to the global economy and its coexistence with the economy of poverty became more and more evident. The city's socio-territorial fragmentation intensified. The rise of a business district in the new heart of Caracas was accompanied by an expansion of informal settlements and the expulsion of downward-mobile middle segments to the city's periphery due to their inability to afford housing in Caracas.

The metropolitan expansion of Caracas has overflowed the boundaries of its Metropolitan Area (CMA) and given rise to the Caracas Metropolitan Region. Four large peripheral sub regions comprise the peri urban interface, one of which –the Middle Tuy Valleys (PUI-Tuy) has been chosen as the focus of this study. It is defined in terms of the far-reaching processes of change that are occurring in the socio-economic sphere, and to a lesser extent, in the physical-natural sphere because this is an area with strong and old processes of human intervention. A large portion of these changes are associated with the expectations created by the major transportation infrastructure projects, private and public housing construction, and an abundant

supply of land capable of being urbanised. This supply of housing for the vulnerable and downward-mobile middle sectors has permitted their displacement from the primary city, which has helped change the socio-economic profile and ways of living, making the PUI-Tuy more socially heterogeneous. However, it is necessary to bear in mind that these expectations have also attracted poor groups, who illegally occupy land and build informal settlements that make the socio-economic and socio-environmental character of the PUI-Tuy all the more complex.

The labour market conditions in the PUI-Tuy are precarious; high levels of informal occupation and unemployment prevail there. De-industrialisation has not been offset by the growth of services and Caracas continues to be the principal source of employment. Though some services are being renewed by the demand from the new middle sectors settling in the area, precariousness has intensified with the arrival of new poor inhabitants who join the informal economy or remain unemployed. This labour market situation is reflected in the fact that more than half the population of the PUI-Tuy can be classified as poor, their incomes falling below the poverty line, and to them must be added vulnerable middle-income groups representing about 20% of the population. Though it can be asserted that social heterogeneity has a positive effect, helping attenuate social inequalities and socio-territorial fragmentation in the PUI, it should be borne in mind that this highly complex process on the one hand reproduces the primary city's pattern of fragmentation, but on the other is characterised by higher levels of segregation and social exclusion.

The PUI-Tuy serves as a recipient of waste materials and the location of the sources of water supply for the primary city. It coincides with the sub-basin of the Tuy River where the adductions for the metropolitan water supply system are located, as well as some of the treatment plants, and a subsystem of the metropolitan water supply system (Losada-Ocumarito) which supplies the towns and cities in the sub-basin. However, since this is the principal water-producing area for the CMR, the population of the PUI-Tuy suffers a structural deficit of water supply, which is only worsened by the rapid growth of population in formal and informal settlements, and to a lesser extent, improved by the new forms of institutional and community organisation.

In the new scheme of water management, community-company interaction through the Water Forums avoids open conflict and tends to rationalise distribution and consumption. But there is a concrete fact that affects the entire process and situations relating to water supply: water is a scarce resource. And it should be borne in mind that the shortage provoked by natural phenomena has depressed the water level in the major reservoirs to its lowest level in the last 15 years (a critical level of extraction). In response, HIDROCAPITAL designed a planned water rationing policy that results in supply cut-offs for different sectors of the city two or three times a week. This policy was accompanied by an informational campaign in the mass media to keep the population informed and allow people to take the necessary precautions for the days on which there is no water supply.

To this situation of scarcity are added other limitations in the PUI-Tuy, having to do with the Losada-Ocumarito system; these range from technical problems stemming from improvised solutions to open conflicts with the communities that complain about inadequate service to the provision of raw untreated water to different parts of the area. In addition, the competition for water between the PUI-Tuy and Caracas is very strong, and on some occasions supply to the cities of the periphery is cut off in order to keep the primary city supplied. The shortage and poor quality of water are objective problems, but the poor population *does not perceive water supply as a problem* if there is a certain frequency in the supply. This view is, on one hand, associated with the accumulation of shortcomings to which that population is subjected and on other hand is

due to the new policy of regular and scheduled rationing for days and hours being pursued by HIDROCAPITAL, in some cases associated with the work of the Water Forum which allows these groups to organise daily life around the changes in the supply of water.

One especially serious problem in the PUI-Tuy is that of sewage from both residential and industrial sources. The Tuy River suffers a heavy deterioration of water quality near the HIDROCAPITAL adductions due to the dumping of wastewater by industrial plants and pig farms located in the upper basin. This provokes problems at the uptake points and in treatment, as well as higher costs for the company. There are no sewage treatment plants in the PUI-Tuy; sewage is dumped directly into the watercourses in the cities, or directly disposed of in the Tuy River, with negative consequences for the environment.

The administration of the water service in the PUI-Tuy takes place in the framework of the WSS national policy, which reflects the new institutional structure introduced by the Constitution of 1999, and especially the new Waters Act (LOPSAPS), enacted in December 2001. All the processes should be understood in the framework of the socio-political and institutional changes and conflicts now under way, which imply a retreat for the "neoliberal" free-market position and for privatisation as a prevailing paradigm However, this should not be understood to imply an exclusion of the private sector; rather, it means the introduction of new forms of regulation of its participation in activities defined by the State as strategic, among them water.

The public sector's participation through HIDROVEN at the national level and HIDROCAPITAL in the CMR is of key importance in view of the water supply company's pre-eminence in all phases of the water cycle. The new water regime does not permit private sector participation in the phases of water extraction and production, since water is defined as in the public domain and these activities are reserved to the State through the National Management Company, which operates the major water production systems (the Tuy System among others). This company, like the National Superintendence of Water Service, which has regulatory powers, reports to the Ministry of Production and Commerce, while the WSS is regulated by the National Water Office, which in turn reports to the Ministry of the Environment and Natural Resources.

In addition to these functions assigned to the State, the new laws and rules governing the WSS provide for the decentralisation and transfer of water supply service to the municipalities. They, individually or in association among themselves, can operate the system directly or assign it to communities or private companies under concession arrangements. Accordingly, the communities' participation can occur in this phase both in organisation –through the Water Forum mechanism- and in the phase of operation of the service under concession. The private sector can also operate in this phase, through companies or in partnership with the municipalities and/or communities.

HIDROCAPITAL has created a community management office that has expedited and implemented Water Forums throughout the CMR. More than 200 of them have been organised in the PUI-Tuy, though no exact number is available because some have dissolved while others are created all the time. They have contributed to an improvement of water service, even if not all continue to operate. In the chosen localities: Bachaquero and Paso Real 2000 did not succeed. In the first stage there were some initial meetings but the community did not continue participating. In a second stage that experience helped the people to realize about need to organize themselves in the search for a permanent solution.Finally, it can be asserted that governance of water provision in the chosen localities combines formal and informal practices.

To conclude, we believe that governance of the water provision and sanitation system rests on the following elements:

1. Accountability: management of the service by Hidrocapital reflects the mechanisms for evaluation and management of service laid down by the agency responsible for the system's operation, HIDROVEN, as well as those adopted by the communities themselves.
2. The decision making process at the water supply company must be transparent and be supported by a clear and precise informational strategy relying on continuous communication with the communities, in order to share the company's technical know-how with the communities' knowledge on their own networks and sources of water supply.
3. The quality of the water bureaucracy, committed to high levels of performance and efficiency in provision of the service and imbued with an integrative social orientation, ensures the existence of a high-quality service for all.
4. The legal and institutional framework spelled out in the LOPSAS introduces a legitimacy of origin based on its consensual and nearly unanimous enactment, in addition to its having the support of organisations and communities.
5. The law establishes principles of responsibility and clear rules of the game regarding the mechanisms and forms of participation by civil society and the private sector in the management and provision of the service, stressing that this is done on the basis of community participation in decision making through the Technical Water Forums.

The institutional change is still under way and is scheduled to conclude in 2007. The participatory bases and nature of the process will strengthen governance of the water management and supply system in the CMR, and by extension, in the PUI-Tuy and the localities chosen for this study, favouring the poor populations in a framework of environmental sustainability which is essential for the actors who currently generate negative impacts on water quality to turn into stakeholders who participate in the process.

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Annex 1: Measurement of the Informal Sector and Poverty

- *The informal sector* is measured in terms of the occupational categories of employers, employees, and unremunerated family assistants in establishments in which fewer than five people work, plus self-employed workers other than professionals and domestic servants.

- *Poverty* is measured by using the poverty line (PL) method, which reflects the current impoverishment stemming from the sustained decline of incomes, on the one hand, and on the other, by the unmet basic needs (UBN) method, which indicates the living conditions associated with structural poverty subject to slow variation in time. The latter method relies on indicators that reflect inclusion / exclusion vis-à-vis core foci of reproduction such as employment, housing, and education, while the former focuses on income from labor and family income

Measurement of poverty through the PL method is done by comparing per capita family incomes and the cost of the National Institute of Statistics' standard food basket. The PL is set at less than double the cost of the food basket. Households whose incomes are lower than the cost of said basket are deemed to be in extreme poverty. Those whose incomes are above it but less than triple its value are considered vulnerable The rest belong to the category of non-poor households.

The UBN method measures the shortcomings in access to health care, education, housing, public services and utilities, and employment opportunities. A low quality of housing (shacks, rooming houses), crowding (more than three people per bedroom), sanitary conditions (access to pure drinking water and elimination of wastes), education (school attendance of children between 7 and 12 years of age), economic capability (more than three persons per employed person and heads of household who did not receive three years of schooling) mark the critical level for the UBN measure. Households that have one or more of these needs unmet are deemed poor.

A cross between both methods permits the identification of social groups and poverty, where in addition to differentiating among the groups subject to structural, extreme, and moderate poverty, and the impoverished groups making up the zone of exclusion, we identify the new poor and the vulnerable non-poor who are immersed in the zone of vulnerability. The non-poor sectors inhabit the zone of social inclusion.

Annex 2: Survey in the Chosen Localities

	Bachaquero	**Paso Real 2000**
Householdes:	50	50
People:	229	230
Days:	5	5
Margin of error:	4,46%	4,27%

Annex 3: Tables

Table 3: Population Density

Table 1															
Caracas Metropolitan Region															
						Population Trends									
	Population						**Year average rate (YAR)%**					**Trends**		**(YAR)**	
AREAS	**1950**	**1961**	**1971**	**1981**	**1990**	**2001**	**1950-61**	**1961-71**	**1971-81**	**1981-90**	**1990-01**	**2,005**	**2,010**	**2001-05**	**2001-10**
Axis CST	**15,823**	**19,285**	**28,976**	**68,555**	**146,735**	**204,256**	**1.8**	**4.2**	**9.0**	**8.8**	**3.1**	**230,360**	**267,731**	**3.1**	**1.7**
Resto PUI-TUY	51,998	55,146	70,967	128,449	218,106	330,496	0.5	2.6	6.1	6.1	3.9	384,417	464,352	3.9	2.1
PUI-TUY	67,821	74,431	99,943	197,004	364,841	534,752	0.8	3.0	7.0	7.1	3.5	614,517	731,157	3.5	1.9
PUI-GG	21,642	34,721	63,864	151,583	227,601	340,557	4.4	6.3	9.0	4.6	3.7	394,305	473,570	3.7	2.1
PUI-AM	41,821	64,837	105,705	190,005	260,281	324,594	4.1	5.0	6.0	3.6	2.0	351,732	388,868	2.0	1.1
PUI-V	85,889	141,270	202,137	251,231	280,439	298,109	4.6	3.6	2.2	1.2	0.6	304,807	313,391	0.6	0.3
Caracas	704,567	1,360,019	2,158,611	2,586,006	2,685,901	2,762,759	6.2	4.7	1.8	0.4	0.3	2,791,249	2,827,276	0.3	0.1
CMR	**921,740**	**1,675,278**	**2,630,260**	**3,375,829**	**3,819,063**	**4,260,771**	**5.6**	**4.6**	**2.5**	**1.4**	**1.0**	**4,433,761**	**4,659,910**	**1.0**	**0.6**
CST: Charallave-Santa Lucía; GG: Guarenas-Guatire; AM: Altos Mirandinos; V: Vargas; CMR: Caracas Metropolitan Region															
Source: Own based on CENSO 2001 Tabulaciones prioritarias, INE and FPEC 1998															

Annex 4: Matrix for Institutional Mapping in the Phases of Metropolitan Water Cycle

CARACAS Case

Actors / Phases	PUBLIC	*Private*		*Community*	
		Formal	**informal**	**Formal**	**Informal**
1) Extraction					
- Regulation	- MARN, HIDROVEN HIDROCAPITAL				
- finance	- MINFRA / HIDROCAPITAL	- Multilateral Institutions: IDB, CAF			
- construction	- HIDROCAPITAL				
- maintenance	- HIDROCAPITAL	- Private Enterprises: NE and TE			
- operation	- HIDROCAPITAL				
2) Treatment&Storage					
- Regulation	- MARN / MSDS				
- Finance	- HIDROCAPITAL	- Multilateral Institutions: IDB, CAF			
- construction	- HIDROCAPITAL	- Private Enterprises: NE and TE			
- maintenance	- HIDROCAPITAL				
- operation	- HIDROCAPITAL				
3) Distribution					
- Regulation	- HIDROCAPITAL			WF / WC / Neighbourhood Associations	
- Finance	- HIDROCAPITAL / Provincial and Municipal Governments.			WF / WC / Neighbourhood Associations	Land Invader inhabitants
- construction	- HIDROCAPITAL / Provincial and Municipal Governments.	- Private Enterprises		WF / WC / Neighbourhood Associations	Land Invader inhabitants
- maintenance	- HIDROCAPITAL / Provincial and Municipal Governments.	Co-operative enterprises/ Enterprises of Hidrocapital former workers		WF / WC / Neighbourhood Associations	Land Invader inhabitants

- operation	- HIDROCAPITAL / Provincial and Municipal Governments.	- Water Trucks		WF / WC / Neighbourhood Associations	
4) Consumption					
- Regulation	HIDROCAPITAL			WF / WC /Neighbourhood Associations	
- finance	HIDROCAPITAL (subsidies)				
-					
- construction					
-					Land Invaders Inhabitants
- maintenance					
- operation	HIDROCAPITAL			Neighbourhood Associations	
- billing	HIDROCAPITAL	- Enterprises of Hidrocapital former workers			Land Invader inhabitants
				WF/ Neighbourhood Associations	
5) Disposal					
- Regulation	- MARN, HIDROVEN HIDROCAPITAL			WF/ Neighbourhood Associations	
- finance	- HIDROCAPITAL / Provincial and Municipal Governments.	Private Enterprises: NE and TE		Community / Neighbourhood Associations	Communities
- construction	- HIDROCAPITAL / Provincial and Municipal Governments.	Private Enterprises: NE and TE			Land Invader inhabitants
- maintenance	- HIDROCAPITAL				
- operation	- HIDROCAPITAL				

Central Government Agencies:
MARN: Ministry of Environment and Natural Resources
MINFRA: Ministry of Infrastructure
MSDS: Ministry of Health and Social Development

Water Bureaucracy:
HIDROCAPITAL: Hydrologic Company of CMR
HIDROVEN: Hydrologic Company of Venezuela

WF: Water Forum
WC: Water Council
NE: National Enterprises
TE: Transnational Enterprises

Multilateral Institutions:
CAF: Andean Development Corporation
IDB: Inter-American Development Bank

Annex 5: Maps

Map 1: Caracas Metropolitan Region

Map 2: The PUI-Tuy Municipalities

Map 3: Charallave Santa Teresa Axis

Map 4: PUI-Tuy Chosen Localities

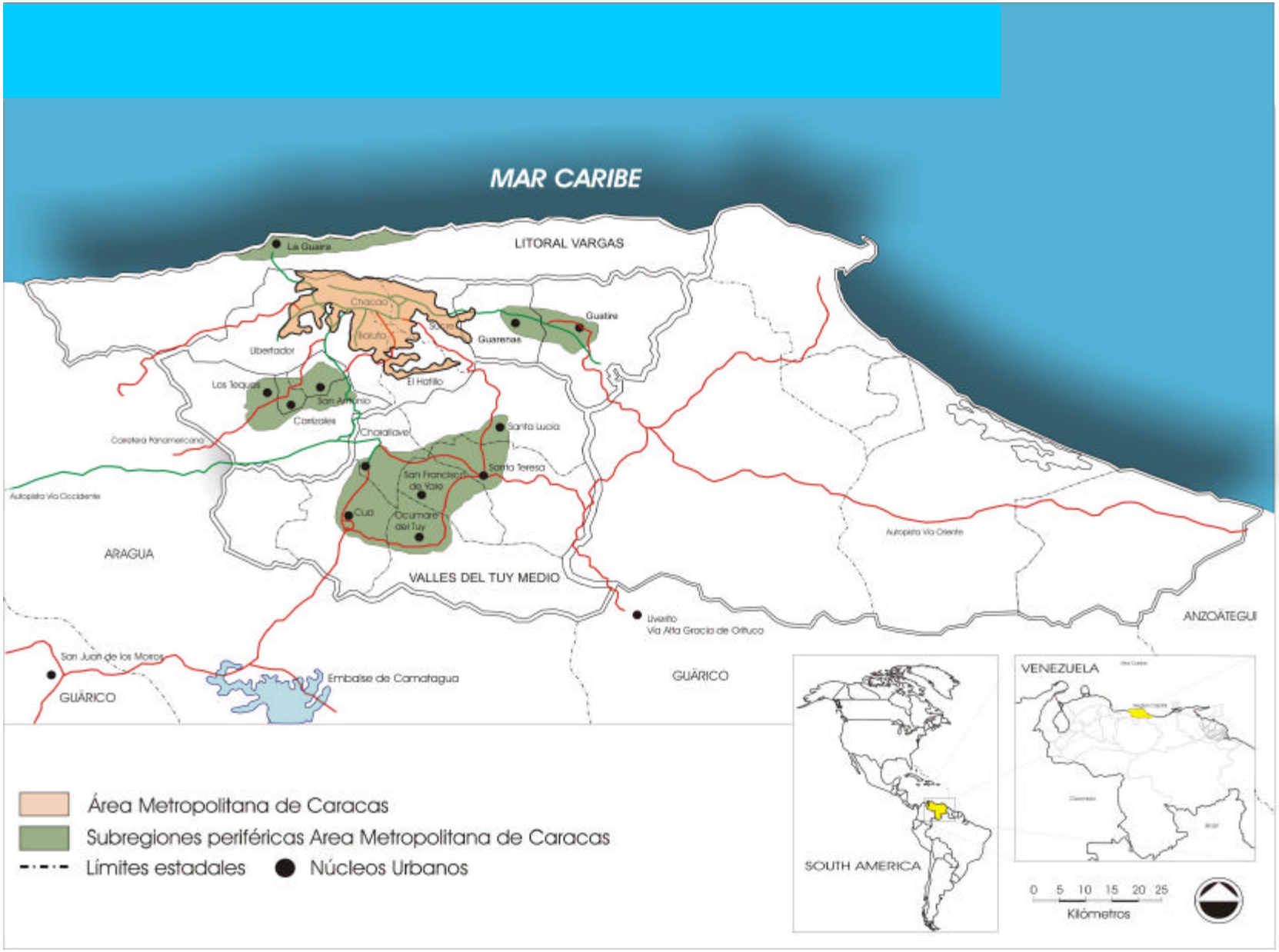
Map 5: Bachaquero – El Cartanal

Map 6: Paso Real 2000 – Charallave

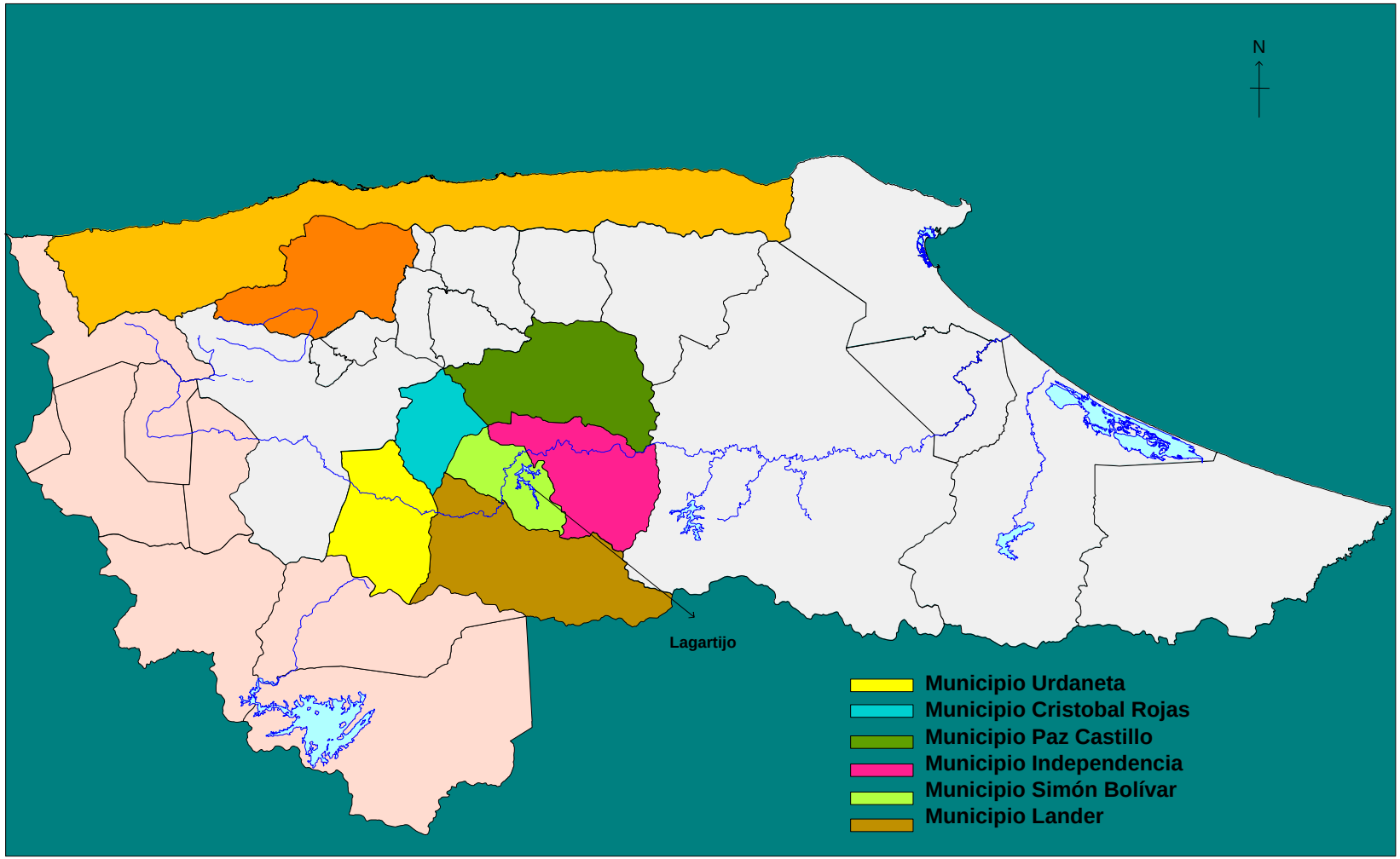
Map 7: Rio Tuy and Rio Guárico Basins

Map 8: Bachaquero WSS

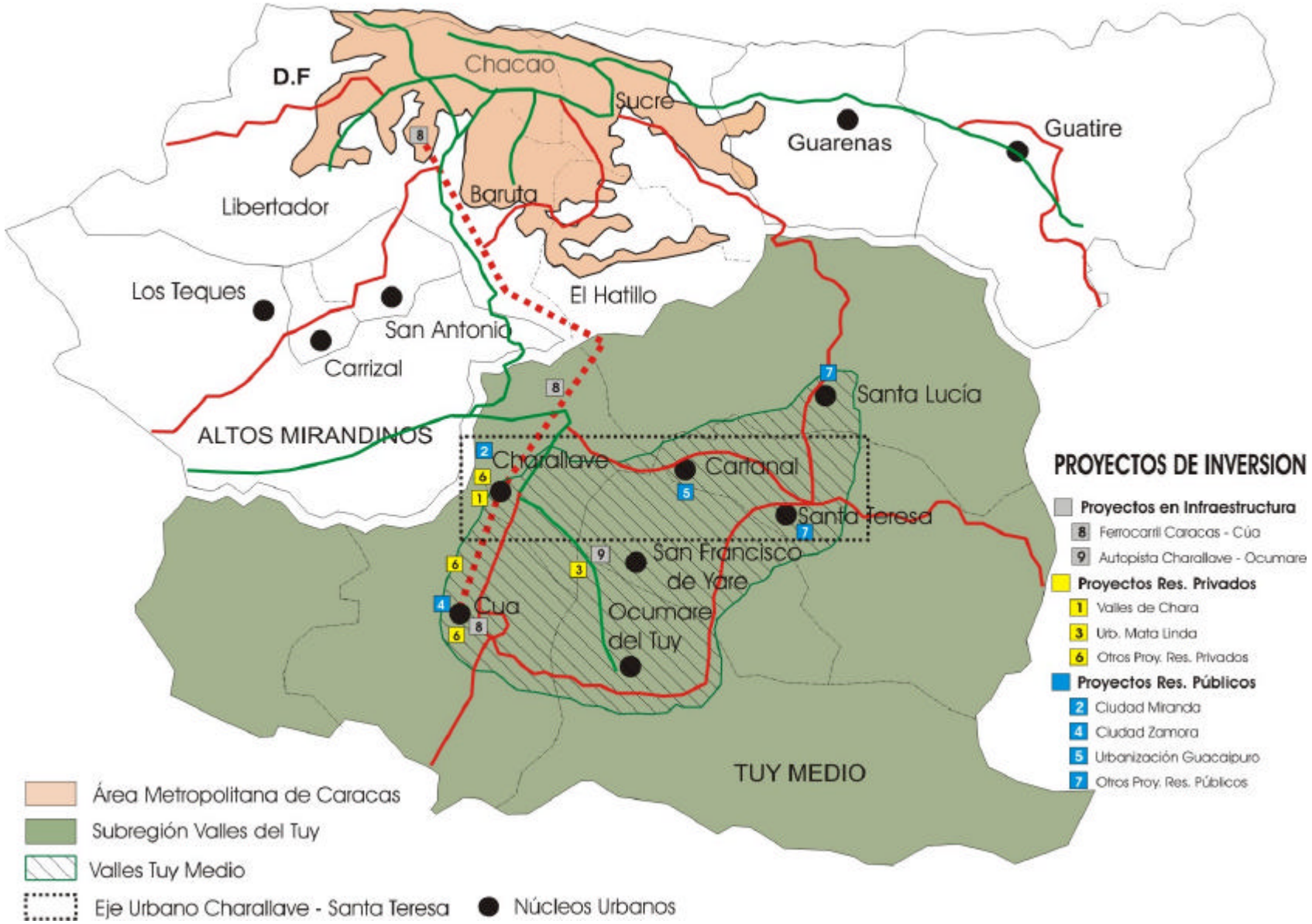
Map 9: Paso Real 2000 WSS


MAR CARIBE
LITORAL VARGAS
La Guaira
Chacao
Baruta
Sucre
Guatire
Guarenas
Libertador
El Hatillo
Los Teques
San Antonio
Carrizales
Charallave
Santa Lucía
Carretera Panamericana
San Francisco de Yare
Santa Teresa
Cua
Ocumare del Tuy
Autopista Vía Occidente
ARAGUA
VALLES DEL TUY MEDIO
Autopista Vía Oriente
Urbano Vía Alta Gracia de Orituco
ANZOÁTEGUI
San Juan de los Morros
GUÁRICO
Embalse de Camatagua
GUÁRICO
VENEZUELA
SOUTH AMERICA
Área Metropolitana de Caracas
Subregiones periféricas Area Metropolitana de Caracas
Límites estadales
Núcleos Urbanos
0 5 10 15 20 25
Kilómetros

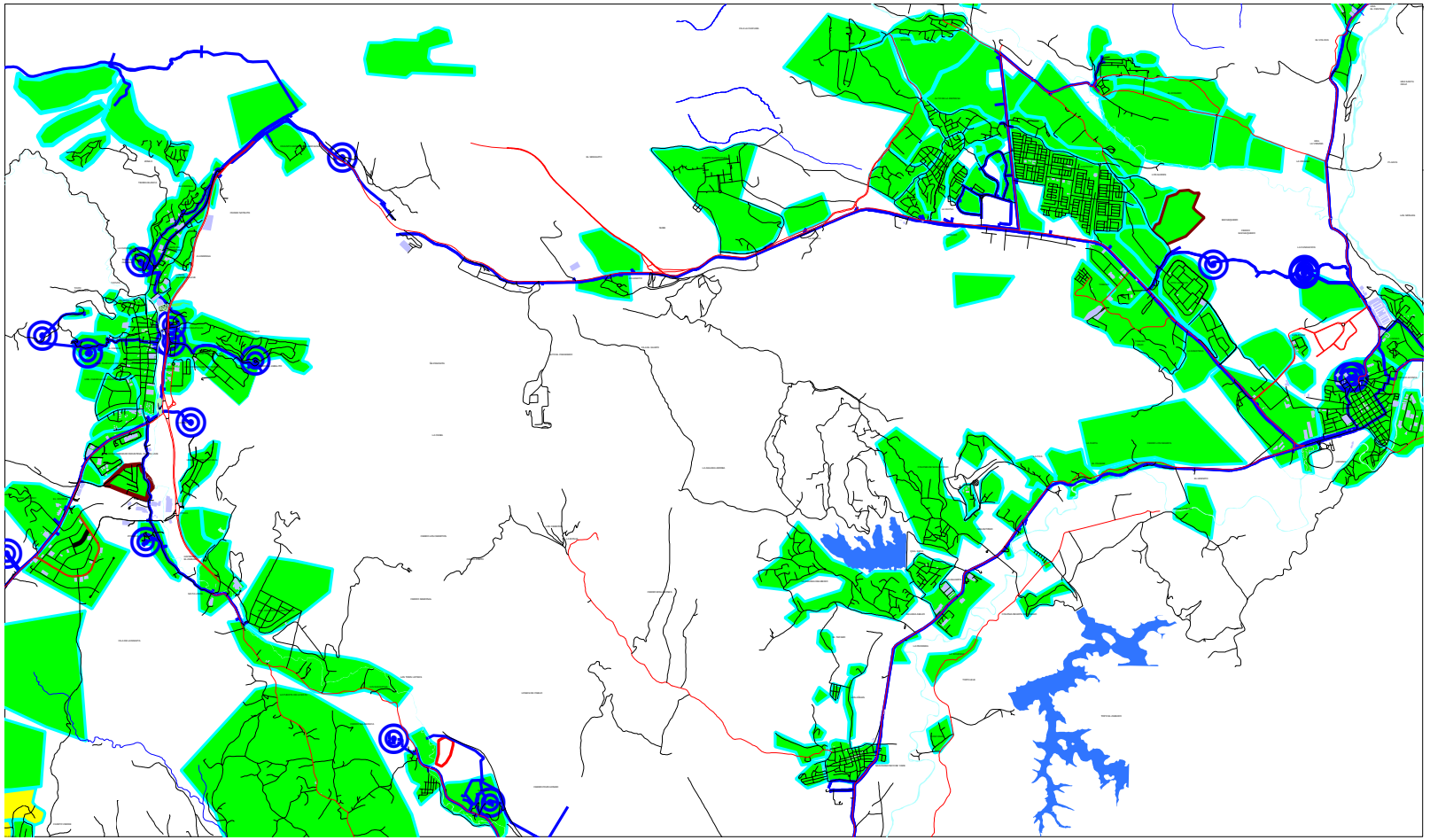
Map 2: PUI-Tuy Municipalities



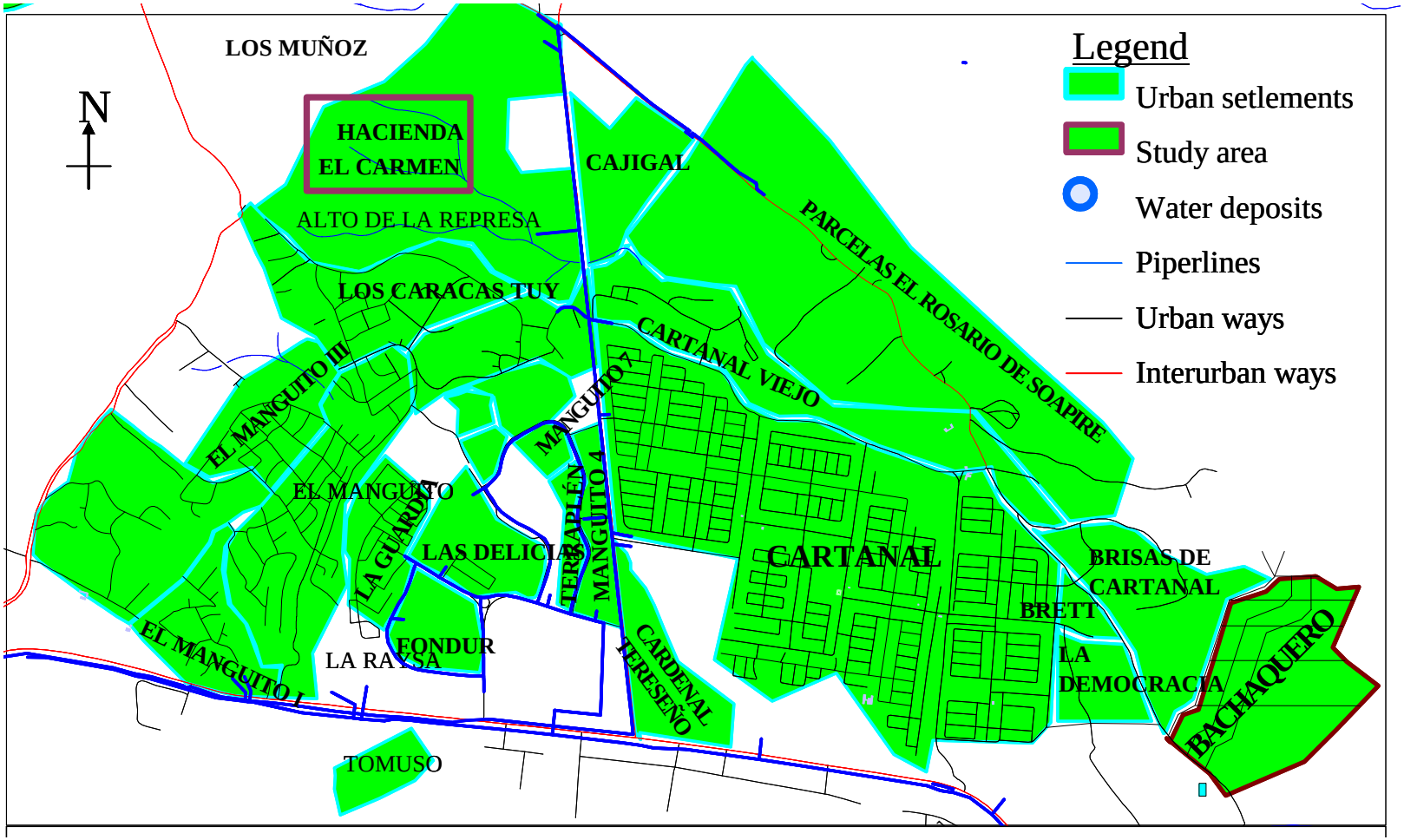
Map 3:Charallave - Santa Teresa Axis



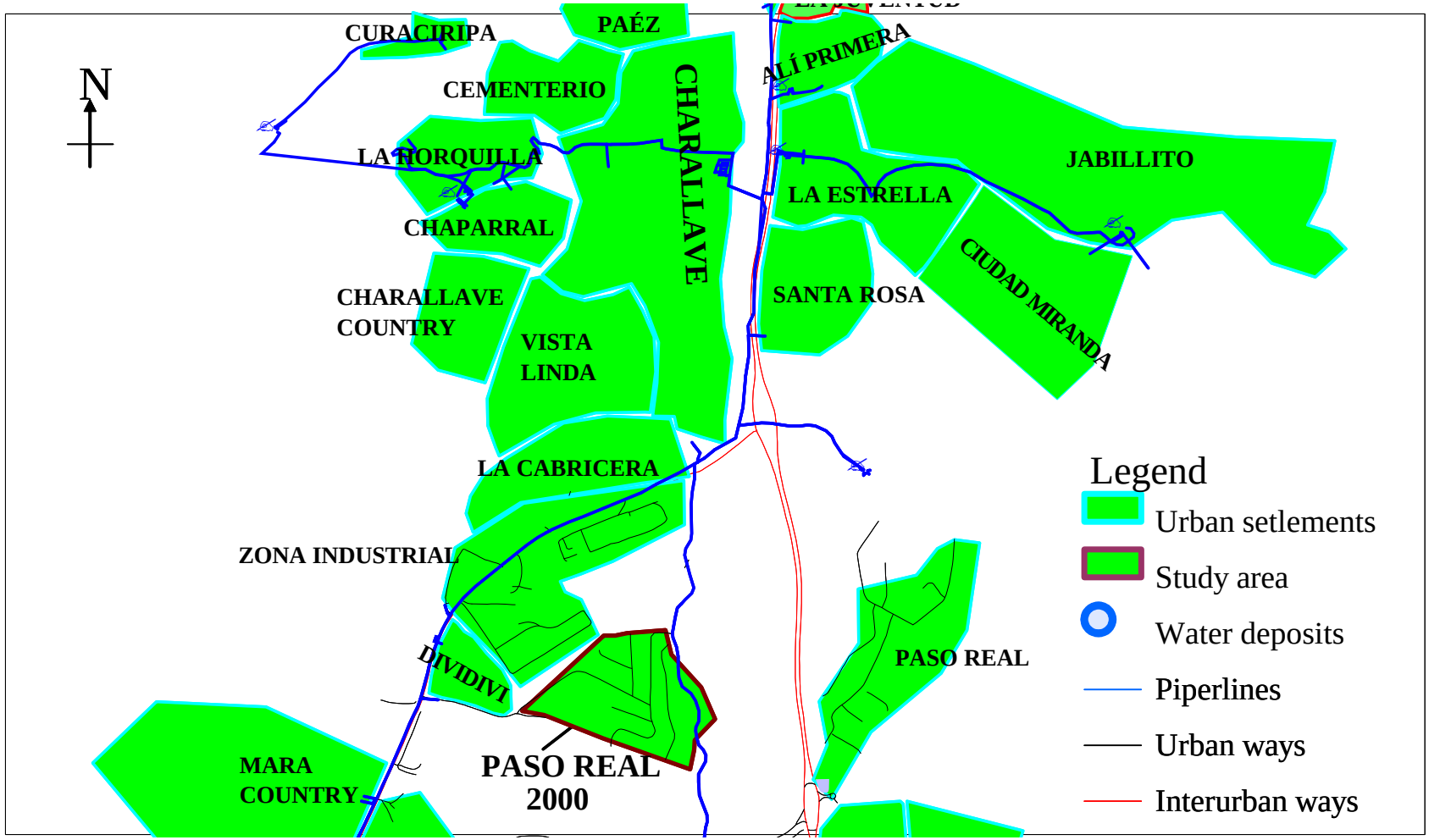
Map 4: PUI-Tuy Chosen Localities



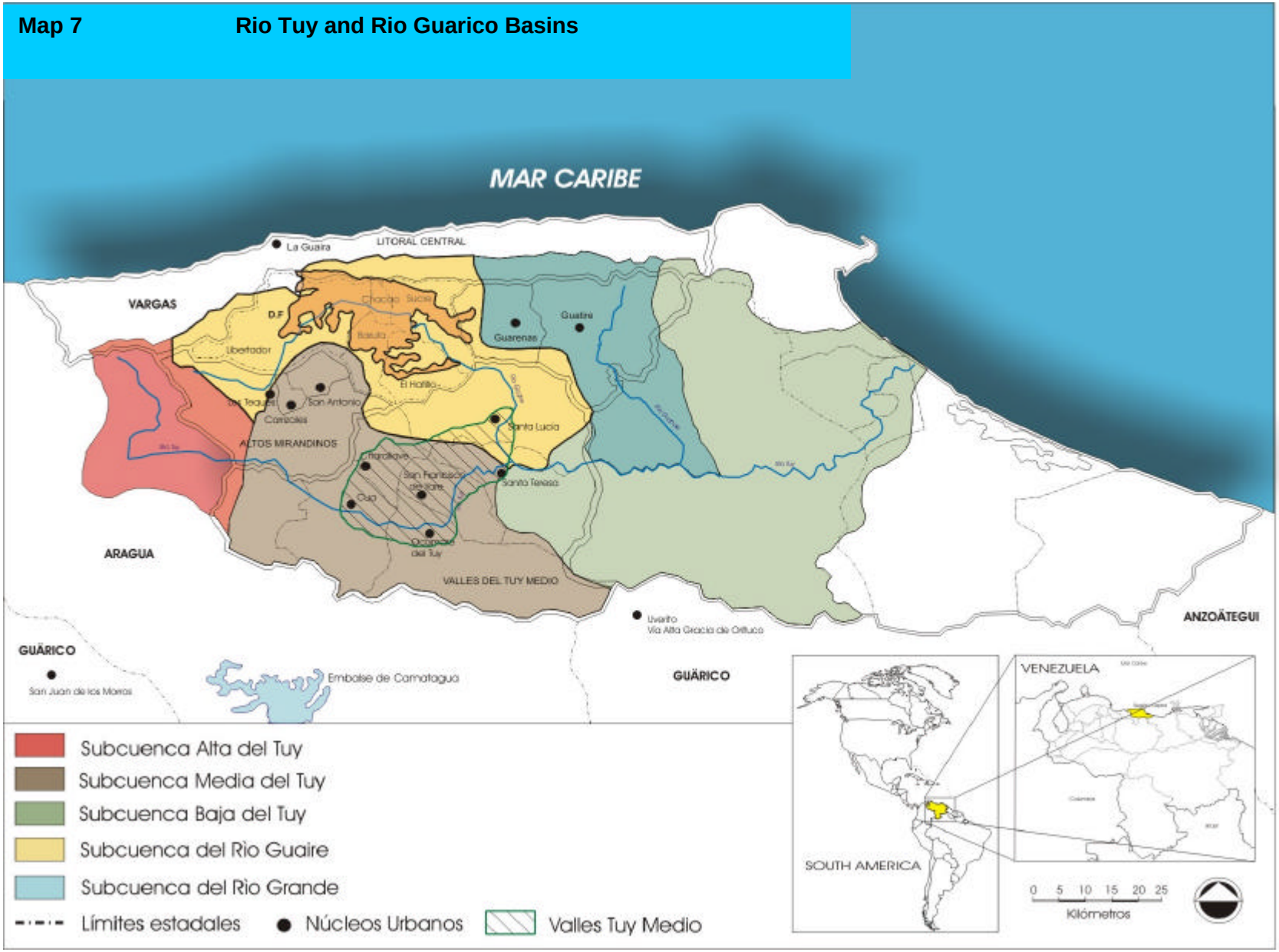
Map 5: Bachaquero - El Cartanal



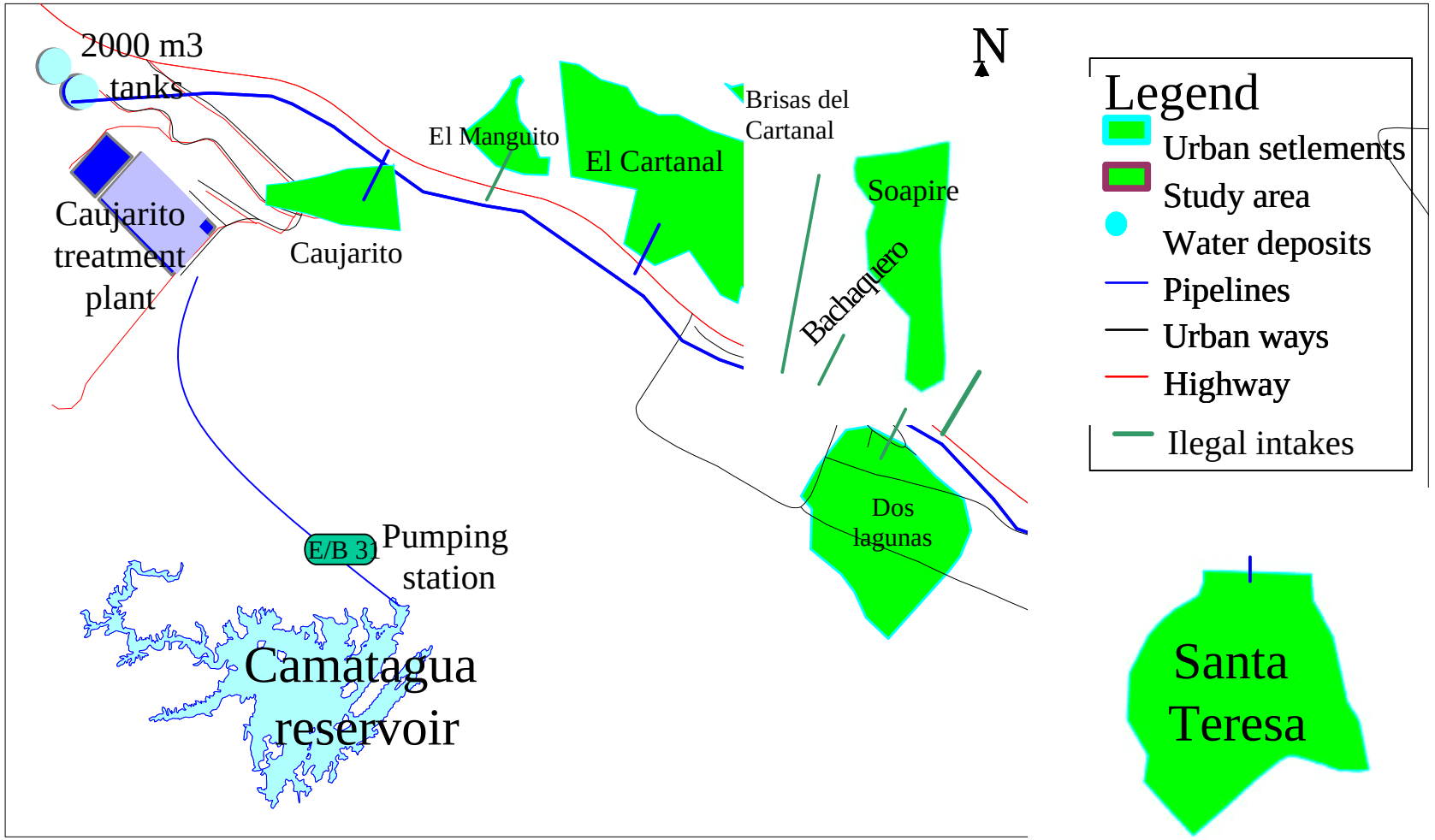
Map 6: Paso Real 2000 - Charallave



Map 7 **Rio Tuy and Rio Guarico Basins**



Map 8: Bachaquero WSS



Map 9 **Paso Real 2000 WSS**