



Developing community-based watershed management in Greater São Paulo: the case of Santo André

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1. This project was conceptualized, and is being implemented, by project teams at the Municipality of Santo André and University of British Columbia to whom thanks are due for assistance in providing the material used in writing this paper. Particular thanks to Erika de Castro. However, the author alone is responsible for any errors in this paper.

SUMMARY: *This paper describes how watershed protection is being combined with settlement upgrading and land-use management within an area that serves as one of Greater São Paulo's main sources of fresh water. This is being undertaken in the municipality of Santo André. Unlike previous watershed protection measures, which proved ineffective, it recognizes the need to combine the protection of watersheds with the improvement of conditions in existing settlements and guiding, rather than prohibiting, further settlement. The paper describes how the community-based watershed management involves the inhabitants of illegal settlements and other stakeholders in an adaptive planning framework that first seeks consensus on what is to be planned before developing the plan, its implementation and its operation, maintenance and monitoring.*

I. INTRODUCTION

A LEGALISTIC APPROACH to environmental management has been shown to be ineffective in Brazil. This is consistent with experience in other countries. Master plans and legal rules are often simply ignored or are so out of touch with the actual development taking place on the ground that their effective implementation is impossible. It is in this context that the municipality of Santo André has embarked on the design and implementation of a community-based watershed management (CBWM) framework, which represents a fundamental change in the way planning and watershed management has traditionally been conducted in Brazilian cities and states.⁽¹⁾ These innovations are supported by recent environmental legislation which sets the parameters within which individual municipalities can formulate and enact plans to manage watershed areas under their jurisdiction.

This paper examines the current attempt to develop a watershed management plan in Santo André. The process is in its infancy and, although physical impacts will only be measurable over the next few years, the purpose of this paper is to highlight aspects of the current approach to formulating the community-based plan which are in sharp contrast to traditional master planning approaches. The paper is divided into three sections. The first provides a regional context for the problem at the level of the São Paulo Metropolitan Area, followed by an elaboration of relevant characteristics at the municipal level. The second section outlines the process involved in formulating the CBWM plan in Santo

André. The purpose of presenting this case is both to provide some detail of land use and innovative aspects of the settlement upgrading component of the CBWM plan, and also to highlight differences from traditional master planning approaches. Based on the Santo André experience, the third and final section makes some general observations about the planning process, which has applicability in other contexts.

II. THE CONTEXT AND THE PROBLEM

a. Regional Context: the São Paulo Metropolitan Area (SPMA)

SÃO PAULO IS Brazil's largest metropolitan area and one of the world's three largest urban agglomerations. With an estimated 18 million people, the SPMA consists of 39 municipalities and covers 8,051 square kilometres. Expansion of the SPMA is constrained to the north and south by major water basins that are the source of most of the urban water supply for the metropolitan region. Urban growth during the 1990s has largely been in a southerly direction towards the Guarapiranga Sub-basin. It is within this sub-basin and the adjacent Billings-Tamanduatei Sub-basin that the Guarapiranga and Billings reservoirs – which provide 40 per cent of the SPMA's water – are located. Population in the Guarapiranga Basin is growing at 7 per cent per year and has reached 580,000, two-thirds of whom are located close to the reservoir itself. The population living in the Billings-Tamanduatei Basin close to the Billings reservoir – which provides water for 1.2 million people – amounts to approximately 350,000 people. Of these, about 130,000 live in *favelas*⁽²⁾ without basic services. Waste water, sewage and solid waste from these areas are discharged directly into the reservoirs and the main polluting source of the waterways is domestic effluent, which accounts for two-thirds of contamination, as 90 per cent of sewage is not treated.⁽³⁾

The water quality of the three most important rivers serving the SPMA and their associated reservoirs is seriously affected by urban sewage and industrial waste water discharges. The reservoirs have significant amounts of toxic substances: 40 cubic metres per second of raw sewage and industrial effluent are discharged into the Tietê River, which has become almost entirely devoid of oxygen. High levels of lead and mercury have been detected in several of the rivers in the São Paulo Metropolitan Area.⁽⁴⁾

Prior to the democratization process in Brazil during the mid-1980s, development planning was strongly grounded in highly centralized, top-down methods, with little or no public participation. In the SPMA, planning has historically relied heavily on tools such as master planning. However, not only did the tools not provide a framework to adequately guide the rapid urban growth taking place throughout the metropolitan area, but they inadequately dealt with the political complexity associated with a multi-stakeholder planning process. As a consequence, none of the master plans formulated for São Paulo was successfully implemented.⁽⁵⁾ The first master plan for SPMA to be formally approved is the *Plano Metropolitan da Grande São Paulo: 1994-2010*.⁽⁶⁾

Over the last three decades, high levels of legal and institutional complexity and a reliance on legal regulatory mechanisms to control growth patterns have exacerbated the haphazard and uneven growth of the metropolitan area. For instance, federal and state laws stipulate strict

2. *Favela* is the Portuguese name for 'slums' and squatter settlements.

3. Jacobi, P (1997), "Environmental problems in São Paulo", *Journal of Contingencies and Crisis Management* Vol 5, No 3, pages 131-139; also Bartone, C R (1996), *Urban Environmental Management Strategies and Action Plans: Case Studies from São Paulo, Brazil and Kumasi*, Ghana, World Bank, Washington DC.

4. Leitmann, J (1994), *Rapid Urban Environmental Assessment. Lessons from Cities in the Developing World, Volume 2 - Tools and Outputs*, UNDP/UNCHS/World Bank Urban Management Programme 15, World Bank, Washington D C, page 130; also see reference 3, Bartone (1996).

5. The political gyrations involved in developing the 1992 Master Plan for São Paulo – which was never effectively implemented – are described in Singer, P (1993), *São Paulo's Master Plan, 1989-92: The Politics of Urban Space*, Woodrow Wilson International Centre for Scholars, Washington DC. For an international perspective on problems with master planning, see Rondinelli, D (1993), *Development Projects as Policy Experiments*, Routledge, London, pages 90-117; also Devas, N (1993), "Evolving approaches" in Devas, N and C Rakodi (editors), *Managing Fast Growing Cities: New Approaches to Urban Planning and Management in the Developing World*, Longman, Singapore, pages 72-73.

6. EMPLASA (1994), *Plano Metropolitan da Grande São Paulo 1994-2010*, Governo d'Estado de São Paulo, Secretaria de Estado de Planejamento e Gestão, Empresa Metropolitana de Planejamento da Grande São Paulo SA.

7. The other sub-basins are Juqueri-Cantareira, Alto Tietê-Cabeceiras, Guarapiranga and Pinheiros-Pirapora.

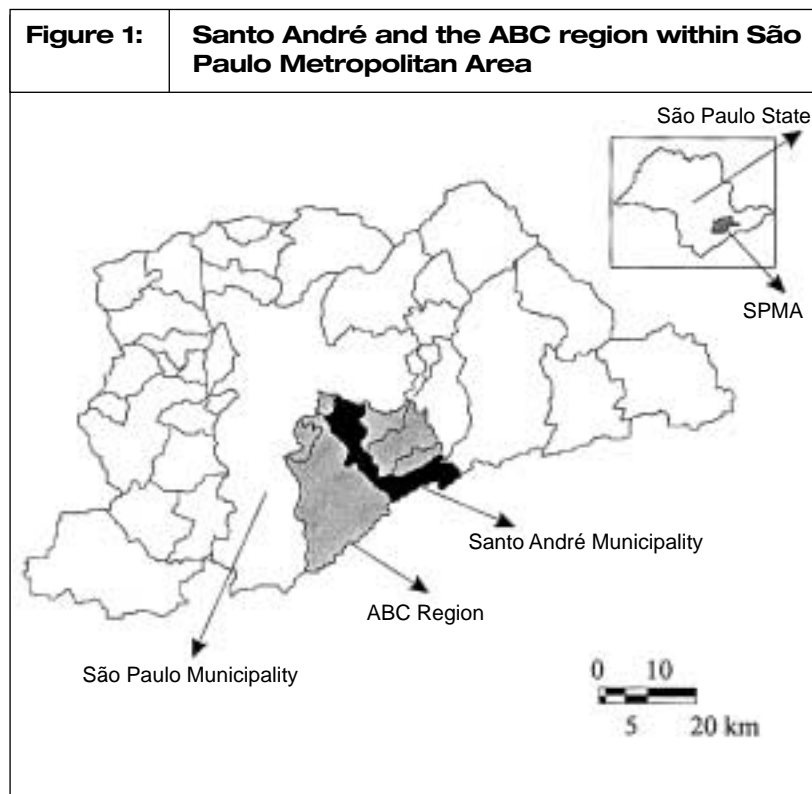
8. See reference 3, Jacobi (1997); also reference 4, Leitmann (1994).

9. Unless otherwise indicated, all statistics and descriptive data in respect of Santo André were obtained from municipal and SEMASA databases. SEMASA (*Serviço Municipal de Água e Saneamento de Santo André*) is the municipal water supply, sewage and drainage company in Santo André.

restrictions on land development in the Alto-Tietê Basin, which encompasses a number of sub-basins within which the SPMA is located.⁽⁷⁾ Consequently, many landowners do not develop their properties, thereby leaving them vulnerable to invasion by settlers and the construction of new *favelas*. More than 30 per cent of the SPMA population live in irregular housing. *Favelas* are not, however, the only polluters of the reservoirs. Compliance with federal and state laws that prohibit municipalities from discharging wastes within the catchment area of the Billings Tamandatei Sub-basin is impossible because neighbouring municipalities outside the catchment area have passed local bye-laws prohibiting the importation of wastes from other jurisdictions. As a consequence, an estimated 20 per cent (more than 4,000 tonnes) of municipal, industrial and hazardous wastes are unprocessed each day by the formal collection and disposal system, resulting in the contamination of water sources, waterways and low-income areas.⁽⁸⁾

b. Santo André Municipal Area⁽⁹⁾

The city of Santo André, founded under that name in 1938, is located on the fringe of the SPMA. Santo André covers approximately 177 square kilometres, of which 66.4 square kilometres are urbanized. The municipality has an estimated population of 665,000. Together with the other cities of the so-called Greater ABC Region (Santo André, São Bernardo do Campo, São Caetano, Diadema, Mauá, Ribeirão Pires, Rio Grande da Serra – see Figure 1), it has, since the 1950s, played an important role in the economic development of the SPMA. As part of the Brazilian import



substitution strategy in the 1950s, the motor vehicle industry was established in the region, making it one of the most important development poles in the country.

Despite the strong economic base, the city of Santo André and the SPMA as a whole have been confronted by the decentralization of some of their main industries to the interior of the state of São Paulo. This has brought a reduction in formal sector industrial employment and consequent shifts in population migration patterns, settlement patterns and the growth of informal sector economic activities. In response to these changes, Santo André now plays a central role in the powerful Council of the Greater ABC Region – an informal consortium of the political leadership of the seven cities of the ABC region. The purpose of the consortium is to develop coordinated, proactive strategies for the region that will preempt the negative impacts of macroeconomic restructuring currently underway in Brazil, and maintain the ABC region’s dominance as an economic centre.⁽¹⁰⁾

Whereas population growth rates in Santo André averaged 5.5 per cent per annum between 1960 and 1970, this growth rate had decreased to 2.82 per cent between 1970 and 1980, and down to 0.97 per cent per annum between 1980 and 1990.

Santo André has inherited a legacy of rapid, but poorly managed, urban growth. Land use development has historically taken place in a haphazard, chaotic fashion without any systematic integrated planning. The majority of new low-income housing construction has been self-help in nature, resulting in the growth of *favelas* and informal settlements. Not only do these settlements violate municipal land use and environmental legislation but they are also unhealthy living environments with low levels of physical and social services – particularly for sanitation and garbage collection.

Although the levels of water supply (98 per cent), solid waste collection (93 per cent) and sewage services (95 per cent) provided to the municipal population as a whole are high, *favelas* are the areas where service levels are lowest. Approximately 10 per cent of Santo André’s population live in *favelas* – the municipality has identified 123 within its jurisdiction, where an estimated 67,000 people live – and the highest density within these *favelas* is 800 people per hectare. Not only are an estimated 4,000 families living in “extremely high risk conditions” – under power lines, near a solid waste dump from which combustible gases are emitted, on geologically unstable land and on land subject to flooding – but increasing numbers are also settling in environmentally sensitive watershed areas.

c. Santo André Environmental Protection Area

A watershed protection law was enacted in 1975, which designated portions of various municipalities as “watershed protection areas”. The objective of this legislation was to ensure water quantity and quality for the reservoirs that feed the SPMA. With a view to protecting the watersheds, Laws No 898/75 and No 1172/76 prescribed stringent land use restrictions for occupation within watershed protection areas, which accounted for 54 per cent of the SPMA. Restrictive zoning was intended to be the primary means of land use control. The 1970s were characterized, however, by a high degree of centralization, and control of financial resources and legislative power at federal and state levels, making it impossible for local governments to formulate and effectively imple-

10. Rodriguez-Pose A and J Tomaney (1999), “Industrial crisis in the centre of the periphery: stabilisation, economic restructuring and policy responses”, *Urban Studies* Vol 36, No3, pages 479-498; also Klink, J (1999), “The future is coming. Economic restructuring in the São Paulo fringe: the case of Diadema”, *Habitat International* Vol 23, No 3, pages 325-338.

ment land use guidelines for areas under their jurisdiction. These legislative controls were ineffective in guiding settlement of watershed protection areas.

In terms of this legislation, most human settlement within watershed protection areas that pre-dates the legislation is illegal insofar as it fails to comply with the stringent land use regulations prescribed by the legislation. In some municipalities, such as Ribeirão Pires and Rio Grande da Serra, 100 per cent of the municipal area falls within the watershed protection areas; in Santo André, 61 per cent (or 9,600 hectares out of a total of 17,780 hectares) is designated as a watershed protection area. Unlike municipalities such as São Bernardo, which has 200,000 people living within the watershed protection areas, Santo André only has 25,000 people living within such protected areas. This accounts for 4 per cent of its total population, the remainder of which live in the higher-density northern portion of the municipality.

Santo André's watershed protection area is made particularly vulnerable by major arterials such as the Anchieta Highway and the Estrada do Pedrosa. These major roads facilitate easy access to the area for the illegal dumping of industrial waste material from Santo André and other municipalities. These roads also provide access to the protection area for aspirant informal settlers wishing to occupy land. Current rates of *favela* growth in Santo André's watershed protection areas are approximately 15-25 new families per month, which is low compared to most other municipalities in the ABC region. However, trends in those other municipalities indicate that unless there is intervention at this early stage of settlement, there is little to prevent a situation arising such as in São Bernardo where 200,000 people – or 30 per cent of its population – live illegally in the protection area.

The democratization process and approval of the new constitution in 1988 marked a shift away from centralized control, towards the decentralization of urban management functions back to the municipal level. Reinforcing this decentralization process were a number of legislative changes that are of particular relevance to environmental management. These included State Law No 7663, passed in 1991, which prescribed a decentralized policy for water resource management via the water basin committees (*Comitês de Bacia*, which are comprised of representatives of state and local government as well as civil society organizations). Santo André is represented on the Alto Tietê and Tamanduatei-Billings water basin committees. State Law No 9034 of 1994, in conjunction with the above mentioned piece of legislation, stipulates that "emergency plans," "environmental plans" and "sustainable development plans" need to be drawn up for the water basins, which are then to be submitted to the water basin committees for approval.

Of greatest significance at the municipal level, and superseding the largely ineffective Watershed Protection Law, is a new piece of legislation – the State Law of Recovery and Protection of Watersheds No 9866 of 1997.⁽¹¹⁾ The significance of this new legislation is at least three-fold. First, it acknowledges the reality of settlement within the watershed protection area. Second, it makes provision for the formulation of emergency plans to provide basic services to the human settlements within respective municipalities' watershed protection areas – most of which are "illegal" in terms of the 1975/1976 legislation. Third, local municipalities such as Santo André have the authority to enact regulations with respect to watershed areas within their municipal boundaries.

11. This is supported by federal level legislation in the form of the National Water Resources Management Act of 1997. See Porto, M (1998), "The Brazilian water law: a new level of participation and decision-making", *Water Resources Development* Vol 14, No 2, pages 175-182.

The new legislation reinforces the process of decentralized watershed management through the tri-partite water basin committees. For each basin, a committee comprising representatives from state government, local government and civil society organizations has been established. This committee is involved in the formulation of an emergency plan aimed at the restoration of watersheds, and in the formulation of an environmental plan – which includes the formulation of a socioeconomic development plan. In addition, the sub-committee of the Billings-Tamanuadatei Basin is also responsible for the formulation of a sustainable development plan dealing with land use, occupation and environmental protection of the Billings reservoir. In order to avoid contradictory regulations being enacted in contiguous municipalities sharing the same water basin, any new enactment of regulations needs to be consistent with state laws that are in the process of being formulated for each water basin – which, in the case of Santo André, refers to the Alto-Tietê Basin.

III. FORMULATING THE WATERSHED MANAGEMENT PLAN

a. Planning the Planning Process

BEFORE ATTEMPTING TO formulate the management plan for the watershed, there is a crucial – and often neglected – initial planning process that needs to be undertaken. This is the *planning of the planning process* itself. Decisions made at this stage will guide the subsequent stage, which focuses on substantive planning – or, in this case, planning the watershed. Given the failure of previous top-down master planning approaches, Santo André has embarked upon a participatory approach to watershed management.

This participatory approach is being pursued in a context of a high level of institutional complexity in the region. Although there were many stakeholders to be considered, including state, metropolitan, municipal, regional, NGO, CBO and watershed area resident interest groups, there were, at the initiation of the planning process, a number of mechanisms which had already formalized interaction and participation within and between state and civil society interests. Some of these provided an opportunity upon which to build and further develop participatory mechanisms. For example, watershed sub-committees provided a strong base for coordination amongst municipalities, while institutions such as the participatory budget councils provided a mechanism to ensure formal inclusion of marginalized or excluded communities in the planning process. In addition, the multi-layered process included the local governments of the ABC region (via the Inter-municipal Consortium of the Greater ABC Region), the private sector, NGOs and civil society organizations (via the Council of the Greater ABC Region), the SPMA (via state corporations and secretariats in the SPMA), and the state of São Paulo (via the Water Basin Sub-committee).

Participation mechanisms have included formalized and informal interaction between communities and the municipal authority. These include workshops, budget councils, public meetings, multi-stakeholder meetings and separate meetings between individual stakeholder groups and the municipal authority. Participation is a dynamic process, which means that the mechanisms whereby stakeholders are to be involved in

planning and watershed management are continually changing with a view to improving overall representation.

The municipal water and sanitation company SEMASA has a permanent presence in the watershed area. Five staff members are permanently based in the watershed protection areas and are supported by technical staff who travel from the main SEMASA office in Santo André city centre each day in order to provide assistance for various projects and programmes in the area. In addition, the municipality provides a doctor, nurse and social worker every day of the week. Given their daily interaction and assistance with water and sanitation-related problems, SEMASA staff have strong informal relationships with local community members but they have also formalized a process of fortnightly meetings with community leaders in the watershed area.

At the local level of the Parque Andreense pilot project, an important mechanism designed to ensure that marginalized groups are included in the planning process was the formation of a group of community leaders, called *Câmara Técnica*. This group has been participating in the planning and management of the project since January 2000 and includes representatives from all major interest groups in the area, including those that have traditionally been excluded from decision-making processes such as women, youth and the unemployed. In an attempt to extend the participation process beyond the boundaries of the pilot project area, community leaders from neighbouring *glebas* (undivided plots of land) have been included in the *Câmara Técnica* group.

b. Planning the Watershed Management Plan

It has been seen that the essence of the problem within Santo André – and, indeed, throughout the SPMA – is that uncontrolled human settlement results in damage to environmentally sensitive areas. This adversely affects the quality of life for people in the area, most visibly those living in informal settlements. The immediate planning problem that arises in this regard is that there is no comprehensive framework either to guide future settlement or to address existing settlement in the watershed protection area. Based on the outcome of discussions amongst state and civil society institutions during 1998, it was agreed that the long-term goal of the plan should be to achieve a balance between human settlement and the environment in such a way that environmental damage is reduced, undamaged areas are protected and quality of life is improved. This all needs to be achieved in fiscally sustainable terms.

A diagnosis of the regional basin and the local watershed has been conducted in order to determine the primary causes of the deteriorating quality of the environment and of people's quality of life. Importantly, the information has been organized in such a way that it is accessible to all stakeholders and provides a basis for exploring realistic intervention possibilities. As distinct from environmental impact assessments, which assess the impacts of specific development proposals, this diagnosis – or environmental sensitivity analysis (ESA) – was completed before any development plans were formulated and provides an important starting point for the design of the CBWM framework.

The organizing concept for the planning process was biophysical boundaries – not political or legal jurisdictions as is the case with master planning. The Billings Reservoir Basin, therefore, provided the boundaries for a regional evaluation of the water resources situation, as well as

the physical, land use, social and institutional processes that significantly affect water resource management. Similarly, the boundaries of the Rio Grande watershed were used to frame the environmental sensitivity analysis that assessed the quality and quantity of the water resources, as well as the quality of life of people living in this watershed. These biophysical boundaries extend beyond the jurisdiction of Santo André. This has ensured that planning is grounded in a comprehensive picture of the regional context, thereby avoiding an “edge of the world” syndrome where data collection and mapping stops outside of Santo André’s jurisdiction. Importantly, this has also facilitated a process of collaboration between neighbouring municipalities, notwithstanding their control by competing political parties.

Let us now consider this planning process as it relates to one of the many aspects of the problem, namely, land use and settlement planning, and what this means for the formulation of a CBWM framework for the area. It is too early in the formulation of the CBWM framework to attempt to draw definitive conclusions about the impact of this approach on the watershed management. The focus in the following sections, therefore, is on what the planning process is attempting to achieve, and some of the steps that have already been taken to move in a direction that is both participatory and also represents a sustainable approach to environmental management.

c. Designing a Land Use Settlement Framework

There are six main settlement types in Santo André’s watershed protection area (see Table 1). These have been defined according to legal status and shelter and infrastructure levels. Large unsubdivided plots known as *glebas* account for 63 per cent of the watershed protection area, part of which already has designated uses that are unlikely to change. For instance, there is a 335-hectare biological reserve with extremely sensitive

Table 1: Settlement types in Santo André Watershed Protection Area

Settlement type	Level of shelter consolidation	Infrastruc ture level	% of total households	% of total land
Larger favelas; more than 20 households (<i>Favela consolidada</i>)	High – houses typically brick	Low	17	9
Smaller favelas; less than 20 households (<i>Favela em formação</i>)	Low – houses typically wood	None	1	1
Clandestine subdivisions (<i>loteamento clandestino</i>)	Low	Low	1	1
Irregular subdivisions (<i>loteamento irregular</i>)	High	High	4	5
Regular subdivisions (<i>regular loteamentos</i>)	High	High	69	19
Heritage site (<i>Paranapiacaba</i>)	High – typically brick	High	6	2
Large unsubdivided plots (<i>glebas</i>)	n/a	n/a	2	63

vegetation, where no human settlement will be permitted in the future. Also, a chemical multinational has a large existing plant and adjacent land holdings comprising 383 hectares, which it is likely to keep free of informal settlement occupation. However, this still means that more than half of the watershed protection area is currently vacant and susceptible to further illegal settlement. The management of future settlement is therefore the first dimension that needs to be addressed in planning the watershed protection area.

The second set of concerns focuses on how to improve the conditions in existing settlements, in order to improve the quality of life for people there as well as to limit damage to the environmentally sensitive areas in which they are located. In this regard, 2,598 hectares (or almost one-quarter) of the watershed area is occupied by human settlements. These range from medium-density low-income *favelas*, characterized by low levels of infrastructure and shelter quality, through to low-density middle-income areas comprising illegal sub-divisions but where housing and infrastructure levels are of a high quality.

Possibilities for dealing with future settlement range along a continuum; attempting to prevent settlement in the watershed area at one extreme, and allowing uncontrolled settlement at the other. Completely preventing new settlement is unrealistic. Planning for future settlement needs to be viewed in the broader context, which is that Santo André’s watershed protection area is located at the edge of a mega-city inhabited by 20 million people. Pressure on vacant land on the periphery of such an extensive agglomeration is likely to increase as the urban area expands. This requires realism about the extent to which settlement levels can be restricted in the future. At the other extreme, a “do nothing” option is likely to lead to invasions and occupation by *favelas*, as has happened in neighbouring municipalities such as São Bernardo. The most practicable options lie somewhere between these two extremes. It is necessary therefore to consider appropriate forms of settlement – for instance, a combination of keeping highly sensitive areas such as biological reserves unsettled through stringent policing, combined with a mix of low-density residential and “clean technology” light industry in other areas.

d. Upgrading of Existing Settlements

Let us look in a little more detail at the planning of one of the more difficult areas in which intervention is necessary: how to deal with land on

Figure 2: Intervention options		CURRENT LEVEL OF SETTLEMENT	
		ALREADY SETTLED	CURRENTLY VACANT
PERMISSIBLE SETTLEMENT LEVELS	NO SETTLEMENT	Remove existing settlement and keep land vacant (= rehabilitation and protection)	Keep land vacant (= protection)
	CONTROLLED SETTLEMENT	Upgrade settlements (= rehabilitation and protection)	Guide future settlement (= protection)

which controlled settlement will be permitted but which is already settled (the “upgrade settlements” option in Figure 2). Given that most new settlement in the watershed protection area in the last five years has taken the form of *favelas*, Santo André’s current approach to upgrading is an important starting point in developing this part of the CBWM framework. The municipality has a well-developed strategy targeting low-income areas within the urbanized portion of the municipality. This is most clearly articulated in the *Integrated Strategy for Urban Poverty Reduction*,⁽¹²⁾ which has the stated objective of reducing social exclusion by facilitating the physical and socioeconomic integration of *favelas* into the city. This programme integrates five existing municipal programmes: *favela* upgrading, micro-credit for informal enterprises, implementing a minimum income programme linked to school attendance by children, adult vocational training, and community health programmes. The strategy places a strong emphasis on community participation and gender equity.

Santo André’s upgrading strategy can be broken down into three levels. The first and most basic type of intervention is known as *favela limpia* (“cleaning the *favela*”), and focuses on mutual self-help groups working in solid waste collection. This is complemented by environmental and health education programmes. This very basic type of intervention is currently being implemented in 13 *favelas*. The second type is “*urbanização comunitária*” (“incremental upgrading”), which comprises social development and the delivery of emergency physical infrastructure that may include drainage, water, sewage and local access roads. This is being implemented in 35 *favelas* in the municipality.

The third and most comprehensive type of upgrading is “*urbanização diferenciada*” (“comprehensive upgrading”), currently being implemented in four *favelas* in the municipality. Here, an attempt is made to transform *favelas* into neighbourhoods with physical infrastructure, social and economic development, and housing improvements. Santo André is currently engaged in this level of comprehensive upgrading involving 5,000 families in the four areas of Capuava, Sacadura Cabral, Tamarutaca and Quilombo. This includes the delivery of:

- **Physical infrastructure:** including water and sewage networks, solid waste collection, electrification and public lighting, paving of local access roads, storm water drainage, and provision of community and recreational facilities.
- **Shelter upgrading:** including the provision of advisory services to support self-help construction, as well as micro-credit for house improvements.
- **Tenure:** provision of security of tenure. The focus is on security rather than only on legal tenure.
- **Social and economic development:** including income and employment-generation programmes, vocational training, the construction of business units, environmental education, organizational and leadership development, and the minimum income programme. For example, the project “Jardim Santo André” integrates physical upgrading with income and employment-generating programmes as well as education projects. This includes the implementation of a community-based micro-finance system designed to channel credit to informal enterprises and communities through simple procedures and flexible guarantee mechanisms.

Although these interventions would go some way towards improving the quality of life of *favela* residents, they do not adequately address envi-

12. Prefeitura Municipal de Santo André, Prefeito Eng. Celso Daniel. (1997), *Integrated Strategy for Urban Poverty Reduction*, Secretaria de Desenvolvimento Urbano e Habitação. Departamento de Habitação.

ronmental considerations. In order to address these shortcomings, a fourth level of upgrading strategy, with specific applicability to environmentally sensitive areas such as the watershed protection areas includes:

- **Work to restore damaged areas.** These are essentially technical measures that can be implemented, including structural works (such as filtration ponds that can be attached to open surface stormwater drains, bench terraces to help control erosion or improve land stability, gully plugs to fill holes in the bank of a stream and water diversion channels to manage surface runoff and sedimentation), vegetative contouring (using vetiver grass, fodder grasses and hedges) and reforestation. Initial interventions have involved cleaning areas damaged by raw sewage, as well as replanting native vegetation.
- **Community-based environmental monitoring.** Given the density of low-income settlements and the rudimentary level of infrastructure, it is important that ongoing discharge of waste, damage to the environment and new settlement in the watershed protection areas are carefully monitored. Given their intimate knowledge of settlements, residents are best placed to conduct such monitoring, but need to be trained and equipped to do so. *Câmara Técnica* is currently responsible for coordinating community monitoring, which is done in conjunction with SEMASA.
- **Environmental education.** The provision of physical services needs to be complemented with education programmes targeting key groups within *favelas*. Although women have historically been excluded from decision-making within *favelas*, they are strategically important actors in this arena given their strength in collective consumption issues. SEMASA has been engaged in environmental education in the watershed protection areas since 1996. Since early 2000, other municipal offices including the Youth Office and the Gender Office have also been active in this area, where most work has focused on the Paranapiacaba and Parque Andreense sections of the watershed protection areas.
- **Community-based solid waste management.** In solid waste management, education programmes can achieve significant changes in population behaviour, but training and credit support can complement these in order to develop economically viable enterprises that will take responsibility for garbage removal. Community-based recycling has been implemented in the urbanized portion of Santo André for a number of years and has been expanded into the watershed protection areas.
- **Tenure.** Upgrading will not only increase the attractiveness of land to aspirant settlers but will also result directly in an increase in land value. Alternative forms of tenure that diminish the market value of land – such as a buy-back option within group title systems – are among the options to be considered when delivering tenure as part of upgrading, but these have not been finalized and are the subject of current discussions between stakeholders.
- **Ongoing funding.** A creative solution to the problem of finding the capital costs for upgrading may be an environmental fund which is in the process of being established. Revenue for the fund will come from taxes and property taxes as well as from penalties on land users who transgress environmental standards.⁽¹³⁾ In addition, a participative budgeting process conducted by budget councils (*conselho municipal*), comprising an equal number of representatives from the municipal administration and the community, ensures that *favela* residents are

13. Prefeitura de Santo André. (1998), *Meio Ambiente*, Política Municipal de Gestao e Saneamento Ambiental, Lei No 773, 14 de outubro de 1998.

included in decision-making about municipal budget allocations. These councils have already made decisions about funding allocations for sanitation infrastructure in the Parque Andreense Gleba III within the watershed protection area, implementation of which began in early 1999.

Santo André's existing approach to upgrading is an advance over many approaches reported in the international housing literature in the 1990s.⁽¹⁴⁾ As with some of the more advanced upgrades that have been widely implemented in the Brazilian context,⁽¹⁵⁾ Santo André is implementing a participatory, comprehensive approach that integrates socioeconomic and physical improvements. Moreover, linking project level activities with broader municipal programmes ensures that the focus does not remain confined to the level of settlement locality. Integrating environmental monitoring and environmental education – activities that are seldom integrated into informal settlement upgrading projects – could potentially further strengthen the municipality's approach.

Community awareness of the implications of uncontrolled settlement in the watershed area has been heightened as a consequence of the project. For the first time, residents have been involved in discussions about alternative layouts and plot demarcation, tenure options and the implications of future settlement. Although it is still too early to quantify impacts in terms of changed water quality and changes in settlement patterns, awareness and cooperation from existing settlers have contributed to the ability of the municipality and SEMASA to curb new settlement in the watershed protection areas since early 2000. The challenge now is to expand this process to encompass all settlements within these areas – which include not only Santo André but also neighbouring municipalities.

IV. CBWM: A FRAMEWORK FOR ADAPTIVE MANAGEMENT

a. The Planning Process

AN IMPORTANT ASPECT of the approach being used in Santo André is that the CBWM framework is the *outcome* of the planning process. This is in direct contrast to master planning, where the plans or frameworks are the starting point into which "reality" on the ground is then supposed to fit. A simple framework has been used to guide the planning process in Santo André, which provides a structured method while simultaneously allowing the flexibility that is necessary when working with both formal and informal settlements. As indicated in figure 3, the stages of initiation, design, installation, and operation and maintenance – with monitoring and feedback of information from earlier steps of the process – are the key elements in watershed management.⁽¹⁶⁾ Underpinning each of these four stages of development is a planning process – indicated by the shaded blocks on the left of figure 3. At each stage, this planning process can be broken down into a set of eight steps.⁽¹⁷⁾ These are described in the right-most column of figure 3.

As noted earlier, it is important not to embark immediately upon an attempt to plan the watershed management system. Rather, the first step should be the *planning of the planning process* itself ((n-1) in figure 3. Decisions made at this (n-1) stage will guide the next stage in the development process, which focuses on substantive planning – or, in this case, *planning the watershed* (n). While this paper has focused only on these first two

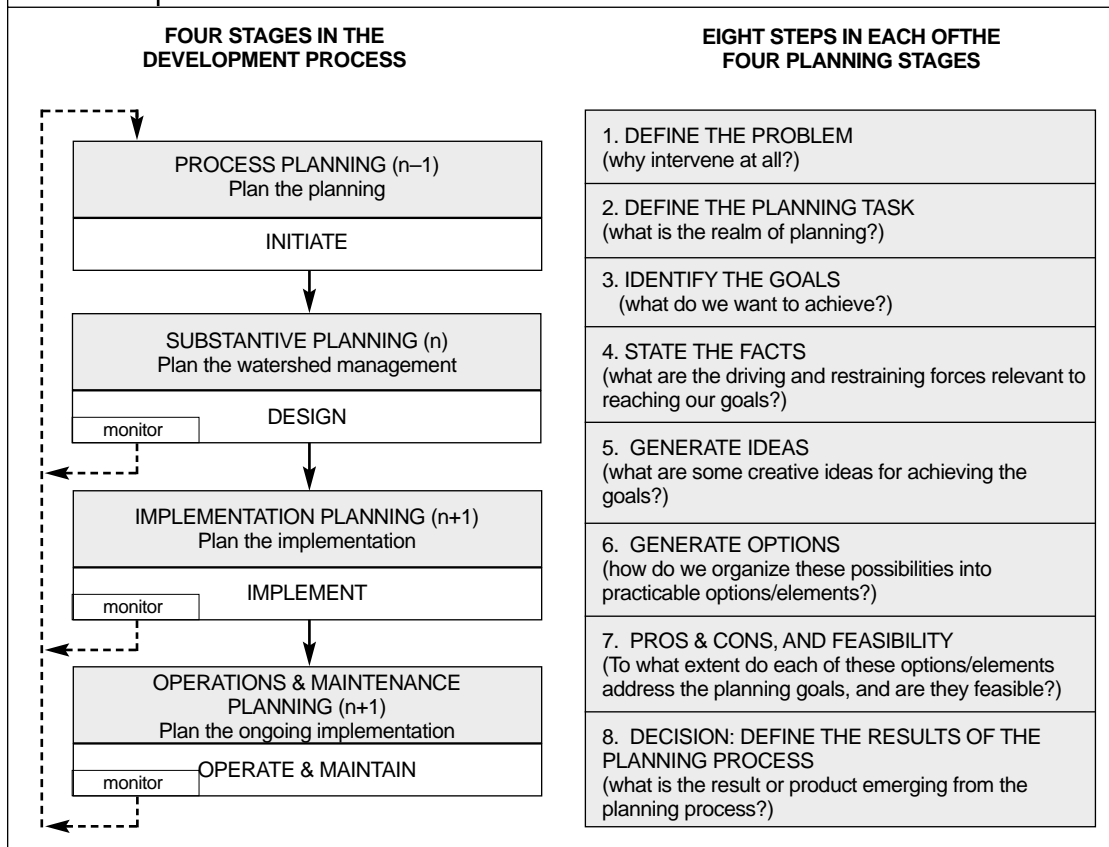
14. See, for example, van der Linden, J (1994), "Incremental servicing and housing: where do we go from here?", *Third World Planning Review* Vol 16, No 3, pages 224-229; also Durand Lasserre, A and R Pajoni (1993), *Managing the Access of the Poor to Urban Land: New Approaches for Regularization Policies in the Developing Countries*, Urban Management Programme Symposium, Mexico City, World Bank-UNDP-UNCHS.

15. See, for example, Pamuk, A and F A Cavallieri (1997), "Alleviating urban poverty in a global city: new trends in upgrading Rio de Janeiro's favelas", *Habitat International* Vol 22, No 4, pages 449-462.

16. See Hufschmidt, M M (1986), "A conceptual framework for watershed management" in Easter, W K et al. (editors), *Watershed Resources Management: An Integrated Framework with Studies from Asia and the Pacific*, Studies in Water Policy and Management No 10, Westview Press, Boulder, Colorado.

17. See Boothroyd, P (1991), *Developing Community Planning Skills: Applications of a Seven Step Model*, Centre for Human Settlements, University of British Columbia, Vancouver; also Holling, C S (1978), *Adaptive Environmental Management and Assessment*, John Wiley and Sons, Chichester.

Figure 3: Planning steps within each stage of the watershed management process



stages, a similar process needs to be undertaken when planning the implementation of the watershed management plan (n+1), and planning the ongoing operation and management of the watershed (n+2).

Although upgrading is only one element of the CBWM framework, some important principles can be discerned from the process that has been conducted thus far. CBWM is a multi stakeholder approach to planning that aims to achieve a balance between human settlement and the environment. A strength of this approach lies in the way in which it integrates biophysical, sociopolitical and economic elements into the watershed management process. Via a multi stakeholder planning framework, this approach explicitly seeks to bring existing conflicts to the surface and to develop mechanisms to deal with them in a constructive manner. Furthermore, CBWM aims to put in place the economic and institutional mechanisms designed to rehabilitate and restore environmentally sensitive areas that have already been damaged, and to protect areas that have not yet been damaged or settled.

As noted earlier, the approach to land use planning in Brazilian cities has historically been exclusionary in nature. CBWM, in contrast, recognizes that communities possess a great deal of useful knowledge that can be used in the planning process. Consequently, this process has been designed to include a wide range of stakeholders in the conceptualization, design and implementation of planning guidelines. In particular,

CBWM involves people in the planning and development process as stewards of the environment. This includes marginalized groups such as low-income *favela* communities, women and “illegal” residents who have traditionally been excluded from decision-making processes. In addition, project planning and policy-making involves working with administrators and professionals involved in projects on the ground, which is more likely to contribute to their commitment to the success of these strategies than would be the case if the framework was imposed from above.

The adaptive learning nature of the planning process means that the CBWM framework will be subject to ongoing revision. Lessons learned throughout the planning process will continually be fed back into the design of the CBWM framework. This framework is therefore not a fixed, static set of rules to be applied to the problem at hand. Rather, it is an adaptive management framework that will be continually revised, based on “learning by doing”, in order to take into account changing circumstances on the ground as well as lessons learned in various stages of the planning process. This is intended to contribute to ongoing improvement and strengthening of the framework, and thereby of the management of watersheds in the region.