# Strategic spatial planning and environmental management: the impact of Guanabara Bay Cleaning Programme in Rio de Janeiro

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## Abstract

This paper looks at a prominent example of planning for sustainable development in Rio de Janeiro, namely the Guanabara Bay Cleaning Programme. We examine the role of the Guanabara Bay Cleaning Programme against the background of socio-economic and spatial trends in the last decade, identifying patterns of segregation and polarization on these levels. Beyond the fact that such patterns follow urban development tendencies under the impact of globalization which also have been documented elsewhere, we are interested here in looking at how the Guanabara Bay Cleaning Programme has contributed to reinforce existing trends of spatial and socio-economic segregation through the way in which sanitation infrastructure has been implemented in different areas of the city. In order to do that, we look here at two neighbourhoods located on opposite sides of the same, heavily polluted Guanabara Bay. The first is Icaraí, a high-income area where the beach, despite being polluted and being closed for bathing for many years, has remained a recreational amenity. The second is Maré Complex, a low-income community which has been closed off from the bay by series of urban interventions, such as the free-way containing the main traffic towards Rio de Janeiro International Airport. The Guanabara Bay Cleaning Programme interventions in both areas have contributed to perpetuate and reinforce existing patterns of spatial segregation, both between neighbourhoods of different socio-economic status and between such neighbourhoods and potential environmental amenities.
*Keywords: Guanabara Bay Cleaning Programme, strategic planning, environmental management, sustainability, Rio de Janeiro, urban development.*

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## 1 Introduction

An earlier study on intra-metropolitan inequalities in Rio de Janeiro [8] analyses the impact of the Guanabara Bay Cleaning Programme (GBCP), the biggest environmental management programme in Brazil in the last three decades with a budget of US$ 860.5 Million. The main conclusion of that study was that whilst the GBCP plays an important role in improving existing infrastructure of low-income areas in the Rio de Janeiro Metropolitan Area, it has also contributed to reaffirm inherited patterns of spatial segregation between different social groups through the design and implementation of sanitation facilities. In addition, the GBCP has limited its environmental approach in the process of implementation and instead of dealing with the Guanabara Bay as a complex ecosystem it has narrowed its scope down to become a sanitation programme. In this paper we move from an analysis at a metropolitan scale, to an investigation at a local scale, focusing on two neighbourhoods located on the Guanabara Bay's waterfront, tracing the impact of GBCP interventions in each of those areas and thus providing further evidence and documentation for the above claims.

## 2 The Guanabara Bay Hydrographical Basin (GBHB)

The Guanabara Bay Hydrographical Basin (GBHB) accommodates 2/3 of the entire metropolitan population of Rio de Janeiro (approximately eight million people). The vast majority of that population lives in Guanabara Bay's North Zone and consists of low-income groups housed in modest residential schemes or in informal settlements [9]. The Guanabara Bay's South Zone on the opposite side of the Guanabara Bay accommodates, by contrast, high-income social groups living in flats costing up to € 1.5 million.

The Guanabara Bay Area receives 17 $m^3$/second of domestic sewage – that is 465 tons per day, only 68 tons of this sewage has had some kind of treatment and most of that treatment is just primary. In addition, it receives a large volume of industrial waste: 64 tons/day of organic material and 0.3 tons/day of oils and heavy metals (chrome, lead, zinc, mercury, etc). On the whole, 7 tons/day of waste are released by oil refineries and ports [5, 6].

Other sources of pollution are the rivers belonging to GBHB that have been contributing with 4,000,000 tons/year of waste. In addition, there are many garbage landfills, official and unofficial, that have a large environmental impact and release 800 litres/day of *chorume* (extremely toxic liquid that leaks from solid waste landfills) in the Guanabara Bay. Another type of intervention with a large degradation impact are landfills which cover 91 $km^2$, an area which previously integrated the Guanabara Bay – that amounts to 29.1% of its area. These landfills have contributed to a pronounced depletion of the Bay's ecosystem, mainly due to the destruction of mangroves – an essential feature of the Guanabara Bay. Those mangroves that originally covered an area of 260 $km^2$ are confined today to only 82 $km^2$ [2, 5].

## 3 Guanabara Bay Cleaning Programme (GBCP)

The Guanabara Bay Cleaning Programme (GBCP) was launched as an aftermath of the Rio World Summit in 1992 with an initial budget of US$ 860.5 million.

The Guanabara Bay Cleaning Programme has mainly focussed on the provision of sanitation infrastructure (an activity which takes up 88.19 % of the overall budget of the programme). This has been realised through the creation of a sanitation belt around the Guanabara Bay with the construction of new sewage treatment units and the upgrading of existing ones, as well as the extension and implementation of sewer pipelines, collectors and submarine emissaries [3, 6]. The choice of location for sanitation facilities can be described as a piece of strategic urban planning, which has had an important impact on the spatial organization of local neighbourhoods.

This paper looks at two neighbourhoods containing sewage treatment units which were either implemented or upgraded by the GBCP. The first is Maré – located on the North Zone – an area which contains the biggest complex of "favelas" (informal settlements) in Rio de Janeiro. The second is Icaraí, a high-income neighbourhood located on the Guanabara Bay's South Zone.

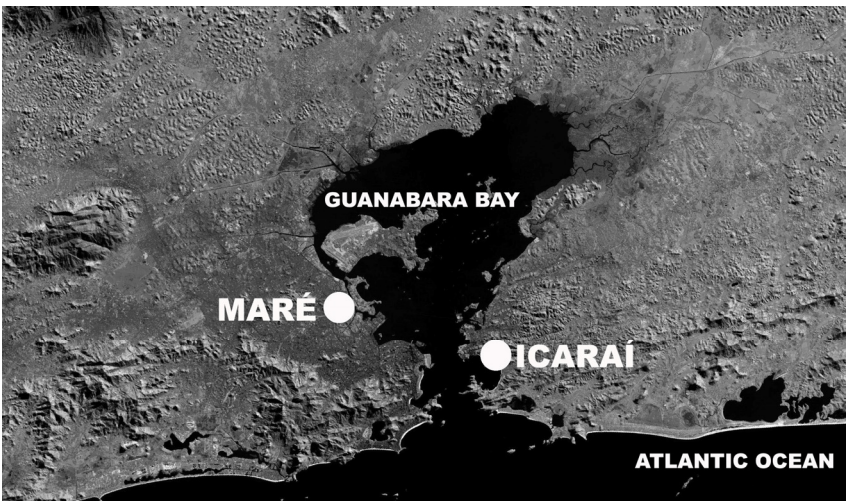


Figure 1: Location of Maré Complex and Icaraí in Rio de Janeiro.

## 4 The Maré Complex

The Maré Complex, occupying a landfill on what used to be the Inhaúma Inlet, is the most polluted spot of the Guanabara Bay and one of the poorest and most dangerous urban areas of Brazil – it has been dubbed *Gaza Strip* by the media. It is composed of sixteen communities and it is the biggest agglomeration of shantytowns in Rio de Janeiro. It has 132,176 inhabitants distributed in 38,273

houses and represents 1.13% of the population of the Rio de Janeiro Metropolitan Area [4].

In the year 1500, at the time of the arrival of the Portuguese colonizers in Brazil, the Inhaúma Inlet was composed of beaches, islands and mangroves. The environmental degradation process of the Guanabara Bay goes back to the XVI century when the Portuguese colonizers completely depleted pau-brasil tree resources and also banished or killed all the indigenous population in the region. But a pronounced increase in the degradation process happened in the XX century when the scale of urban development placed the Guanabara Bay ecosystem under enormous pressure. During the XX century the Inhaúma Inlet was plugged up by several landfills implemented by the public sector, informal communities and private companies. The biggest landfills were made by the public sector based on a sanitation discourse that described the indigenous mangrove vegetation as a health hazard. At the same time, a rapidly growing population and accelerated industrialization accentuated the degradation of that part of the Guanabara Bay.

Brasil Avenue, constructed in 1946, is another important historical landmark in the process of environmental degradation of the Guanabara Bay and in the development of the Inhaúma Inlet as an urban site. This historical moment coincides with the inception of the Maré Complex. Brasil Avenue is the main motorway in the metropolitan area linking the south and north regions on the west side of the Guanabara Bay. From its construction to the 1980s, Brasil Avenue has made possible intense urban development on reclaimed land and in the remaining mangrove areas [1]. The latter takes the form of so-called "palafitas" – fragile, recycled timber houses built in the swamp.

The Maré Complex became one of the most notorious Brazilian symbols of urban poverty. In this context, in 1979 the Federal Government announced the Rio Project, an ambitious sanitation programme that had as its main goal the improvement of sanitation conditions around the Guanabara Bay. The project was only partially executed; but in the Maré Complex all the "palafitas" were removed and the population was located in four social housing complexes. These were constructed on landfills where the "palafitas" used to be and a new sanitation system was implemented. After that intervention, the growth of Maré Complex has mainly been characterized by illegal constructions and the collapse of the sanitation system.

As part of preparations for the Rio Summit in 1992, the Maré Complex was impacted by another major public intervention – namely the Red Line Expressway linking Rio de Janeiro's International Airport to the wealthy South Zone and by-passing the low-income neighbourhoods of the Maré Complex. It can be said that the Red Line emerges as a prominent symbol of social inequalities in Rio de Janeiro – the raised expressway creates a traffic link for expensive, air-conditioned cars and at same time shuts out with a wall the inhabitants of the Maré Complex. Both the Red Line and the wall which separates it from the surrounding shanty towns stand as physical barriers between local inhabitants and the Guanabara Bay.

### 4.1 GBCP interventions in the Maré Complex

The Guanabara Bay Cleaning Programme (GBCP) implemented seven new sewage treatment units, the biggest of which was built in the Maré Complex waterfront. Alegria Sewage Treatment Unit, as it is called, was designed to receive sewage from nearly two million inhabitants and to release its waste (sewage after primary treatment) on the Maré Complex waterfront [5, 6]. Construction of Alegria Sewage Treatment Unit started in the late 1990's. The unit is already operational and receives mainly sewage from wealthy neighbourhoods in Rio de Janeiro's South Zone. Sewage from the North Zone is released directly in the Guanabara Bay as collection pipes linking the Maré Complex to Alegria Sewage Treatment Unit are yet to be implemented.

The urban development process of the Maré Complex has been marked by accentuated degradation, and the Alegria Sewage Treatment Unit can be said to have played a role in this process in that it greatly reduces the potential of the waterfront as a leisure area and environmental amenity.

The Maré Complex stands as a diffuse urban spread – concentrating the poorest segments of the society – notorious for narcotics gang warfare, and located in the most polluted spot of the Guanabara Bay, in the vicinity of industries, waste landfills, motorways and now the biggest sewage treatment unit of Rio de Janeiro.

## 5 Icaraí

Icaraí is located in the south-eastern margin of the Guanabara Bay, in the Municipality of Niterói, which has 62,494 inhabitants [7]. During the XX century the population of Icaraí grew rapidly and that neighbourhood consolidated its status as a high-income residential area. The urban development of Icaraí through the XX century can be described according to three important moments.

The first moment was marked by the transferral of the Rio de Janeiro State capital to Niterói in 1903. In this connection, the public sector implemented key urban development policies, promoting infrastructure improvement and the revitalization of the central urban areas.

In this context, important urban interventions took place in Icaraí in the first decade of the XX century: namely, the construction of a tram system linking Icaraí to Niterói City Centre and the construction of a monumental waterfront avenue in the "belle époque" style along Icaraí Beach.

According to the local Mayor at the time, the tram would support urban development in the most exclusive bourgeois quarter of Niterói; and the new waterfront avenue would be the site of hotels, casinos, sports courts and other centres of leisure and diversion. Furthermore, Niterói City Hall was ahead of its time concerning the introduction of an agenda for environmental protection and the exploration of the tourist potential of selected spots of the Guanabara Bay, notably Icaraí Beach.

A second moment points to a somewhat contradictory development: the loss of Rio de Janeiro State Capital status and the construction of the Rio-Niterói Bridge linking the most important municipality of the Metropolitan Area – namely Rio de Janeiro – to Niterói. Such infrastructure investment caused a boom in the Niterói real state market, especially in Icaraí which has since then emerged as one of the most exclusive neighbourhoods in the Rio de Janeiro Metropolitan Area. On the other hand, in parallel to this market boom, Niterói Municipality underwent a period of economic decay, the sanitary infrastructure of Icaraí collapsed and environmental degradation in that part of the Guanabara Bay became extreme. These factors contributed to erode the image of this neighbourhood. Icaraí Beach was closed for bathing. Interviews carried out by the present authors with local residents indicate that they used Icaraí Beach up to the late 1970's, after that, it became impossible to bath in it due to its accentuated environmental degradation.

A last important moment of inflexion in the urban development process of the Icaraí started in the 1990's together with the economical recovery of Niterói Municipality following the oil boom. Two public urban interventions have contributed to the revitalization of this neighbourhood: (a) the opening of the Contemporary Art Museum (1996), designed by the architect Oscar Niemeyer, which is located in the Icaraí waterfront; and (b) the Guanabara Bay Cleaning Programme interventions in Icaraí.

In the 1990s Niterói Municipality introduced, as a strategic planning component, the construction of the "Niemeyer Path," which when completed will rank as the second biggest project ever built by Oscar Niemeyer (the largest being his work in the Federal Capital Brasília). The Niemeyer Path is a set of nine buildings on the Guanabara Bay waterfront aimed at raising the profile Niterói in the international scene. Despite of the Contemporary Art Museum being the only finished building in the "Niemeyer Path", Niterói municipality and especially Icaraí neighbourhood have indeed already significantly raised their profile internationally.

Our interviews with the local organizations point to two main controversies in this project: the first is corruption and the second is the issue of investment priorities. According to those organizations, the budget of the Niemeyer Path is a black box to which they do not have access. In addition, such organizations complain about government investment priorities which relegate to a second plan demands related to social issues such as increasing violence and the growth in the number of homeless people. Despite these criticisms, and in contrast with the Maré Complex case, the Guanabara Bay Cleaning Programme is seen to accommodate by and large local demands by the residents of Icaraí.

### 5.1 GBCP interventions in Icaraí

Icaraí had a sewage unit providing secondary treatment. That unit was built in the 1960s. But its capacity was already exhausted a decade later. Despite of the negative impact in the Guanabara Bay, the GBCP implemented the expansion of the capacity of this unit by changing the level of treatment from secondary to

primary [5, 6]. This decision was based on the fact that the unit did not have available physical space in which to expand.

The GBCP solved the possible negative impacts of the discharge of waste treated at primary stage in Icaraí through the construction of a submarine emissary which releases the waste 3,300 meters away from Icaraí waterfront [5, 6]. The discharge point is exactly in the middle of the deep canal in the Guanabara Bay and there are conflicting analyses about the impacts of releasing sewage in that particular point. Technicians from the Sewage Company say that there are no negative impacts on the Bay. On the other hand, some specialists from NGOs and universities say that there will be long-term impacts.

The fact is that Icaraí Beach has been officially declared suitable for bathing since 2004. And according to the population and local organizations the results are already visible and the dwellers are coming back to use the beach.

The combined actions of the public sector were decisive to improve the life quality of the inhabitants and also to start a speculation process on the state market. At the moment, there are apartments in Icaraí waterfront costing up to € 1.5 million.

## 6 Local residents opinions

The analysis presented in this section builds on a field study carried out by the authors in February/March 2006. Questionnaires were applied to 142 residents in Icaraí (0,23% of the population of Icaraí). In the case of the Maré Complex, questionnaires were applied to residents of the settlement Esperanca – which is the settlement in the Maré Complex closest to Alegria Sewage Unit. 137 residents in Esperanca responded questionnaires (1,72% of the population of Esperanca and 0,10% of the population of the Maré Complex).

The designs of the two sewage treatment units afford different physical and environmental impacts on the local neighbourhoods where they are located. But data from interviews carried out with local residents highlighted the fact that the socio-economical conditions of the inhabitants and their local demands have an important role in their perception of these two interventions.

Despite of the large scale of intervention of the Alegria Sewage Treatment Unit and its impact on the Maré waterfront as a physical obstacle, 62% of the Maré inhabitants are not even aware of the purpose of the building. And of the remaining 38% that know of its purpose, 67% consider the unit a very good public investment that will create jobs and upgrade the neighbourhood for it denotes the presence of the public sector; the other 33% are worried about possible environmental impacts on the neighbourhood, especially related to the bad smells released by it.

Icaraí the interviews highlighted a completely different scenario where nearly all inhabitants know about the Icaraí Sewage Treatment Unit. Respondents made comments about the positive impacts of the unit in the life quality of the neighbourhood, the environmental improvement and also the increase in real state value (by 80%). On the other hand, 20% pointed out that the unit should be located elsewhere, for it represents a function that conflicts with residential land

uses, and which may lead to depreciation in the value of dwellings in the unit's vicinity.

Both Icaraí and Maré Complex are based on the Guanabara Bay waterfront, the very same ecosystem, but the interactions between the inhabitants and the Guanabara Bay in these two areas are completely different.

In Icaraí, 64% of the respondents indicated their use of the waterfront for leisure activities and 18% of that total said that they would be prepared to use the waterfront even more if some public space improvements were implemented. 29% of the respondents affirmed that they do not use the waterfront, but 29% of that total said that would use it if public space improvements were implemented.

In the Maré Complex case, 93% of the respondents affirmed that they do not use the waterfront. Only 7% of them use it (mainly for fishing).

When asked about their level of satisfaction concerning living in their neighbourhoods, 69% of the Icaraí respondents answered that they are very satisfied with their neighbourhood, 23% are satisfied but require some improvements and 8% are dissatisfied. The Maré Complex results show a lower level of satisfaction, where 45% are satisfied, 33% are dissatisfied but demand improvements and 22% are completely dissatisfied.

Finally, when the Icaraí respondents were asked about their opinions about Maré Complex and vice-versa an important spatial stigmatization emerged. 86% of the Icaraí respondents have a very negative opinion ("image of hell", "sewer", "slum", "Brazilian shame", etc…) about the Maré Complex and 24% do not have any opinion about it. But none of those interviewed in Icaraí manifested a positive opinion about the Maré Complex.

When the Maré Complex inhabitants were interviewed, 91% of them had a positive opinion about Icaraí (beautiful, nice beach, well structured, well known, etc.) and 9% did not have an opinion about it.

## 7 Conclusion

The above analysis verifies the assertion that the Guanabara Bay Cleaning Programme (GBCP) has promoted a differentiated pattern of intervention between high-income and low-income neighbourhoods and has, in that way, contributed to perpetuate spatial segregation from the waterfront in the latter and consolidation of the Guanabara Bay as a recreational amenity in the former [8].

The Guanabara Bay is located in the middle of the Rio de Janeiro Metropolitan Area and is of key strategic importance in its urban development. The spatial analysis of the bay area reveals intrinsic inequalities that are reaffirmed through the design of the waterfront and the assignment of land uses. The elaboration and implementation of the GBCP highlight two important challenges both to local authorities and to international agencies that are involved in implementing strategic planning on a regional scale.

The first challenge relates to the question of how to address regional demands as well as local ones. The GBCP case shows that regional goals where not linked with the demands of the residents of the Maré Complex. The physical intervention obliterated the potential of the waterfront as an environmental

amenity. In addition, our interviews highlight the gap between local demands and the GBCP interventions and the fact that community based organizations and residents did not participate in the processes of design and implementation.

This lack of participation reflects a lack of capacity as well as managerial limitations in the agencies involved in the implementation of the Guanabara Bay Cleaning Programme (GBCP) and in the Government of the Rio de Janeiro State. In addition, the interviews with residents of the Maré Complex in particular reveal that lack of participation limits their understanding of the purpose of the sewage treatment unit (let alone its impact). The ostensible endorsement of 67% of that minority (i.e. 38 % of the total) who is actually aware of the purpose of the unit can be seen in the light of the extreme disregard by the public sector vis-à-vis those neighbourhoods. Any public intervention stands out in an indiscriminate landscape of neglect and is taken as a sign of commitment, even if such intervention ignores the potential of the Guanabara Bay as an environmental amenity. The fact remains that the residents of the Maré Complex have to live next door to a unit treating sewage of a population of two million inhabitants. The infrastructural onus is therefore placed on this particular neighbourhood, with little consideration of the potential of the Guanabara Bay as a leisure area and as an environmental amenity.

The second challenge relates to the promotion of a development which operates at the three levels of environment, economy and equity; which in the case of Rio de Janeiro amounts to dealing with extreme environmental degradation, pronounced socio-spatial inequality and serious economic decay as interrelated problems.

The GBCP was managed by a governmental agency in a top-down fashion and its implementation emphasised a sanitation approach that neglected its potential as a strategic element in the development of the Rio de Janeiro Metropolitan Area. But it is important to point out that the initial scope of the GBCP encompassed such three-fold dimensionality of environmental, social and economic goals. This was formulated in the following terms: (a) clean-up the Guanabara Bay, (b) minimize socio-spatial inequalities through provision and extension of sanitation infrastructure and (c) attract investments to the city through the improvement of its image.

The Guanabara Bay clean-up process is far away from achieved. The programme focused in the sewage system expansion, which is definitely an important step in the clean-up process but there are still several interventions required for its completion. In addition, the sewage network expansion put further environmental pressure on the Guanabara Bay as an ecosystem by increasing the amount of sewage which is released in the bay after primary treatment.

Concerning equity, the GBCP expanded the sewage system provision especially to low-income neighbourhoods, but as pointed out above, this analysis highlights deep inequalities of the GBCP treatment between low-income and wealthy neighbourhoods as the Maré and Icaraí comparison reveals.

Finally, the potential of the GBCP as a generator of economic growth has remained unfulfilled. The Guanabara Bay is still far from being cleaned-up and

as our interviews with local inhabitants indicate, parts of the Guanabara Bay, such as the Maré Complex, are still perceived as being highly polluted. So, the ambition of the GBCP that a clean Guanabara Bay would promote a new image of the Rio de Janeiro Metropolitan Area and that it would be a key factor in attracting international events such as the Olympics as well as other investments is still far from being a reality. The case of Icaraí, on the other hand, could support the argument that the interventions by the Guanabara Bay Cleaning Programme may have played a role in increasing in the value of property in that neighbourhood. The extent to which such financial benefit has reached others than real state speculators and those who own property in the area is a matter for further research.

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