

(11) Input Basic Load Parameters

**Load Parameters**

Per Capita Load Generation	
Per Capita BOD Generation (g/(capitaEd))	64
Per Capita TN Generation (g/(capitaEd))	10
Per Capita TP Generation (g/(capitaEd))	2.5
Per Capita F. Coli Generation (No/(capitaEd))	100000000

Unit Load by Treatment Type	
Treatment Type	Unit Load for BOD (g/m3)
Raw Sewage	220
Primary	155
Secondary	75

Basic Basin Data | Basic WWTP Data | **Basic Load Parameters**

Clique duas vezes sobre a célula desejada para alterar seu valor.

(12) View and Edit Detailed Basin Data

**Detailed Basin Data**

Basin Name		Population Data		Hydrological Data		Load Data
Basin ID	Basin Name	Basin Population (persons)	Sewage Treatment Ratio	Average Overland Flow (m3/s)	Basin Distance from Bay (km)	Industrial / Non-Industrial BOD Load (ton/day)
B0100	B. Charitas	30559	0.45	0.171	1.5	0.73
B0200	Canal Conto do Rio	90467	0.45	0.112	1.5	0.03
B0300	B. Detadraz	91390	0.45	0.137	1	0.00
B0400	B. Norte Centro	71373	0.45	0.167	3	0.00
B0500	Rio Bombo	241500	0.23	0.447	2	4.11
B0600	Rio Imboassu	157098	0.13	0.360	3.5	0.00
B0700	B. Itaoca	2578	0.13	0.104	1	0.00
B0800	Rio Alcantara	593400	0.00	2.930	10	1.00
B0900	Rio Cocorobu	256254	0.00	0.570	15	0.18

Detailed Basin Data | Detailed WWTP Data | Detailed Load Parameters

As células em cinza não poderão ter seus valores alterados.

(13) View and Edit Detailed Wastewater Treatment Plant (WWTP) Data

The screenshot shows the 'Decision Support System of Guanabara Bay' interface. The 'Detailed Data' tab is active, displaying a table titled 'Detailed WWTP Load Data'. The table is organized into columns for 'WWTP ID', 'WWTP Description', 'Treatment Method', 'Population Data', and 'Flow Data'. The 'Population Data' column is further divided into 'Sewer District Population by WWTP (persons)' and 'Sewered Ratio'. The 'Flow Data' column is divided into 'Per Capita Water Consumption (lpcd)'. The table contains six rows of data for different WWTPs.

WWTP ID	WWTP Name	Treatment Method	Population Data		Per Capita Water Consumption (lpcd)	no
			Sewer District Population by WWTP (persons)	Sewered Ratio		
WWTP 039	Icaraí	CEPT	183400	0.9	255	
WWTP 036	São Gonçalo	Secondary	207500	0.18	230	
WWTP 006	Serapiú		834100	0.5	240	
WWTP 005	Gramacho		66000	0.9	235	
WWTP 003	Pavuna		847062	0.4	300	
WWTP 004	Acari		550000	0.14	240	

At the bottom of the window, a message reads: "As células em cinza não poderão ter seus valores alterados." (Gray cells cannot have their values changed.)

(14) View and Edit Detailed Load Parameters

The screenshot shows the 'Decision Support System of Guanabara Bay' interface. The 'Detailed Data' tab is active, displaying a table titled 'Detailed Pollution Load Analysis Parameters'. The table is organized into columns for 'Parameter', 'Value', and 'Unit'. The 'Parameter' column is further divided into 'Per Capita Load Generation'. The table contains four rows of data for different parameters.

Parameter	Value	Unit
Per capita BOD Generation	54	g/(capita.d)
Per capita TN Generation	10	g/(capita.d)
Per capita TP Generation	2.5	g/(capita.d)
Per capita F. Coli Generation	100000000	No/(capita.d)

Below the table, there is a section titled 'Model for Load Including Mineralisation and/or Retention of BOD, TN and TP from Source to Bay'. It includes the equation:  $BOD_{bay} = BOD \cdot \exp(-K \cdot BOD \cdot Distance / 86400)$ .

At the bottom of the window, a message reads: "As células em cinza não poderão ter seus valores alterados." (Gray cells cannot have their values changed.)

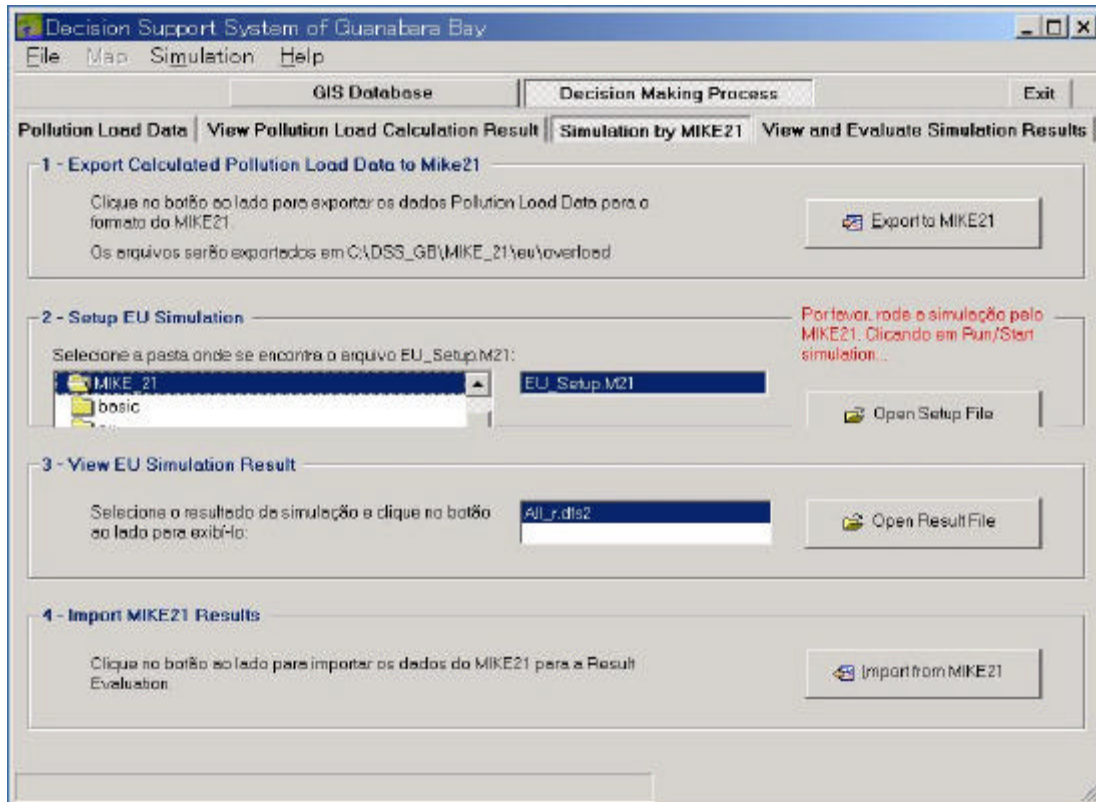
(15) View Basin Load Calculation Result

Basin Load Calculation						
Pollution Load Calculation						
BOD Load Calculation						
Total BOD Load from Basin to Bay				BOD Load for EU Model		
BOD Load by Population with Sewage Treatment (ton/day)	BOD Load by Population without Sewage Treatment (ton/day)	Total Generated BOD Load (ton/day)	BOD Load from Basin to Bay after Self-Purification (ton/day)	Constant DC Load from Rivers to Bay for EU Model (g/m3)	Proportional DC Load from Rivers to Bay for EU Model (ton/day)	
0.74	0.91	1.64	1.48	81.15	0.29	
2.20	2.69	2.72	2.45	204.72	0.49	
2.22	2.71	2.71	2.53	173.52	0.51	
1.73	2.12	2.12	1.72	96.42	0.34	
2.94	10.10	14.21	12.36	259.24	2.50	
1.08	7.40	7.40	5.81	151.18	1.17	
0.02	0.12	0.12	0.11	10.17	0.02	

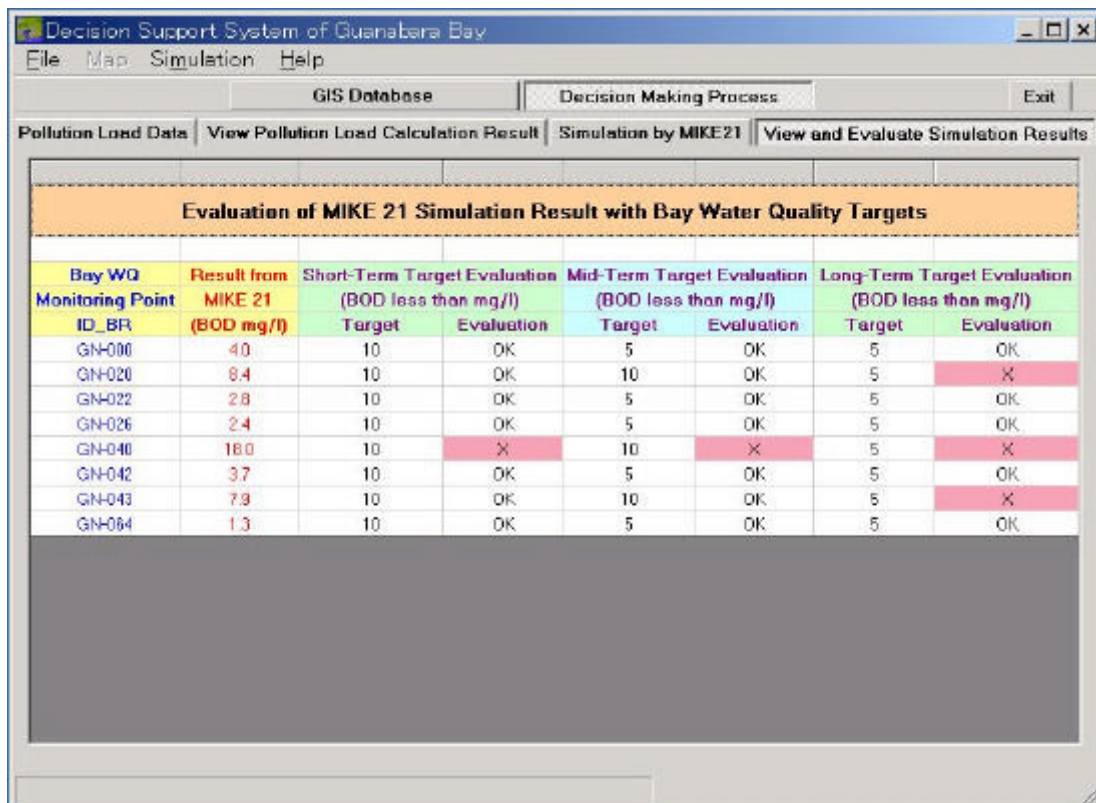
(16) View Wastewater Treatment Plant (WWTP) Load Calculation Result

WWTP Load Calculation					
Load from WWTP to Bay				WWTP Flow	
BOD from WWTP to Bay (ton/day)	TN from WWTP to Bay (ton/day)	TP from WWTP to Bay (ton/day)	F. Cali from WWTP to Bay (nos./day)	Flow from WWTP (m3/d)	Flow from WWTP (m3/s)
4.01	1.07	0.08	1850600000000.10	42.090	0.487
0.20	0.28	0.07	3736800000000.02	8.595	0.099
2.94	4.09	1.09	5447700000000.10	128.021	1.482
0.89	2.19	0.52	23519350000000.00	70.558	0.817
0.66	1.19	0.32	15916376000000.10	44.566	0.516
0.02	0.02	0.01	322740000000.00	2.275	0.026
16.92	0.64	2.09	114478266000000.00	296.105	3.427

**(17) Export Pollution Load Calculation Result, Open MIKE 21 Setup File, Open MIKE 21 Result File and Import MIKE 21 Simulation Result**



**(18) View and Evaluate Simulation Result at Bay Water Quality Monitoring Points**



***SUPPORTING 16***  
***RESIDENTS' AWARENESS SURVEY***

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## SUPPORTING 16 RESIDENTS' AWARENESS SURVEY

### 1. INTRODUCTION

The main objectives of the Residents' Awareness Survey were to appraise the needs and service conditions of basic sanitation services, mainly sewerage but also water supply, and the residents' Willingness to Pay for possible improvement works in the sewerage system. The survey also appraised the health and hygiene conditions of the residents as well as their awareness level about the environmental conditions of the Guanabara Bay and other issues.

### 2. SURVEY PREPARATION

#### 2.1 SAMPLING PLAN

##### (1) Sampling Method and Selection

The residences to be interviewed were selected, by utilizing the smallest unit available for the selection of the sample which was the "Census District" provided (in maps) by IBGE. Each "Census District" encompasses 250 to 350 households, defined by IBGE as the maximum number of households that their Census' surveyor can cover.

It was decided to exclude from our sampling those census districts with very low population density, and with large empty areas. It is important to mention that a census district is always encompassed within the boundaries of a neighborhood. Also, the subnormal settlements ("favelas") are always encompassed in a census district, never mixed with other kinds of settlements in the same census district.

Only one residence was selected for interview in each census district. The interviewers received clear instructions in how to proceed to choose the next residence if the primarily selected residence could not be utilized.

##### (2) Sampling Coverage and Distribution

The sampling covers 600 samples distributed in the Study Area. The distribution was carried out dividing the samples into three groups of 200 samples. These groups were called "segments". The characteristics of each segment are presented as follows.

Segment 1: Regular settlements (excluding favelas) in the Baixada Fluminense municipalities (Belford Roxo, Duque de Caxias, Magé and Nova Iguaçu) and in Itaboraí. These settlements could have had some improvements through small sewerage works or not.

Segment 2: Regular settlements (excluding favelas) in the municipality of Rio de Janeiro. These settlements necessarily had sewerage works, also some works connected to the Guanabara Bay Pollution Abatement Program (PDBG).

Segment 3: Subnormal settlements (favelas) in the Baixada Fluminense municipalities (Magé, São João do Meriti, Nilópolis, Duque de Caxias and Nova Iguaçu) and in Rio de Janeiro. In opposition to the regular settlements, the subnormal settlements are those formed by more than 50 residential units disposed in a "disorganized and dense manner, on a land belonging to third party, and lacking essential public services", according to the definition established for the IBGE Census 2000 (*Table 1*).

A list with the number of samples selected for each segment is provided as follows.

**Table 1 Distribution of Samples into SEGMENTS**

SEGMENT 1		SEGMENT 2		SEGMENT 3	
Municipality	Samples	Municipality	Samples	Municipality	Samples
Belford Roxo	39	Rio de Janeiro	200	Duque de Caxias	12
Duque de Caxias	56			Magé	4
Itaboraí	28			Nilópolis	1
Magé	26			Nova Iguaçu	1
Nova Iguaçu	51			Rio de Janeiro	179
				São João de Meriti	3
<b>TOTAL</b>	200		200		200

The spatial distribution of the samples are shown in *Figure 1*.

## 2.2 INTERVIEWERS SELECTION AND TRAINING

The selection of the survey team (field supervisors and interviewers) was based on their previous experience in similar surveys, also on their experience in surveying residences in subnormal settlements (favelas) in which due to the existence of particular conditions the approach has to be carried out very carefully.

The interviews were carried out by a team of outstanding undergraduate students at the State University of Rio de Janeiro (UERJ), all of which underwent a training program comprised of technical skills along with ethical and theoretical background. These interviewers (24) were distributed in groups that were supervised by field supervisors (4).

The interviewers were introduced to the objectives of the survey and of the research tools. At the initial phase, we briefed the interviewers on the work plan including: a) purposes, b) sample plan, c) data processing plan, d) the manner the interview has been conceived, and e) the manner the data should be processed.

The questionnaire was clarified in a step-by-step manner, each question intention being explained and defining possible behaviors in face of expected situations during the field work.

## 2.3 QUESTIONNAIRE

The questionnaire was elaborated in order to fulfill with the survey's main objectives as presented in the beginning of this Chapter. The final format of the questionnaire is presented in Appendix 1 at the end of this Chapter.

## 3. SURVEY RESULTS

The "segments" above described are named hereinafter as S1 for Segment 1, S2 for Segment 2 and S3 for Segment 3.

### (1) Construction Characteristics, Location and Infrastructure

In terms of topography, most of the samples in S1 and S2 are located in "flat" areas (85% and 91%). S3 samples are more equally distributed in "flat" and "hilly" areas (54.5% and 41%). As for problems caused by occupation of inappropriate topography areas, most of the S1 samples are

located in “flat areas with flooding problems” (38.5%) while 6% of the samples of S3 are located in “hilly areas with land sliding problems” (the highest percentage among the three segments) (*Table 2*).

In S1 and S3, by far the majority of the surveyed residences were single houses (99.0% and 98.5%). In S2, the percentage of surveyed apartments was the highest among the three segments (26%). (*Table 3*).

In the three segments, by far the majority of the surveyed residences were built with masonry (96.5%, 99.5% and 97.5%, respectively for S1, S2 and S3). (*Table 4*).

As for infrastructure, electricity was available for all the segments' residences, except for S1 where 1.5% (equivalent to 3 residences) were not provided with this service. In general, though, we can say that the surveyed residences are well served with electricity. As for street lighting, the S1 again falls behind with 10.5% of its residences not provided with this service. S3 have the same problem for 4% of its residences (*Table 22*).

Street paving is also a problem for S1. Only 50% of the residences were provided with paved streets. In second place comes the S3, with 14.5% of its residences with the same problem (*Table 23*).

As for garbage collection, the situation reverts and now the S3 is the one with more problems. Only 56% of its residences have garbage collection at their doors, while for the other two segments this percentage corresponds to 89.5% (*Table 23*).

Although the S3 corresponds only to “subnormal” residences, i.e., those located in the so called “favelas”, it seems that their conditions in terms of location, construction material, availability of electric energy, and street lighting and paving are better than those residences located in S1. S3 only falls behind when talking about garbage collection, probably because of the dense and disorganized occupation which didn't leave room for streets in which the collection truck could transit.

S2 is better than the other two segments in all the items, and besides has the higher number of apartments, which could be a sign of an orderly but also dense land occupation.

## **(2) Family**

Most of the interviews were answered by either the family head or his/her partner (*Table 6*). Most of them were answered by women (*Table 7*). The majority of the respondents were over 19 years old (*Table 8*).

In all the segments, most families were formed of four (4) members or less, but the figures representing families with five (5) members or more can not be considered negligible (36% for S1, 26.5% for S2, 33% for S3) (*Table 9*).

The figures for two or more families living in the same house are not representative although existent (*Table 5*).

In all the segments, most of the family members are 19 (nineteen) years old or less (39.7% for S1, 27.4% for S2, 41.8% for S3). These figures are particularly high for S1 and S3, showing a very young population in these areas (*Table 13*).

### (3) Economic Status

In both S1 and S3, the families with income of less than 3 MW (Minimum Wage), i.e. less than R\$ 600 (US\$ 191.69, as of September 9, 2002), represent 48.5% and 58.0% of the total interviewed families, respectively. The subnormal settlements (S3) are where the poorest live, followed by S1. On the other hand, families receiving less than 3 MW in S2 represent only 20% of the total, while 31% earn more than R\$ 2000 or 10 MW (*Table 10*). It seems that S2 gathers the better-off families.

The above statement is reinforced by the figure on the average per capita income of the interviewed families. The per capita income for S2 is R\$ 433.00, while for S1 and S3 this is R\$ 188.0 and R\$ 184.00, respectively (both figures lower than the Minimum Wage of R\$ 200). These figures are pushed down also by the fact that in these two segments the percentage of residents without any income source is also higher (53.3% for S1, 55.1% for S3) (*Table 14*).

As for the appliances and goods available at the residences, in more than 90% of all the segments' residences, with slight differences, there are the following appliances: gas stove, color TV, refrigerator and electric fan (*Table 67*). As for telephones, most of the residences, in all segments, have either conventional telephone set or mobile phone, or both (S1 - 71.5%, S2 - 92.0%, S3 - 76.5%). Again, we observe similarities between S1 and S3. Also, in S2 the percentage of those having both conventional telephone set and mobile phone is the highest one (58.0%) (*Table 68*). Despite the differences between S1 and S3, on one side, and S2 on the other, the high percentage of telephones, of both types, in the residences is a good sign of better chances to get work. Communication is vital for this purpose.

A computer set is available in 32.0% of residences in S2, and in 6.5% of residences in S1 and S3. This tool which is an important item also for income generation appears five times more in S2 in comparison to the other segments, what reinforces the idea of a better economic status in this segment (*Table 67*). The residents of S1 and S3 seem to be on the other side of the digital divide, or as expressed here in Brazil, they are digitally excluded.

### (4) Water Supply

As expected, the coverage of water supply is quite high in S2 (98%). Even in the subnormal settlements (S3), this coverage reaches 90.5%. The surprise is given by the figure for S1 where the coverage of water supply is very low (60%) in comparison to the Southeast region standards (approximately 96%<sup>1</sup>) (*Table 25*). As already shown in item (1), the infrastructure conditions in S1 are worse than in S3 although the first one is considered a "regular settlement", as for the IBGE standards.

The frequency of water supply is also the worst for S1. Even for those connected to the water supply distribution system, only 44% of them have water in a daily basis (*Table 26*).

In terms of micro-measurement, the three segments are very different. The S2 has the higher percentage of water connections with water meter (71.4% out of which 1.5% is not operative). For S1, this figure is much lower: 36.7% out of which 2.5% is not operative. In subnormal settlements (S3), the percentage of connections with water meter is very low, only 8.9%. (*Table 30*).

<sup>1</sup> "National System of Information on Sanitation (SNIS), Diagnosis of Water Supply and Sewerage Services - 2000, in Table 1 - SUMMARY, Group 1 - Regional coverage sanitation companies" (including CEDAE).

As for payment of water supply, excluding those who didn't reveal how much they pay on the bill, the differences among the segments are similar to that shown in the above paragraph. In S2, only 18.1% of the households pay less than R\$10/month. For S1, this figure raises to 62.5% and, for S3 it escalates to 91.0%. For both S1 and S3, the percentage of those who don't pay anything is also high, 53.6% and 80.3%, respectively (*Table 32*).

In average, excluding those who didn't reveal how much they paid and those who paid nothing, the household expense with water bill is as follows: R\$ 24.00 for S1 and S3, and R\$ 40.00 for S2 (*Table 34*).

Water payers (those connected to the water supply system) represent the following figures for the three segments: 43.3% for S1, 85.7% for S2, and only 18.2% for S3. Among these payers, most consider the price reasonable (S1 - 55.8%, S2 - 59.5%, and S3 - 90.9%). For S1 and S2, those considering the price high represent 38.4% and 38.1% of the payers, respectively (*Table 36*).

As already mentioned, it was found in S1 that the highest percentage of residences are not connected to the water supply system. When asked how much the respondent of these residences would be willing to pay for water supply, 30% said nothing, followed by 25% who would pay R\$ 10 to R\$ 19 (*Table 38*).

Among those who declared the monthly consumption of water (either through the water bill or by estimation), S1 and S3 present the higher percentage of monthly consumption of "10 m<sup>3</sup> or less" (76.2% and 66.7%, respectively). On the other hand, S2 presented the higher consumption over 20 m<sup>3</sup>/month (45.1%) (*Table 39*). In average, the monthly consumption of the household is as follows: S1 - 8.8 m<sup>3</sup>/month, S2 - 22.7 m<sup>3</sup>/month, and S3 - 7.5 m<sup>3</sup>/month (*Table 40*).

For all the segments, the most water consuming activity was declared to be "Laundry", followed by "Cooking and Washing Dishes" and "Shower" (*Table 41*).

## **(5) Sewerage**

Among the survey residences, the percentage of those connected to the sewerage system is as follows: 70.5% for S1, 97.5% for S2, and 85.0% for S3. Thus, 29.5% of the residences in S1 are not connected to the sewerage system and find various forms to dispose off their sewage (*Table 42*).

As for those connected to the sewerage system, most of them declared to be "satisfied" with the CEDAE work (S1 - 73.0%, S2 - 80.5%, and S3 - 80.0%) (*Table 45*). Among those who were not satisfied, the main reason for dissatisfaction was that "CEDAE does not unclog pipes and street drains" (*Table 46*).

Those connected to the sewerage system were asked if they knew the destination of the sewage collected from their residences. Most of them said they didn't know where it goes (S1 - 64.6%, S2 - 65.1%, and S3 - 70.5%) (*Table 47*).

## **(6) Willingness to Contribute**

When asked if he/she was willing to contribute (pay) for an adequate collection and treatment of sewage or for good maintenance of the sewerage system, most of respondents in S1 and S2 answered "NO" (73.0% and 73.5%, respectively). Only in S3, those willing to contribute were majority (55.0%). Breaking down the figures - only for S1 and S3 that presented significant number of "not connected" (29.5% and 15.0%, respectively) - in this particular universe the trend

is reinforced, i.e., in S1 the percentage of those “not willing” to contribute increases (78.0%) while in S3 the percentage of those “willing” to contribute increases (63.3%) (*Table 50*).

The main reason pointed out for not contributing, in all segments, is “cannot afford to pay” (S1 - 54.8%, S2 - 41.2%, S3 - 61.1%). The second main reason differs for all the three segments. For S1, the second main reason is “already pay taxes / taxes are high” (27.4%). For S2, they say they “already pay an extra charge added to the water bill for sewerage” (21.6%). And for S3, the second main reason is “this is Governments’ / politicians’ job” (17.8%) (*Table 53*). Residents in S2 seem to give more attention to what is charged through the water bill than the other segments’ residents.

*Table 51* presents the relation between family income and willingness to contribute to all the segments. In S1 and S3, the differences are not so remarkable, i.e., the family income does not interfere so much in the rate of those willing to contribute. In S2, although in not a remarkable manner, the “higher the income the higher the willingness to contribute” trend is much clear.

As for the contribution amount, most respondents would contribute with R\$10.00, and this percentage is particularly high for S3 (45.5%). It is interesting to notice that also for S3, the percentage of those willing to contribute with values above R\$10.00 (25, 50 and 100) is also higher than in the other segments (*Table 52*).

It seems that the residents in subnormal settlements (S3) are more willing to pay for improvements in the sewerage system than the residents in regular settlements (S1 and S2). They are also willing to pay more. This may be related to the feeling of acquired “rights” in case of the residents in regular settlements, in opposition to those living in “subnormal” settlements.

## **(7) Hygiene Conditions**

The majority of the residences in all segments have at least one toilet. For S2, a considerable percentage have two toilets, 30.5% (*Table 55*). Also, the majority of them have a exclusive toilet in the house, not having to share it with other families (*Table 56*). Other sanitary appliances at the residence can be seen in *Table 54*.

Most of them filter the water (either tap water or from another source) before drinking it. However, as for S1 and S3, in not a negligible number of residences water is drunk without any treatment. Some of them, buy mineral water for drinking purposes (*Table 57*).

As for water borne diseases, those recorded (for some of the residents) in the past 12 months before the survey (09/01 - 09/02), Dengue Fever and Diarrhea appears as the most frequent ones. The figures for dengue fever were the highest for S2 (40.5%) and the lowest for S3 (27.0%). In fact, coinciding with this period, Rio Metropolitan area had an outbreak of dengue fever (along with other cities in Brazil) which not necessarily had to do with specifically bad hygiene conditions. The larvae of the mosquito transmitting dengue fever grows in stagnant and clean water. That is maybe why the figure for subnormal settlements is smaller than that for regular settlements.

On the other hand, Diarrhea was present in 32.0% of S1 and in 30.5% of S3, and in only 21.0% of S2, what directly implies that hygiene conditions are better in S2 (*Table 58*).

The percentage of residents affected by infectious diseases in the past 12 months and the percentage of family annual income spent on treating these diseases in the same period are shown in *Tables 59* and *60*, respectively. *Table 61* presents the average duration of leaves of absence taken by the residents affected by infectious diseases and regularly working in the past 12 months.

## (8) Perception of Problems

When asked about the problems or needs within their communities, the residents of S1 and S3 gave the same answers for the first and second main problems/needs. For them, “basic sanitation infrastructure” (66.5% and 50.0% for S1 and S3, respectively) and “urban infrastructure in general” (49.0% and 35.5% for S1 and S3, respectively) are the two main ones. This is very different for S2. For this segment’s residents, the main problem/need is “security, violence” (44.5%), followed by “basic sanitation infrastructure” (38.0%). Once again, we can observe similarities between S1 and S3 (*Table 62*).

The respondents were also asked about the main health problems within the family and the community. Most of them vaguely responded that the problems were diseases. The second and third most given answers though were more specific in pointing out the lack of basic health services and professionals in these services as problems. These seem to worry more the residents in S1 and S3 (*Table 63*).

For a little more than half of the respondents in all the segments, the Guanabara Bay is polluted but this doesn’t affect their lives. The higher percentage of those feeling affected by the pollution of the Bay (47.0%) (*Table 64*) were found in S2.

Among those feeling affected by the Guanabara Bay pollution, the most given reasons for this feeling was the “bad smell” and the fact that they “cannot go for a swim in the waters of the Bay”. Only for S1, the reason “the natural beauty is harmed” appeared as the second most given answer (*Table 65*).

Among those who actually perceive the Bay pollution, the main reason pointed out as causing the pollution was “Domestic Sewage” (*Table 66*).

## Conclusions

Considering the similarities in terms of infrastructure problems present in both S1 and S3, it is possible to infer that part of the S1 samples are located in “irregular land allotment projects” which comprehends land plots sold without proper authorization given by the local government thus without proper provision of infrastructure demanded by the local governments in these cases. The owner of these land plots usually does not have land ownership documents. The residents of these “irregular land allotment projects” are as poor as those living in favelas (S3) and could be characterized as belonging to the same social class.

The main difference between S1 and S3 is the type of land occupation. While in favelas (S3) the occupation is carried out in a dense and disorganized manner, in S1 the occupation follows some standards such as opening of streets and division of the land into regular plots. This could be verified through the differences in garbage collection between these two segments. In S3, most of the residences can not be reached by the collection truck due to the irregularity (straightness and/or steep gradient) of the alleys/streets.

Despite the similarities in terms of income level and infrastructure conditions, respondents in S1 and S3 differ as for the willingness to pay for improvements in the sewerage system. Respondents in favelas (S3) are more willing to pay for this while those in S1, similarly to those in S2, are not. One possible answer for this difference is that, although part of the respondents in S1 live in not legally recognized allotment projects, they have paid for the land as if in a regular project. They bought it as the only alternative to purchase a piece of land due to the lack of other alternatives provided by the official market or the government. Consequently, they may feel they have the

same rights for such services as much as the other citizens have. In case of S2, the willingness to pay rate increases proportionally to the increase of the family income.

Respondents in S1 and S3 are similarly concerned with the lack of infrastructure, mainly sanitation infrastructure, more than the S2 respondents for who the main concern is the urban violence problem. The respondents in S1 and S3 are also concerned with the lack of good medical services which shows their vulnerability in terms of health problems.

More than 60% of all segments' respondents, for those residences connected to the sewerage system, don't know the destination of the collected sewage. For more than 50% of them, the pollution of the Guanabara Bay does not affect their lives. Analyzing these figures, it is observed a great lack of knowledge and interest about the problems the untreated sewage can cause.

However, through awareness campaigns this reality could be changed, also influencing in the rate of willingness to pay for the upgrading of sewerage services. Nevertheless, the willingness to pay rate is proportional to the household financial capacity that should be deeply analyzed in order to adopt any kind of pricing policy.

**Table 2 Characterization of Housing Units According to Local Topography**

Local topography	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
Plain area without flooding problems	93	46.5	153	76.5	76	38.0
Plain area affected by flooding problems	77	38.5	29	14.5	33	16.5
Hill free from landslide problems	19	9.5	12	6.0	70	35.0
Hill with landslide problems	4	2.0	-	-	12	6.0
Others	7	3.5	6	3.0	9	4.5
<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>

**Table 3 Characterization of Residences According to Type**

Type of residence	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
House	198	99.0	148	74.0	197	98.5
Apartment	2	1.0	52	26.0	3	1.5
<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>

**Table 4 Characterization of Residences According to Prevailing Building Material**

Prevailing building material	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
Bricks	193	96.5	199	99.5	195	97.5
Bricks and second hand material	7	3.5	-	-	1	0.5
Wood	-	-	-	-	3	1.5
Second hand material	-	-	1	0.5	1	0.5
<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>



**Table 5 Characterization According to Number of Families Sharing the Same Residence**

Number of families sharing the same residence	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
A single family	195	97.5	196	98.0	198	99.0
Two families or more	5	2.5	4	2.0	2	1.0
<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>

**Table 6 Characterization of Interviewee According to Role Played in the Family**

Role played in the family	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
Family head	100	50.0	117	58.5	94	47.0
Spouse of family head	87	43.5	65	32.5	95	47.5
Others	13	6.5	18	9.0	11	5.5
<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>

**Table 7 Characterization of Interviewee According to Gender**

Gender	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
Women	136	68.0	141	70.5	156	78.0
Men	64	32.0	59	29.5	44	22.0
<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>

**Table 8 Characterization of Interviewee According to Age Group**

Age Group	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
19 years old or less	7	3.5	6	3.0	4	2.0
20 to 29 years old	31	15.5	23	11.5	41	20.5
30 to 39 years old	52	26.0	27	13.5	56	28.0
40 to 49 years old	52	26.0	45	22.5	38	19.0
50 to 59 years old	31	15.5	40	20.0	39	19.5
60 years old or more	27	13.5	59	29.5	22	11.0
<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>

**Table 9 Characterization of Family According to Number of Members**

Number of members	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
One member	4	2.0	18	9.0	10	5.0
Two members	24	12.0	38	19.0	32	16.0
Three members	41	20.5	44	22.0	43	21.5
Four members	59	29.5	47	23.5	49	24.5
Five members	34	17.0	24	12.0	36	18.0
Six members	20	10.0	14	7.0	19	9.5
Seven members or more	18	9.0	15	7.5	11	5.5
<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>

**Table 10 (a) Characterization of Residence According to Family Income  
(In Brazilian Currency - REAIS)**

Family Income	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
Under 200 reais	14	7.0	11	5.5	21	10.5
200 to 399 reais	44	22.0	12	6.0	50	25.0
400 to 599 reais	39	19.5	18	9.0	45	22.5
600 to 799 reais	30	15.0	23	11.5	27	13.5
800 to 999 reais	14	7.0	14	7.0	19	9.5
1000 to 1499 reais	35	17.5	38	19.0	20	10.0
1500 to 1999 reais	13	6.5	22	11.0	8	4.0
2000 reais or more	11	5.5	62	31.0	10	5.0
<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>

**Table 10 (b) Characterization of Residence According to Family Income  
(In Minimum Wages - MW)\***

Family Income	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
< MW	14	7.0	11	5.5	21	10.5
1 MW to < 2 MW	44	22.0	12	6.0	50	25.0
2 MW to < 3 MW	39	19.5	18	9.0	45	22.5
3 MW to < 4 MW	30	15.0	23	11.5	27	13.5
4 MW to < 5 MW	14	7.0	14	7.0	19	9.5
5 MW to < 7.5 MW	35	17.5	38	19.0	20	10.0
7.5 MW to < 10 MW	13	6.5	22	11.0	8	4.0
10 MW or more	11	5.5	62	31.0	10	5.0
<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>

Note: (\*) National Minimum Wage (MW) per month as of Sept. 2002: 200 reais

**Table 10 (c) Characterization of Residence According to Family Income  
(In American Dollars - US\$) \***

Family Income	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
< US\$ 63.9	14	7.0	11	5.5	21	10.5
US\$ 63.9 to < US\$ 127.8	44	22.0	12	6.0	50	25.0
US\$ 127.8 to < US\$ 191.7	39	19.5	18	9.0	45	22.5
US\$ 191.7 to < US\$ 255.6	30	15.0	23	11.5	27	13.5
US\$ 255.6 to < US\$ 319.5	14	7.0	14	7.0	19	9.5
US\$ 319.5 to < US\$ 479.2	35	17.5	38	19.0	20	10.0
US\$ 479.2 to < US\$ 639.0	13	6.5	22	11.0	8	4.0
US\$ 639.0 or more	11	5.5	62	31.0	10	5.0
<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>

Note: (\*) Dollar exchange rate as of Sept. 9, 2002: US1 = 3.13 reais

**Table 11 Income per Capita Considering All the Residents (Not Only Interviewees)**

Family income per capita	Segment 1	Segment 2	Segment 3
In Reais	188.00	433.00	184.00
In American Dollars	60.06	138.34	58.78
In Minimum Wages (MW)	0.94	2.16	0.92

Note: National Minimum Wage (MW) per month as of Sept. 2002: 200 reais  
Dollar exchange rate as of Sept. 9, 2002: US\$ 1 = 3,13 reais

**Table 12 Characterization of All the Residents According to Gender\***

Gender	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
Women	424	50.7	389	52.1	411	52.7
Men	413	49.3	357	47.9	369	47.3
<b>Total</b>	<b>837</b>	<b>100.0</b>	<b>746</b>	<b>100.0</b>	<b>780</b>	<b>100.0</b>

Note: (\*) The "residents" correspond to the sum of all the family members in the surveyed residences.

**Table 13 Characterization of All the Residents According to Age Group\***

Age group	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
19 years old or less	331	39.7	204	27.4	326	41.8
20 to 29 years old	133	15.9	120	16.1	136	17.4
30 to 39 years old	125	14.9	106	14.2	112	14.4
40 to 49 years old	120	14.3	89	11.9	81	10.4
50 to 59 years old	59	7.0	83	11.1	71	9.1
60 years old or more	69	8.2	142	19.0	54	6.9
Did not respond	-	-	2	0.3	-	-
<b>Total</b>	<b>837</b>	<b>100.0</b>	<b>746</b>	<b>100.0</b>	<b>780</b>	<b>100.0</b>

Note: (\*) The "residents" correspond to the sum of all the family members in the surveyed residences.

**Table 14 Characterization of All the Residents According to Sources of Income Held (\*)**

Sources of income held	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
Holding sources of income	391	46.7	406	54.4	350	44.9
Not holding sources of income	446	53.3	340	45.6	430	55.1
<b>Total</b>	<b>837</b>	<b>100.0</b>	<b>746</b>	<b>100.0</b>	<b>780</b>	<b>100.0</b>

Note: (\*) The "residents" correspond to the sum of all the family members in the surveyed residences.

**Table 15 Characterization of Residents Holding Sources of Income According to Origin of these Sources**

Origin of sources of income	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
Jobs	293	74.9	289	71.2	272	77.7
Pension / retirement	84	21.5	136	33.5	60	17.1
Social benefits	30	7.7	7	1.7	41	11.7
Real estate leases	1	0.3	3	0.7	1	0.3
Did not respond	1	0.3	1	0.2	-	-
<b>Total</b>	<b>409</b>	<b>104.7</b>	<b>436</b>	<b>107.3</b>	<b>374</b>	<b>106.8</b>

Note: (1) The universe of this table corresponds to residents claiming sources of income only.

(2) The number of sources of income exceeds the number of residents holding those sources and the 100%, respectively, because a single person can hold more than one source of income.

**Table 16 Characterization of Residents above 15 Years Old According to Employment Situation**

Employment Situation	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
Working	288	51.1	294	51.1	269	52.7
Not working	276	48.9	281	48.9	241	47.3
<b>Total</b>	<b>564</b>	<b>100.0</b>	<b>575</b>	<b>100.0</b>	<b>510</b>	<b>100.0</b>

Note: The universe of this table corresponds to residents above 15 years old only.

**Table 17 Type of Work of Residents above 15 Years Old Claiming to be Working**

Type of professional occupation	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
Employed at the private sector	118	41.0	135	45.9	108	40.1
Informal work outside the house	82	28.5	74	25.2	82	30.5
Informal work at the house	40	13.9	37	12.6	39	14.5
Employed at the public sector	20	6.9	43	14.6	21	7.8
Housekeeper	22	7.6	8	2.7	21	7.8
Employer	9	3.1	8	2.7	4	1.5
<b>Total</b>	<b>291</b>	<b>101</b>	<b>305</b>	<b>103.7</b>	<b>275</b>	<b>102.2</b>

Note: (1) The universe of this table corresponds to residents above 15 years old who claim to be working at present.

(2) The total sum of absolute and relative figures exceeds the number of residents above 15 years old who claim to be working at present and 100%, respectively, because the question admits more than one answer

**Table 18 Nature of Labor Relation Set Up by Residents above 15 Years Old**

Nature of labor relation	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
Informal work (no labor relation)	186	64.6	176	59.9	182	67.7
Formal work (labor relation)	102	35.4	118	40.1	87	32.3
<b>Total</b>	<b>288</b>	<b>100.0</b>	<b>294</b>	<b>100.0</b>	<b>269</b>	<b>100.0</b>

Note: The universe of this table corresponds to residents above 15 years old who claim to be working at present.

**Table 19 Collection of Unemployment Benefits by Residents above 15 Years Old**

Collection of unemployment benefits	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
Does not collect unemployment benefits	197	71.3	146	51.9	179	74.2
Collects unemployment benefits	9	3.3	1	0.4	4	1.7
Did not respond	70	25.4	134	47.7	58	24.1
<b>Total</b>	<b>276</b>	<b>100.0</b>	<b>281</b>	<b>100.0</b>	<b>241</b>	<b>100.0</b>

Note: The universe of this table corresponds to residents above 15 years old claiming "not" to be working at present.

**Table 20 Main Sources of Expenditures For the Families**

Expenditures	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
<b>FOOD</b>						
Have disbursement on the item	197	98.5	196	98.0	197	98.5
Do not have disbursement on the item	2	1.0	1	0.5	3	1.5
Did not respond	1	0.5	3	1.5	-	-
<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>
<b>LIGHT BILL</b>						
Have disbursement on the item	174	87.0	190	95.0	165	82.5
Do not have disbursement on the item	25	12.5	8	4.0	35	17.5
Did not respond	1	0.5	2	1.0	-	-
<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>
<b>TRANSPORTATION</b>						
Have disbursement on the item	169	84.5	159	79.5	167	83.5
Do not have disbursement on the item	29	14.5	31	15.5	31	15.5
Did not respond	2	1.0	10	5.0	2	1.0
<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>
<b>TELEPHONE BILL</b>						
Have disbursement on the item	127	63.5	178	89.0	143	71.5
Do not have disbursement on the item	72	36.0	20	10.0	56	28.0
Did not respond	1	0.5	2	1.0	1	0.5
<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>
<b>HEALTH</b>						
Have disbursement on the item	95	47.5	121	60.5	100	50.0
Do not have disbursement on the item	104	52.0	78	39.0	99	49.5
Did not respond	1	0.5	1	0.5	1	0.5
<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>
<b>EDUCATION</b>						
Have disbursement on the item	59	29.5	72	36.0	54	27.0
Do not have disbursement on the item	140	70.0	127	63.5	146	73.0
Did not respond	1	0.5	1	0.5	-	-
<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>
<b>HOUSING</b>						
Have disbursement on the item	39	19.5	91	45.5	17	8.5
Do not have disbursement on the item	160	80.0	108	54.0	183	91.5
Did not respond	1	0.5	1	0.5	-	-
<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>

**Table 21 Average Expenditures of Families According to Main Sources of Expenses (Unit: R\$ - Real)**

Sources of expenses	Segment 1	Segment 2	Segment 3
Housing	298.51	227.56	349.51
Food	269.04	256.21	270.43
Education or child care	136.72	184.50	129.44
Health care	139.63	167.22	122.42
Transportation	126.17	108.81	130.54
Telephone bill	80.69	79.33	69.31
Energy bill	54.89	56.77	53.17

Note: The universe of this table corresponds to interviewees who claimed to spend a certain amount on one of the main items of the family expenses.

**Table 22 Infrastructure and Basic Services Available at Residences**

Basic services	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
ENERGY						
Do have	197	98.5	200	100.0	200	100.0
Do not have	3	1.5	-	-	-	-
<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>
PAVEMENT						
Do have	100	50.0	199	99.5	171	85.5
Do not have	100	50.0	1	0.5	29	14.5
<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>
PUBLIC LIGHTING						
Do have	179	89.5	200	100.0	192	96.0
Do not have	21	10.5	-	-	8	4.0
<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>
GARBAGE COLLECTION						
Do have, at their doors	179	89.5	188	89.5	112	56.0
Do have, in collective bins	4	2.0	22	10.5	63	31.5
Do have, in neighboring streets	7	3.5	-	-	19	9.5
Do not have	10	5.0	-	-	3	1.5
Did not respond	-	-	-	-	3	1.5
<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>210</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>

**Table 23 Utilization of Alternative Disposal of Garbage Produced at Residences**

Utilization	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
Make exclusive use of garbage collecting system	144	72.0	190	95.0	178	89.0
Make use of both the collection system and alternative disposal	46	23.0	8	4.0	14	7.0
Make exclusive use of alternative disposal	10	5.0	-	-	3	1.5
Did not respond	-	-	2	1.0	5	2.5
<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>

**Table 24 Alternative Methods of Garbage Disposal**

Alternative Methods	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
The garbage is burned	48	85.7	2	20.0	4	21.1
The garbage is disposed off either in the streets or in vacant lots	7	12.5	1	10.0	8	42.2
The garbage is disposed off at pits	1	1.8	-	-	3	15.8
The garbage is disposed off in the river	1	1.8	-	-	-	-
Others	1	1.8	5	50.0	2	10.5
Did not respond	-	-	2	20.0	2	10.5
<b>Total</b>	<b>58</b>	<b>103.6</b>	<b>10</b>	<b>100</b>	<b>19</b>	<b>100.1</b>

Note: (1) The universe of this table corresponds to residences whose members use alternative methods of garbage disposal.

- (2) The total sum of absolute and relative figures exceeds the number of residences whose members use alternative methods of garbage disposal and 100%, respectively, because the question admits more than one answer.

**Table 25 Connection to Water Supply System**

Connection to water supply system	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
Connected	120	60.0	196	98.0	181	90.5
Not connected	80	40.0	4	2.0	19	9.5
<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>

**Table 26 Frequency of Water Supply to Residences Connected to the Distribution System**

Frequency	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
Once a week	8	6.7	1	0.5	1	0.6
Twice a week	8	6.7	2	1.0	8	4.4
3 times a week	9	7.5	3	1.5	11	6.1
4 times a week	3	2.5	2	1.0	5	2.8
5 times a week	1	0.8	2	1.0	3	1.7
6 times a week	3	2.5	1	0.5	-	-
Everyday	53	44.1	182	93.0	148	81.6
Less than once a week	32	26.7	-	-	5	2.8
Did not respond	3	2.5	3	1.5	-	-
<b>Total</b>	<b>120</b>	<b>100.0</b>	<b>196</b>	<b>100.0</b>	<b>181</b>	<b>100.0</b>

Note: The universe of this table corresponds to residences "connected" to the water supply system.

**Table 27 Average Frequency of Water Supply to Residences Connected to the Distribution System**

Average frequency	Segment 1	Segment 2	Segment 3
Average frequency	3.9	6.8	6.4

Note: (1) Figures corresponds to residences connected to the water supply system only.

- (2) For the purpose of average frequency calculation, the 37 residences where water supply occurs less than "once a week" have been regarded as having "zero" frequency.

**Table 28 Daily Frequency of Water Supply at Residences Connected to the Water Supply System With Regular Daily Water Supply**

Frequency	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
The whole day	45	84.9	164	90.1	114	77.0
Only a few hours	8	15.1	16	8.8	34	23.0
Did not respond	-	-	2	1.1	-	-
<b>Total</b>	<b>53</b>	<b>100.0</b>	<b>182</b>	<b>100.0</b>	<b>148</b>	<b>100.0</b>

Note: The universe of this table corresponds to residences connected to the water supply system with regular daily water supply.

**Table 29 Reasons for Water Shortage as Presented by Interviewees Whose Residences are Connected to the Water Supply System**

Reasons	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
Inefficiency of CEDAE or of water supply companies	8	26.7	3	37.5	3	7.9
Rain shortage / water shortage in reservoir	9	30.0	-	-	4	10.5
Water pump out-of-order	1	3.3	1	12.5	8	21.1
Controlled water supply / alternating supply among residents	1	3.3	-	-	8	21.1
Waste by population	1	3.3	-	-	5	13.2
Political reasons, government's fault	4	13.3	-	-	-	-
High number of consumers	-	-	-	-	5	13.2
Street topography (slopes)	-	-	1	12.5	-	-
Water switch turned off	1	3.3	-	-	1	2.6
Lack of a professional in charge of the water distribution among residents	-	-	-	-	2	5.3
Payment failure	1	3.3	-	-	-	-
Broken pipe	1	3.3	-	-	-	-
Did not respond	3	10.0	3	37.5	3	7.9

Note: (1) The universe of this table corresponds to residences connected to the water supply system with regular daily water supply.

(2) The total sum of absolute and relative figures exceeds the residences connected to the water supply system with regular daily water and 100%, respectively, because the question admits more than one answer.

**Table 30 Classification According to Consumption Measurement with Water Meter**

Situation	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
Measured by water meter in good working conditions	41	34.2	140	71.4	15	8.3
Measured by water meter in poor conditions or not operative	3	2.5	2	1.0	1	0.6
Water consumption is not measured	76	63.3	54	27.6	165	91.1
<b>Total</b>	<b>120</b>	<b>100.0</b>	<b>196</b>	<b>100.0</b>	<b>181</b>	<b>100.0</b>

Note: The universe of this table corresponds to residences connected to the water supply system.



**Table 31 Residences Where Water Consumption is not Being Measured (Reasons)**

Reasons	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
CEDAE (or the municipal water supply company) did not set up the meter	50	66.6	22	40.7	97	58.7
The resident himself (herself) made the connection to the water supply system.	6	7.9	3	5.6	26	15.8
Others reasons	8	10.5	13	24.1	10	6.1
Did not respond	12	15.8	16	29.6	32	19.4
<b>Total</b>	<b>76</b>	<b>100.0</b>	<b>54</b>	<b>100.0</b>	<b>165</b>	<b>100.0</b>

Note: The universe of this table corresponds to residences connected to the water supply system

**Table 32 Monthly Amount Spent on Water Bill**

Amount	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
Pay nothing on the water bill (0 reais)	60	53.6	12	6.6	144	80.9
1 to 9 reais	10	8.9	21	11.5	18	10.1
<i>Pay less than 10 reais or nothing</i>	<i>70</i>	<i>62.5</i>	<i>33</i>	<i>18.1</i>	<i>162</i>	<i>91.0</i>
10 to 19 reais	18	16.1	12	6.6	8	4.5
20 to 29 reais	8	7.1	53	29.1	1	0.6
30 to 39 reais	8	7.1	14	7.7	1	0.6
40 to 49 reais	3	2.7	18	9.9	1	0.6
50 reais or more	5	4.5	52	28.6	5	2.8
<b>Total</b>	<b>112</b>	<b>100</b>	<b>182</b>	<b>100</b>	<b>178</b>	<b>100</b>

Note: (1) The universe of this table corresponds to residences connected to the water supply system whose interviewees showed the water bill.

(2) In case of apartments or houses in condominium, the amount spent by one unit was calculated by dividing the total amount spent at the apartment building or condominium by the number of units.

**Table 33 Average Monthly Amount Spent on Water Bill**

Average monthly amount spent on water bill	Segment 1	Segment 2	Segment 3
Average amount spent	11.00	37.00	5.00

Note: (1) The universe of this table corresponds to residences connected to the water supply system whose interviewees showed the water bill.

(2) The universe includes the residences where the amount spent is equivalent to "Zero" Reais)

**Table 34 Average Monthly Amount Spent on Water Bill**

Average monthly amount spent on water bill	Segment 1	Segment 2	Segment 3
Average amount spent	24.00	40.00	24.00

Note: (1) The universe of this table corresponds to residences connected to the water supply system whose interviewees showed the water bill.

(2) The universe excludes the residences where the amount spent is equivalent to "Zero" Reais

**Table 35 Awareness about the Characteristics of The Water Charge**

Characteristics of the water charge	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
It is not the minimum charge	16	14.3	88	48.3	5	2.8
It is the minimum charge	17	15.2	38	20.9	18	10.1
Does not know whether it is the minimum charge	19	17.0	44	24.2	11	6.2
Do not pay water bill	60	53.5	12	6.6	144	80.9
<b>Total</b>	<b>112</b>	<b>100.0</b>	<b>182</b>	<b>100.0</b>	<b>178</b>	<b>100.0</b>

Note: (1) The universe of this table corresponds to residences connected to the water supply system whose interviewees showed the water bill.

**Table 36 Opinion on The Amount Charged for Water Consumption**

Opinion		Segment 1		Segment 2		Segment 3	
		n	%	n	%	n	%
(1)	Consider it high	20	38.5	64	38.1	2	6.1
(2)	Consider it reasonable	29	55.8	100	59.5	30	90.9
(3)	Consider it low	3	5.8	4	2.4	1	3.0
<i>Total Payers (1) + (2) + (3)*</i>		52	100.0	168	100.0	33	100.0
(4)	Total Payers	52	46.4	168	92.3	33	18.5
(5)	Do not pay water bill	60	53.6	12	6.6	144	80.9
(6)	Did not respond	-	-	2	-	1	-
Total (4) + (5) + (6)**		112	100.0	182	100.0	178	100.0
Total Payers		52	43.3	168	85.7	33	18.2
Connected to the water supply system		120	100	196	100	181	100

Note: (\*) We consider PAYERS only those who gave opinion about the water charge. We are not considering those who did not respond to this question and those who answered "Do not pay water bill".

(\*\*) This total corresponds to residences connected to the water supply system whose interviewees showed the water bill.

**Table 37 Origin of Water Consumed at Residences not Connected to the Water Supply System**

Origin	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
Deep well	41	51.3	-	-	1	5.3
Shallow well	30	37.5	1	25.0	1	5.3
Public tap or fawcett supplied by CEDAE	-	-	2	50.0	8	42.1
Streams, rivers, reservoirs or canals	4	5.0	1	25.0	3	15.8
Neighbors' residence	4	5.0	-	-	2	10.5
Community water reservoir	-	-	-	-	3	15.8
Water container ordered by residents themselves	2	2.5	-	-	-	-
Other	1	1.3	-	-	1	5.3

Note: (1) The universe of this table corresponds to residences not connected to the water supply system.

(2) The total sum of absolute and relative figures exceeds the number of residences not connected to the water supply system and 100%, respectively, because the question admits more than one answer.

**Table 38 Maximum Amount the Interviewee at Residences not Connected to the Water Supply System Would Be Willing to Pay For Water If Connected**

Amount	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
Nothing	24	30.0	-	-	1	5.3
1 to 9 reais	5	6.3	-	-	2	10.5
10 to 19 reais	20	25.0	-	-	6	24.8
20 to 29 reais	10	12.5	2	23.5	1	5.3
30 to 39 reais	10	12.5	1	25.0	1	5.3
40 to 49 reais	4	5.0	-	-	1	5.3
50 reais or over	2	2.5	1	25.0	-	-
Did not respond	5	6.3	-	-	7	36.8
<b>Total</b>	<b>80</b>	<b>100.0</b>	<b>4</b>	<b>100.0</b>	<b>19</b>	<b>100.0</b>

Note: The universe of this table corresponds to residences not connected to the water supply system.

**Table 39 Monthly Consumption of Water at the Residence (In Cubic Meters)**

Monthly Water Consumption		Segment 1		Segment 2		Segment 3	
		n	%	n	%	n	%
(1)	Up to 1 m <sup>3</sup>	54	42.9	3	2.1	12	36.4
(2)	Over 1 to 10 m <sup>3</sup>	42	33.3	20	13.9	10	30.3
	<i>10 m<sup>3</sup> and less</i>	96	76.2	23	16.0	22	66.7
(3)	Over 10 to 20 m <sup>3</sup>	16	12.7	56	38.9	10	30.3
(4)	Over 20 to 30 m <sup>3</sup>	5	4.0	32	22.2	-	-
(5)	Over 30 m <sup>3</sup>	9	7.1	33	22.9	1	3.0
	<i>Over 20 m<sup>3</sup></i>	14	11.1	65	45.1	1	3.0
<b>Total</b>		<b>126</b>	<b>100.0</b>	<b>144</b>	<b>100.0</b>	<b>33</b>	<b>100.0</b>

Note: The universe of this table corresponds to the informants who disclosed the monthly water consumption at their residences.

**Table 40 Average Monthly Consumption of Water at Residence (In Cubic Meters)**

Segment	Average monthly consumption
Segment 1	8,8 m <sup>3</sup>
Segment 2	22,7 m <sup>3</sup>
Segment 3	7,5 m <sup>3</sup>

Note: The universe of this table corresponds to the informants who disclosed the monthly water consumption at their residences.

**Table 41 Activity Regarded as the Most Water Consuming One**

Activity	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
<b>Doing the laundry</b>						
Regarding as the most water consuming activity	147	73.5	93	46.5	123	61.5
Not regarding as the most water consuming activity	53	26.5	107	53.5	77	38.5
<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>
<b>Cooking and doing the dishes</b>						
Regarding as the most water consuming activity	21	10.5	36	18.0	33	16.5
Not regarding as the most water consuming activity	179	89.5	164	82.0	167	83.5
<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>
<b>Taking a shower</b>						
Regarding as the most water consuming activity	17	8.5	32	16.0	19	9.5
Not regarding as the most water consuming activity	183	91.5	168	84.0	181	90.5
<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>
<b>Flushing</b>						
Regarding as the most water consuming activity	6	3.0	25	12.5	22	11.0
Not regarding as the most water consuming activity	194	97.0	175	87.5	178	89.0
<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>
<b>Cleaning outdoors areas and watering the garden</b>						
Regarding as the most water consuming activity	8	4.0	14	7.0	2	1.0
Not regarding as the most water consuming activity	192	96.0	186	93.0	198	99.0
<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>
<b>Washing the car</b>						
Regarding as the most water consuming activity	-	-	-	-	-	-
Not regarding as the most water consuming activity	200	100.0	200	100.0	200	100.0
<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>

**Table 42 Method of Sewage Disposal**

Method		Segment 1		Segment 2		Segment 3	
		n	%	n	%	n	%
Connected to sewerage		141	70.5	195	97.5	170	85.0
Not connected to sewerage		59	29.5	5	2.5	30	15.0
a	Disposed off or channeled straight into the river, stream or the sea	17	8.5	3	1.5	19	9.5
b	Discharged into open ditches	13	6.5	-	-	5	2.5
c	Septic tank + open ditch	13	6.5	-	-	2	1.0
d	Rudimentary cesspit	4	2.0	-	-	3	1.5
e	Disposed off into the drainage system	2	1.0	2	1.0	1	0.5
f	Septic tank without outlet	5	2.5	-	-	-	-
g	Septic tank + drainage system	4	2.0	-	-	-	-
h	Others	1	0.5	-	-	-	-
<b>Total</b>		<b>200</b>	<b>100</b>	<b>200</b>	<b>100</b>	<b>200</b>	<b>100</b>

**Table 43 Frequency of Septic Tank Cleaning**

Frequency	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
Every six months	3	13.6	-	-	-	-
Once a year	5	22.7	-	-	-	-
Every two years	-	-	-	-	-	-
Every three years	-	-	-	-	-	-
Other	10	45.5	-	-	1	50.0
Not usually cleaned	2	9.1	-	-	-	-
Did not respond	2	9.1	-	-	1	50.0
<b>Total</b>	<b>22</b>	<b>100.0</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>100.0</b>

Note: The universe of this table corresponds to residences that use septic tanks.

**Table 44 Destination of The Sludge Taken Out of the Septic Tank after Cleaning**

Destination	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
Dispose the sludge into the river or the nearest stream	5	25.0	-	-	-	-
Dispose the sludge together with the garbage	3	15.0	-	-	1	50.0
Other	9	45.0	-	-	1	50.0
Does not know	3	15.0	-	-	-	-
<b>Total</b>	<b>20</b>	<b>100.0</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>100.0</b>

Note: The universe of this table corresponds to residences that use septic tanks and carry out their cleaning at least every three years

**Table 45 Satisfaction with the Work Carried Out by CEDAE**

Situation	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
Satisfied	103	73.0	157	80.5	136	80.0
Not satisfied	38	27.0	37	19.0	34	20.0
Did not respond	-	-	1	0.5	-	-
<b>Total</b>	<b>141</b>	<b>100.0</b>	<b>195</b>	<b>100.0</b>	<b>170</b>	<b>100.0</b>

Note: The universe of this table corresponds to the residences claiming to be connected to the sewerage system.

**Table 46 Reasons for Dissatisfaction with the Work Carried Out by CEDAE**

Reasons	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
CEDAE does not unclog pipes and street drains	18	47.4	17	45.9	21	61.8
CEDAE does not carry out maintenance / it takes long time to act	8	21.1	10	27.0	6	17.6
CEDAE does not carry out the necessary works	4	10.5	5	13.5	4	11.8
CEDAE works are poorly done / ineffective / incomplete	1	2.6	4	10.8	2	5.9
Did not respond	<b>9</b>	<b>23.7</b>	<b>2</b>	<b>5.4</b>	<b>3</b>	<b>8.8</b>

Note: (1) The universe of this table corresponds to the residences claiming to be connected to the sewerage system and whose interviewees were "not satisfied" with the work carried out by CEDAE.

(2) The total sum of absolute and of relative figures exceeds the number of interviewees who claimed to be connected to the sewerage and who were not happy about the work carried out by CEDAE and 100%, respectively, because the question admits more than one answer.

**Table 47 Awareness of the Destination of the Sewage Collected by CEDAE**

What is the destination of the sewage collected by CEDAE?	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
It is disposed off with no treatment	47	33.3	43	22.1	42	24.7
It is treated at a treatment station	3	2.1	22	11.3	4	2.4
Others	-	-	2	1.0	4	2.4
Does not know	91	64.6	127	65.1	120	70.5
Did not respond	-	-	1	0.5	-	-
<b>Total</b>	<b>141</b>	<b>100.0</b>	<b>195</b>	<b>100.0</b>	<b>170</b>	<b>100.0</b>

Note: The universe of this table corresponds to the residences connected to the sewerage system only.

**Table 48 Awareness about the Existence of Sewerage in Front of the Residence**

Is there sewerage in front of your residence?	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
There is not	52	88.1	-	-	18	60.0
There is	7	11.9	5	100.0	12	40.0
<b>Total</b>	<b>59</b>	<b>100.0</b>	<b>5</b>	<b>100.0</b>	<b>30</b>	<b>100.0</b>

Note: The universe of this table corresponds to residences claimed not to be connected to the sewerage system.

**Table 49 Reasons Why the Residence is Not Connected to the Public Sewerage Despite the Existence of Collection Pipe for Their Use**

Reasons	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
Problems related to CEDAE	2	28.6	3	60.0	2	16.7
Financial reasons	-	-	1	20.0	2	16.7
It requires action / laziness	1	14.3	-	-	1	8.3
Inadequate location of the land plot	1	14.3	-	-	-	-
Residential land plot does not belong to the resident	-	-	-	-	1	8.3
Does not know	3	42.9	1	20.0	6	50.0
<b>Total</b>	<b>7</b>	<b>100.0</b>	<b>5</b>	<b>100.0</b>	<b>12</b>	<b>100.0</b>

Note: The universe of this table corresponds to interviewees claiming not to be connected to the sewerage system but that acknowledge the existence of a collection pipeline for their use.

**Table 50 Willingness to Pay for Adequate Collection and/or Treatment of Sewage**

Status	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
<b>Is connected (1)</b>						
Would not contribute	100	70.9	144	73.9	79	46.5
Would contribute	41	29.1	49	25.1	91	53.5
Did not respond	-	-	2	1.0	-	-
<b>Sub-total</b>	<b>141</b>	<b>100.0</b>	<b>195</b>	<b>100.0</b>	<b>170</b>	<b>100.0</b>
<b>Is not connected (2)</b>						
Would not contribute	46	78.0	3	60.0	11	36.7
Would contribute	13	22.0	2	40.0	19	63.3
Did not respond	-	-	-	-	-	-
<b>Sub-total</b>	<b>59</b>	<b>100.0</b>	<b>5</b>	<b>100.0</b>	<b>30</b>	<b>100.0</b>
<b>Both (1) and (2)</b>						
Would not contribute	146	73.0	147	73.5	90	45.0
Would contribute	54	27.0	51	25.5	110	55.0
Did not respond	-	-	2	1.0	-	-
<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>

**Table 51 Willingness to Pay for Adequate Collection and/or Treatment of Sewage According to Family Income**

Willingness to Pay				Segment 1		Segment 2		Segment 3		
				n	%	n	%	n	%	
Family Income	Under US\$ 127.8	Under 2 MW	Under 400 Reais	Would not contribute	41	70.7	20	87.0	35	49.3
				Would contribute	17	29.3	3	13.0	36	50.7
				<b>Total</b>	<b>58</b>	<b>100.0</b>	<b>23</b>	<b>100.0</b>	<b>71</b>	<b>100.0</b>
	From US\$ 127.8 to US\$ 255.6	From 2 MW to 4 MW	From 400 to 800 Reais	Would not contribute	58	76.3	38	79.2	34	43.0
				Would contribute	18	23.7	10	20.8	45	57.0
				<b>Total</b>	<b>76</b>	<b>100.0</b>	<b>48</b>	<b>100.0</b>	<b>79</b>	<b>100.0</b>
	Over US\$ 255.6	Over 4 MW	Over 800 Reais	Would not contribute	47	71.2	89	68.9	21	42.0
				Would contribute	19	28.8	38	29.5	29	58.0
				Did not respond	-	-	2	1.6	-	-
				<b>Total</b>	<b>66</b>	<b>100.0</b>	<b>129</b>	<b>100.0</b>	<b>50</b>	<b>100.0</b>

Note: National Minimum Wage (MW) per month as of Sept. 2002: 200 Reais  
Dollar exchange rate as of Sept. 9, 2002: US\$ 1 = 3,13 reais

**Table 52 Willingness to Pay for Adequate Collection and/or Treatment of Sewage According to Amount to Pay**

Values in Reais		Segmento 1		Segmento 2		Segmento 3	
		n	%	n	%	n	%
<b>1</b>	R\$1.00	1	0.5	1	0.5	1	0.5
<b>2</b>	R\$3.00	1	0.5	1	0.5	5	2.5
<b>3</b>	R\$5.00	9	4.5	4	2.0	13	6.5
<b>4</b>	More than R\$ 5.00 to R\$ 9.00	-	-	-	-	-	-
	<i>Less than R\$ 10.00</i>	<i>11</i>	<i>5.5</i>	<i>6</i>	<i>3</i>	<i>19</i>	<i>9.5</i>
<b>5</b>	Other values from R\$ 10.00 to R\$ 100.00 (*)	43	21.5	45	22.5	91	45.5
	<i>a. R\$10.00</i>	<i>43</i>	<i>21.5</i>	<i>45</i>	<i>22.5</i>	<i>91</i>	<i>45.5</i>
	<i>b. R\$25.00</i>	<i>17</i>	<i>8.5</i>	<i>21</i>	<i>10.5</i>	<i>32</i>	<i>16.0</i>
	<i>c. R\$50.00</i>	<i>13</i>	<i>6.5</i>	<i>20</i>	<i>10.0</i>	<i>24</i>	<i>12.0</i>
	<i>d. R\$100.00</i>	<i>5</i>	<i>2.5</i>	<i>10</i>	<i>5.0</i>	<i>10</i>	<i>5.0</i>
<b>6</b>	Nothing	146	73.0	147	73.5	90	45.0
<b>7</b>	Didn't say if would contribute or not	-	-	2	1.0	-	-
<b>Total (1 + 2 + 3 + 4 + 5 + 6 + 7)</b>		<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>

Note: It is important to mention that the values for "R\$ 10.00" include all the other higher values considering that anyone willing to pay 25, 50 or 100 Reais would also pay 10. The same concept is valid for the other values. That is why the values from (a.) R\$10.00 to (d.) R\$ 100.00 decreases.



**Table 53 Reasons Why the Respondent Would "Not Be Willing" to Pay for Adequate Collection and/or Treatment of Sewage**

Reasons	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
Cannot afford to pay	80	54.8	61	41.5	55	61.1
Already pays taxes / taxes are high	40	27.4	30	20.4	10	11.1
It is the government's / politicians' job	33	22.6	24	16.3	16	17.8
Already pays an extra charge added to the water bill for sewerage	3	2.1	32	21.8	5	5.6
There are resources, but they are misused / there is no control upon the use of resources	3	2.1	7	4.8	-	-
Does not feel affected by the pollution / does not live close to the river / lives far away from the pollution of Guanabara Bay	3	2.1	2	1.4	5	5.6
Is satisfied with the treatment given to the sewage / is satisfied with the sewerage system	1	0.7	5	3.4	-	-
Would pay only if it was mandatory	1	0.7	1	0.7	2	2.2
Interviewee is not in charge of payment of utilities at the residence	-	-	2	1.4	2	2.2
Does not believe services can be upgraded	1	0.7	1	0.7	1	1.1
On account of ignoring the technical data concerning the type of treatment to be used	1	0.7	1	0.7	-	-
Did not respond	3	2.1	1	0.7	1	1.1
Total of those not willing to pay	146	100.0	147	100.0	90	100.0

Note: (1) The universe of this table corresponds to interviewees not willing to pay for sewage treatment and/or sewerage system maintenance.

(2) The total of absolute and relative figures exceeds the number of interviewees not willing to pay and 100%, respectively, because the question admits more than one answer.

**Table 54 Sanitary Items at Residence**

Sanitary items	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
<b>Piped water</b>						
There is	188	94.0	198	99.0	192	96.0
There is not	12	6.0	1	0.5	6	3.0
Did not respond	-	-	1	0.5	2	1.0
<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>
<b>Bath or shower</b>						
There is	184	92.0	196	98.0	187	93.5
There is not	16	8.0	4	2.0	13	6.5
<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>
<b>Bath or shower with hot water</b>						
There is	113	56.5	177	88.5	117	58.5
There is not	87	43.5	23	11.5	83	41.5
<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>
<b>Electric shower</b>						
There is	134	67.0	166	83.0	130	65.0
There is not	66	33.0	34	17.0	70	35.0
<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>
<b>Toilet</b>						
There is	200	100.0	199	99.5	199	99.5
There is not	-	-	1	0.5	1	0.5
<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>
<b>Toilet with flushing</b>						
There is	177	88.5	197	98.5	182	91.0
There is not	23	11.5	1	0.5	17	8.5
Did not respond	-	-	2	-	1	-
<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>

**Table 55 Number of Existing Bath and Toilette Rooms at the Residence**

Number	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
None	-	-	1	0.5	1	0.5
One	161	80.5	123	61.5	169	84.5
Two	31	15.5	61	30.5	24	12.0
Three	7	3.5	10	5.0	5	2.5
Four or more	-	-	5	2.5	1	0.5
Did not respond	1	0.5	-	-	-	-
<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>

**Table 56 Characterization of Residence According to Type of Bath and Toilette Rooms**

Type	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
Residence where the family alone has exclusive use of bath and toilette rooms	199	99.5	198	99.0	199	99.5
Residence where bath and toilette rooms are for collective use	1	0.5	1	0.5	-	-
Residences lacking bath and toilette rooms	-	-	1	0.5	1	0.5
<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>

**Table 57 Treatment Given to Drinking Water by Residents**

Type of Treatment	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
Filtering	119	59.5	169	84.5	150	75.0
Purchase of bottled mineral water	24	12.0	18	9.0	6	3.0
Boiling	16	8.0	10	5.0	15	7.5
Chloriding	12	6.0	3	1.5	4	2.0
Others	1	0.5	3	1.5	3	1.5
No treatment	45	22.5	13	6.5	34	17.0

Note: The total sum of absolute and of relative figures exceeds the number of residences and 100%, respectively, because the question admits more than one answer.

**Table 58 Prevailing Infections Recorded at the Residence in the Past 12 Months**

Infections		Segment 1		Segment 2		Segment 3	
		n	%	n	%	n	%
Dengue Fever	Had the disease	69	34.5	81	40.5	54	27.0
	Did not have the disease	131	65.5	119	59.5	146	73.0
	<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>
Diarrhea	Had the disease	64	32.0	42	21.0	61	30.5
	Did not have the disease	136	68.0	158	79.0	139	69.5
	<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>
Impetigo	Had the disease	3	1.5	6	3.0	2	1.0
	Did not have the disease	197	98.5	194	97.0	198	99.0
	<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>
Type A Hepatitis	Had the disease	1	0.5	1	0.5	2	1.0
	Did not have the disease	199	99.5	199	99.5	198	99.0
	<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>
Scabies	Had the disease	1	0.5	2	1.0	-	-
	Did not have the disease	199	99.5	198	99.0	200	100.0
	<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>
Tuberculosis	Had the disease	-	-	-	-	2	1.0
	Did not have the disease	200	100.0	200	100.0	198	99.0
	<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>
Leptospirosis	Had the disease	1	0.5	-	-	-	-
	Did not have the disease	199	99.5	200	100.0	200	100.0
	<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>
Filariasis or Elephantiasis	Had the disease	-	-	1	0.5	-	-
	Did not have the disease	200	100.0	199	99.5	200	100.0
	<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>
Cholera	Had the disease	-	-	-	-	1	0.5
	Did not have the disease	200	100.0	200	100.0	199	99.5
	<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>
Chagas Disease	Had the disease	-	-	-	-	-	-
	Did not have the disease	200	100.0	200	100.0	200	100.0
	<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>
Typhoid Fever	Had the disease	-	-	-	-	-	-
	Did not have the disease	200	100.0	200	100.0	200	100.0
	<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>
Schistosomiasis	Had the disease	-	-	-	-	-	-
	Did not have the disease	200	100.0	200	100.0	200	100.0
	<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>
Others	Had the disease	12	6.0	8	4.0	12	6.0
	Did not have the disease	188	94.0	192	96.0	188	94.0
	<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>

**Table 59 Percentage of People Affected by Infectious Diseases in the Past 12 Months**

Segment	Percentage of people
Segment 1	28.4%
Segment 2	28.6%
Segment 3	25.6%

Note: The following infectious diseases were taken into account: Diarrhea, Leptospirosis, Schistosomiasis, Filariasis, or Elephantiasis, Dengue, Cholera, Impetigo, Scabies, Tuberculosis, Chagas Disease, Type A Hepatitis and Typhoid Fever.

**Table 60 Percentage of Family Annual Income Spent on Treatment of Infectious Diseases in the Past 12 Months**

Segment	Percentage of family annual income
Segment 1	0.39%
Segment 2	0.14%
Segment 3	0.22%

Note: (1) The following infectious diseases were taken into account: Diarrhea, Leptospirosis, Schistosomiasis, Filariosis, or Elephantiasis, Dengue, Cholera, Impetigo, Scabies, Tuberculosis, Chagas Disease, Type A Hepatitis and Typhoid Fever.

- (2) The universe of this table corresponds to residences where the interviewee disclosed family income and where at least one resident has been infected once or more in the past twelve months. The annual income was calculated by multiplying the disclosed family income in the month x 12.

**Table 61 Average Duration of Leaves Of Absence Taken by the Residents Placed on the Job Market as A Result of Infectious Diseases in the Past 12 Months**

Segment	Average duration of leaves of absence
Segment 1	7.0 days
Segment 2	3.0 days
Segment 3	3.5 days

Note: (1) The following infectious diseases were taken into account: Diarrhea, Leptospirosis, Schistosomiasis, Filariosis, or Elephantiasis, Dengue, Cholera, Impetigo, Scabies, Tuberculosis, Chagas Disease, Type A Hepatitis and Typhoid Fever.

- (2) Residents placed on the job market are those over 15 years old who have a job at the moment and who have been infected once or more in the past twelve months.

**Table 62 The Top 10 Problems or Needs Within the Community According to the Interviewee's Opinion**

Problems	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
Basic sanitation infrastructure	133	66.5	76	38.0	100	50.0
Urban infrastructure in general (except basic sanitation infrastructure)	98	49.0	60	30.0	71	35.5
Security, violence	35	17.5	89	44.5	32	16.0
Health	15	7.5	20	10.0	15	7.5
Education	9	4.5	9	4.5	19	9.5
Poverty, unemployment	5	2.5	5	2.5	9	4.5
Lack of urban equipment	2	1.0	10	5.0	5	2.5
Others	4	2.0	18	9.0	12	6.0
There is no problem	11	5.5	20	10.0	22	11.0
Did not respond	13	6.5	14	7.0	17	8.5

Note: The total of absolute and relative figures exceeds the number of interviewees and 100%, respectively, because the question admits more than one answer.

**Table 63 The Top 10 Health Problems within the Family and the Community**

Health problems	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
Diseases which affect the population	63	31.5	66	33.0	58	29.0
Lack of basic health and hospital units (not for emergencies)	28	14.0	19	9.5	32	16.0
Lack of professionals in basic health and hospital units	35	17.5	10	5.0	22	11.0
Lack of basic sanitation infrastructure	6	3.0	11	5.5	14	7.0
Lack of medication / material in basic health and hospital units	10	5.0	6	3.0	11	5.5
The access to health services is difficult	3	1.5	14	7.0	7	3.5
Lack of emergency services	14	7.0	2	1.0	3	1.5
Lack of urban equipment	3	1.5	1	0.5	2	1.0
Difficulty in obtaining laboratory tests and exams	3	1.5	1	0.5	1	0.5
Other health problems	-	-	2	1.0	2	1.0
Mentioned economic, environment and educational problems	3	1.5	5	2.5	2	1.0
<i>Sub-total 1</i>	<i>168</i>	<i>84.0</i>	<i>137</i>	<i>68.5</i>	<i>154</i>	<i>77.0</i>
There is no problem	25	12.5	39	19.5	48	24.0
Did not respond	49	24.5	43	21.5	28	14.0
<i>Sub-total 2</i>	<i>74</i>	<i>37.0</i>	<i>82</i>	<i>41.0</i>	<i>76</i>	<i>38.0</i>

Note: The total of absolute and relative figures exceeds the number of interviewees and 100%, respectively, because the question admits more than one answer.

**Table 64 Perception of the Pollution of the Guanabara Bay**

Perception	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
Consider it polluted and this fact <b>affects</b> the residents	65	32.5	94	47.0	71	35.5
Consider it polluted and this fact <b>does not</b> affect the residents	119	59.5	101	50.5	106	53.0
Does not consider it polluted	14	7.0	3	1.5	18	9.0
Did not respond	2	1.0	2	1.0	5	2.5
<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>

**Table 65 Reason Why the Pollution of Guanabara Bay Affects the Residents**

Reason	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
Bad smell	15	23.1	19	20.2	23	32.4
Cannot go for a swim in the waters of the Bay	10	15.4	23	24.5	22	31.0
Cannot go for a swim in the open sea waters close to the Bay	9	13.8	14	14.9	4	5.6
Pollution causes respiratory and water borne diseases caught outside the residence	7	10.8	15	16.0	3	4.2
The natural beauty is harmed	12	18.5	8	8.5	3	4.2
Pollution contaminates the drinking water consumed in the residence	5	7.7	6	6.4	9	12.7
Pollution contaminates the fish	9	13.8	9	9.6	2	2.8
Pollution damages professional activities such as fishing and local trade	4	6.2	6	6.4	-	-
Pollution attracts mosquitoes and rats	-	-	2	2.1	3	4.2
Other	6	9.2	4	4.3	4	5.6
Did not respond	1	1.5	3	3.2	4	5.6

Note: (1) The universe corresponds to the residents who are aware of the Guanabara Bay pollution and believe this fact affects them and/or their family.

(2) The total of absolute and relative figures exceeds the number of residents who are aware of the Guanabara Bay pollution and believe this fact affects them and/or their family, and 100%, respectively, because the question admits more than one answer.

**Table 66 Main Reason Presented for the Pollution of the Guanabara Bay**

Main reason	Segment 1		Segment 2		Segment 3	
	n	%	n	%	n	%
Domestic sewage	74	40.0	58	29.7	58	32.8
Industrial garbage and sewage	43	23.2	54	27.7	32	18.1
Non-industrial garbage	38	20.5	32	16.4	41	23.2
Oil leak	14	7.6	18	9.2	27	15.3
Others	5	2.7	21	10.8	9	5.1
Did not respond	11	5.9	12	6.2	10	5.6
<b>Total</b>	<b>185</b>	<b>100.0</b>	<b>195</b>	<b>100.0</b>	<b>177</b>	<b>100.0</b>

Note: The universe of this table corresponds to interviewees who consider the Guanabara Bay to be polluted.

**Table 67 Existing Appliances and Goods at the Residence**

Existing Appliances			Segment 1		Segment 2		Segment 3	
			n	%	n	%	n	%
1	Gas Stove	There is	200	100.0	200	100.0	199	99.5
		There isn't	-	-	-	-	1	0.5
		<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>
2	Color TV	There is	189	94.5	197	98.5	196	98.0
		There isn't	11	5.5	3	1.5	4	2.0
		<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>
3	Refrigerator	There is	189	94.5	197	98.5	192	96.0
		There isn't	11	5.5	3	1.5	8	4.0
		<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>
4	Electric fan	There is	189	94.5	193	96.5	188	94.0
		There isn't	11	5.5	7	3.5	12	6.0
		<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>
5	Radio	There is	164	82.0	163	81.5	122	61.0
		There isn't	36	18.0	37	18.5	78	39.0
		<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>
6	Hi-Fi system	There is	142	71.0	163	81.5	158	79.0
		There isn't	58	29.0	37	18.5	42	21.0
		<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>
7	Bicycle	There is	140	70.0	88	44.0	101	50.5
		There isn't	60	30.0	112	56.0	99	49.5
		<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>
8	Electric shower	There is	134	67.0	166	83.0	130	65.0
		There isn't	66	33.0	34	17.0	70	35.0
		<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>
9	Conventional telephone set	There is	109	54.5	172	86.0	127	63.5
		There isn't	91	45.5	28	14.0	73	36.5
		<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>
10	Mobile telephone	There is	94	47.0	128	64.0	82	41.0
		There isn't	106	53.0	72	36.0	118	59.0
		<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>
11	Video system	There is	92	46.0	131	65.5	86	43.0
		There isn't	108	54.0	69	34.5	114	57.0
		<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>
12	Washing machine	There is	85	42.5	147	73.5	83	41.5
		There isn't	115	57.5	53	26.5	117	58.5
		<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>
13	Freezer	There is	66	33.0	109	54.5	70	35.0
		There isn't	134	67.0	91	45.5	130	65.0
		<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>
14	Automobile	There is	54	27.0	92	46.0	31	15.5
		There isn't	146	73.0	108	54.0	169	84.5
		<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>
15	Air conditioning	There is	34	17.0	86	43.0	42	21.0
		There isn't	166	83.0	114	57.0	158	79.0
		<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>
16	Black and white TV	There is	19	9.5	20	10.0	19	9.5
		There isn't	181	90.5	180	90.0	181	90.5
		<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>
17	Computer	There is	13	6.5	64	32.0	13	6.5
		There isn't	187	93.5	136	68.0	187	93.5
		<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>
18	Vacuum cleaner	There is	13	6.5	59	29.5	12	6.0
		There isn't	187	93.5	141	70.5	188	94.0
		<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>
19	Domestic servant on a monthly basis	There is	5	2.5	20	10.0	5	2.5
		There isn't	195	97.5	180	90.0	195	97.5
		<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>
20	Motorcycle	There is	6	3.0	7	3.5	5	2.5
		There isn't	194	97.0	193	96.5	195	97.5
		<b>Total</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>



**Table 68 Possession of Telephone**

Alternatives		Segment 1		Segment 2		Segment 3	
		n	%	n	%	n	%
<b>(1)</b>	Only conventional telephone set	49	24.5	56	28.0	71	35.5
<b>(2)</b>	Only mobile telephone	34	17.0	12	6.0	26	13.0
	<i>Either (1) or (2)</i>	83	41.5	68	34.0	97	48.5
<b>(3)</b>	Both conventional and mobile telephones	60	30.0	116	58.0	56	28.0
	<i>Sub-total (1) + (2) + (3)</i>	143	71.5	184	92.0	153	76.5
<b>(4)</b>	Neither of the above alternatives	57	28.5	16	8.0	47	23.5
<b>Total (1) + (2) + (3) + (4)</b>		<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>	<b>200</b>	<b>100.0</b>

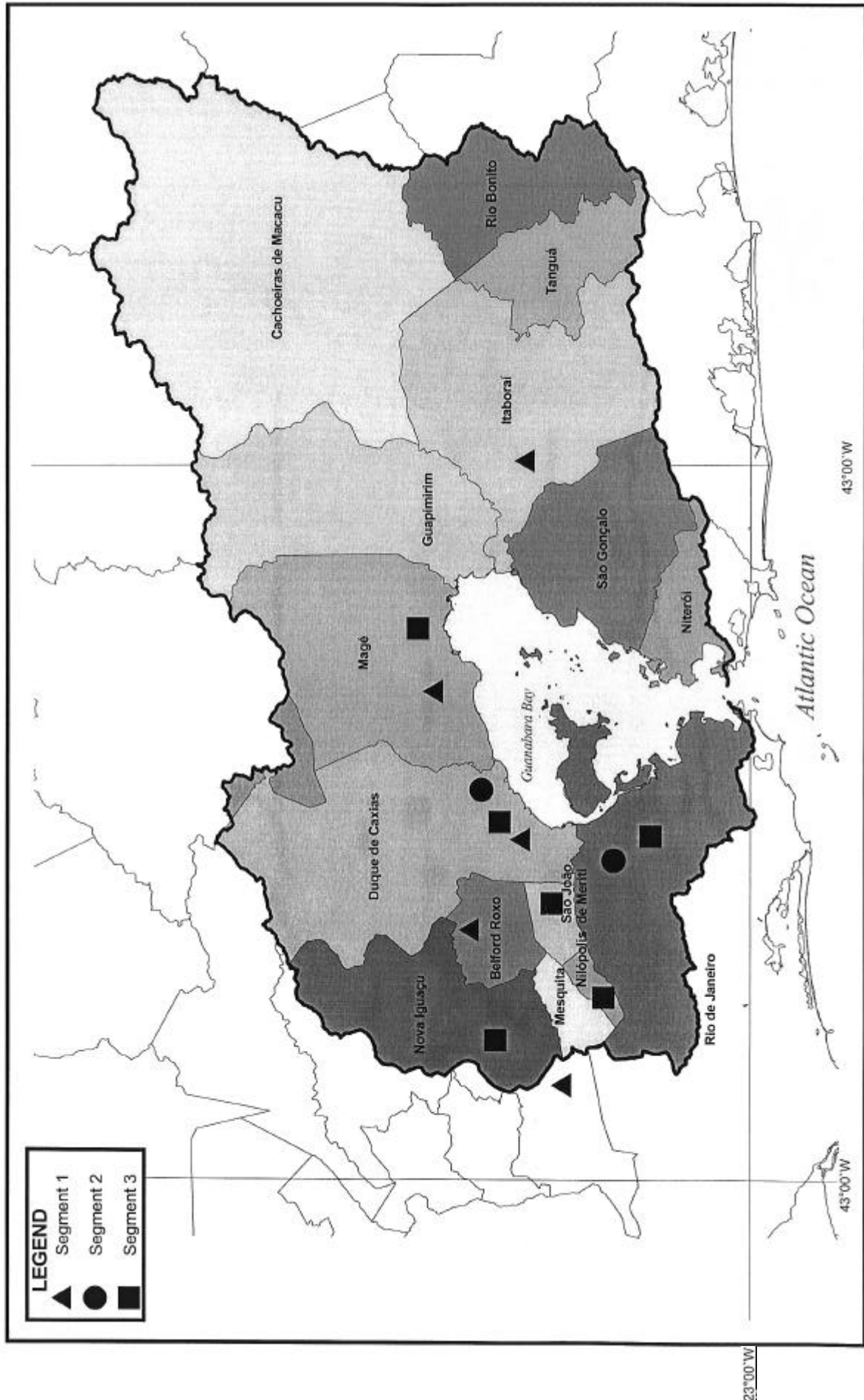


Figure 1 Locations of Sampling Point of Residents' Awareness Survey

## **APPENDIX 16-I**

### **Residents' Awareness Survey Questionnaire**

Appendix 16-I - Residents' Awareness Survey Questionnaire

**PRODEMAN/UERJ** PESQUISA Sewerage conditions in the Guanabara Bay basin

ADDRESS \_\_\_\_\_

NO. INTERVIEW \_\_\_\_\_

BLOCK \_\_\_\_\_ LOT \_\_\_\_\_

CENSUS SECTOR \_\_\_\_\_

MUNICIPALITY \_\_\_\_\_

MUNICIPALITY CODE \_\_\_\_\_

PHONE \_\_\_\_\_ REFERENCE \_\_\_\_\_

INTERVIEWER \_\_\_\_\_

INTERVIEWER CODE \_\_\_\_\_

INFORMER \_\_\_\_\_

INTERVIEW DATE \_\_\_\_\_

Good morning / afternoon / evening. My name is \_\_\_\_\_ and I am working for the Rio de Janeiro State University- UERJ. At the moment, we are carrying out a research about sanitation with the Rio de Janeiro population and, for that, we need your cooperation.

WHO IS THE HEAD OF THIS RESIDENCE? WHAT IS YOUR RELATIONSHIP TO HIM/HER?

1.( ) I am the head 2.( ) Partner 3.( ) Other

**GENERAL INFORMATION**  
(TO BE FILLED OUT BEFORE THE INTERVIEW)

**A. Local topography**

1.( ) Hill without landslide problems

2.( ) Hill with landslide problems

3.( ) Flat area without flooding problems

4.( ) Flat area with flooding problems

5.( ) Others. Specify: \_\_\_\_\_

**B. Type of residence:**

1.( ) House

2.( ) Apartment

3.( ) One room

4.( ) Schack

5.( ) Other. Specify: \_\_\_\_\_

**C. Type of construction material**

1.( ) Masonry

2.( ) Wood

3.( ) Masonry / second hand material

4.( ) Second hand material

5.( ) Others. Specify: \_\_\_\_\_

**D. How many persons live in this residence, including the children?**

\_\_\_\_ persons

**E. What are their names? Let's start with the family head name.**

CODE	Name	Gender M=1 F=2	Age	What is your relationship with the family head?	How long do you live in this residence?	Are you currently working?				How much do you earn per month?
						YES		NO		
						What type of work do you have? (POST)	Are you registered? Yes = 1 No = 2	O(a) está recebendo auxílio desemprego atualmente? Sim = 1 (PROSSIGA) Não = 2 (PULEP/PESSOA SEGUINTE)		
	1 <sup>st</sup> ocup.	2 <sup>nd</sup> ocup.	1 <sup>st</sup> ocup.	2 <sup>nd</sup> ocup.						
01				N.A.						
02										_. _ . _ . _ . _ .00
03										_. _ . _ . _ . _ .00
04										_. _ . _ . _ . _ .00
05										_. _ . _ . _ . _ .00
06										_. _ . _ . _ . _ .00
07										_. _ . _ . _ . _ .00
08										_. _ . _ . _ . _ .00
09										_. _ . _ . _ . _ .00
10										_. _ . _ . _ . _ .00

- POSITION AT OCCUPATION
- Employer.....1
  - Employee - private sector.....2
  - Employee - public sector.....3
  - Independent at house.....4
  - Independent outside house.....5
  - Domestic worker.....6
  - Retired/Pensionist.....7
  - Renting real estates.....8
  - Receiving social benefits.....9 (EXCEPT UNEMPLOYMENT ALLOWANCE)

**F. Is there anyone in this residence receiving pension, some support from the government or any other type of income?**

1.( ) Yes - FILL OUT TABLE E, THE FIELDS FOR "WHAT TYPE OF INCOME?" (SUBSTITUTE "WHAT TYPE OF WORK?")

2.( ) No

**BASIC INFORMATION ABOUT THE FAMILY****G. Are there more than one family living in this residence?**

1. ( ) Yes. How many? | \_ | \_ |  
 2. ( ) No

**H. Now we will talk about consumption items and I would like to know how much is the total expense of the residents with these items. Let's start with housing.**

How much is the monthly expense with....	Value
a) ...housing? (Include rental, condominium tax, installment, etc.)	_.   _   _   _   _   _   .00
b) And with transportation? (Include bus, taxi, subway, train, gasoline/ alcohol/gas/oil, etc.)	_.   _   _   _   _   _   .00
c) And with food?	_.   _   _   _   _   _   .00
d) And with health ? (Include private health services, medicines, doctors)	_.   _   _   _   _   _   .00
e) And with children care / education? (Include school, day-care center, etc.)	_.   _   _   _   _   _   .00
f) And with electric energy?	_.   _   _   _   _   _   .00
g) And with phone? (Include fix and mobile phones)	_.   _   _   _   _   _   .00
h) Is there any other type of expense? IF YES What?	_.   _   _   _   _   _   .00
i) Any other? IF YES, What? _____	_.   _   _   _   _   _   .00

**BASIC INFRASTRUCTURE AND SERVICES****I. Does this residence have electric lighting?**

1. ( ) Yes  
 2. ( ) No

**J. Is your street paved? (CHECK)**

1. ( ) Yes  
 2. ( ) No

**K. Does the street you live have public lighting? (CHECK)**

1. ( ) Yes  
 2. ( ) No

**L. Is this residence served by the solid waste collection service, either at the door or at a nearby container?**

1. ( ) Yes, at the door. How many times a week is it collected? | \_ | \_ | \_ | times  
 2. ( ) Yes, at the container. How many times a week is it collected? | \_ | \_ | \_ | times  
 3. ( ) Yes, but neither at the door nor at the container. How many times a week is it collected? | \_ | \_ | \_ | times  
 4. ( ) No

**M. Do you use another way to get rid of the waste?**

1. ( ) No, I don't  
 2. ( ) Waste is burned  
 3. ( ) Waste is buried  
 4. ( ) Waste is thrown in a ditch  
 5. ( ) Waste is thrown in the river  
 6. ( ) Waste is thrown on my own land  
 7. ( ) **Waste is thrown on the street or on empty land**  
 8. ( ) Other. Specify: \_\_\_\_\_

**WATER SUPPLY****N. Is your residence connected to the water supply system?**

1. ( ) Yes (GO TO P)  
 2. ( ) No

**O. Where does the water consumed here comes from?**

1. ( ) Deep well  
 2. ( ) Shallow well  
 3. ( ) Brooks, rivers, reservoirs or canals  
 4. ( ) Water supply truck paid by the residents  
 5. ( ) Water supply truck supplied by CEDAE, municipal water supply company or prefecture. How many times per month? | \_ | \_ | \_ | times  
 6. ( ) Tap or fountain of CEDAE or municipal water supply company  
 7. ( ) Other. Specify: \_\_\_\_\_

GO TO W

**P. How many days per week does the water come to your residence?**

1. ( ) One day  
 2. ( ) Two days  
 3. ( ) Three days  
 4. ( ) Four days  
 5. ( ) Five days  
 6. ( ) Six days  
 7. ( ) Seven days. Does the water come to you residence all the time or some hours a day?  
     7.1 ( ) The whole day (GO TO R)  
     7.2 ( ) Only in some periods  
 8. ( ) Less than once a week

**Q. Do you happen to know why there is water shortage?**

1. ( ) Yes. Why? \_\_\_\_\_  
 2. ( ) No

**R. Is the water consumption at your residence measured by a water-meter?**

1. ( ) Yes and it is working  
 2. ( ) Yes but it is not working  
 3. ( ) No. Why?  
     2.1 ( ) The resident made a direct connection to the water supply system  
     2.2 ( ) CEDAE (or municipal water supply company) did not put a water-meter  
     2.3 ( ) Other. Specify: \_\_\_\_\_

S. How much do you pay per month for water bill? (ASK TO SHOW THE WATER BILL)

1. IF IT IS CONDOMINIUM

R\$ I \_ I \_ I . I \_ I \_ I ,00 per month paid by the condominium

I \_ I \_ I \_ I (residences)

2. IF IT IS NOT FOR CONDOMINIUM

R\$ I \_ I \_ I . I \_ I \_ I ,00 per month paid by the residents themselves

T. What you pay is the minimum charge?

- 1.( ) It is the minimum charge
- 2.( ) It is not the minimum charge
- 3.( ) I don't know if it is the minimum charge
- 4.( ) It doesn't apply (Pay nothing)

U. Where do you pay your water bill?

- 1.( ) At the bank
- 2.( ) At services shops (lottery, pharmacy, mail service, etc.)
- 3.( ) Automatic debt
- 4.( ) Through Internet
- 5.( ) Other. Specify: \_\_\_\_\_

V. Do you think your residence water bill is.....

- 1.( ) ...high?
- 2.( ) low
- 3.( ) or reasonable? (GO TO X)

W. What is the maximum value would you be willing to pay for water consumption at your residence?

R\$ I \_ I \_ I , 00

X. What is approximately the monthly water consumption at your residence?

1. IF CONDOMINIUM

I \_ I \_ I . I \_ I \_ I cubic meters (m<sup>3</sup>) per month, consumed by the condominium  
I \_ I \_ I \_ I residences

2. IF NOT CONDOMINIUM

I \_ I \_ I cubic meters (m<sup>3</sup>) per month, consumed by the residence

or

I \_ I \_ I buckets of I \_ I \_ I liters per day

Y. In these cards, we listed some activities and we would like to know in which of them you and your family consumes water the most. Please put these cards in order (SHOW CARDS) starting from the most water consuming activity.

Activities	Consumption order
a) Laundry	
b) Taking shower	
c) Flushing the toilet	
d) Cooking and washing dishes	
e) Washing the car	
f) Cleaning outside areas and watering plants	

Z. Is there any other activity in which you consume water?

- 1.( ) Yes. Specify: \_\_\_\_\_
- 2.( ) No

**SEWERAGE**

A'. Is this residence connected to the sewerage system?

- 1.( ) Yes
- 2.( ) No (GO TO G')

B'. Are you satisfied with CEDAE work (or the municipal sewerage company work)?

- 1.( ) Yes
- 2.( ) No. Why? \_\_\_\_\_

C'. Do you know where the sewage collected by CEDAE goes (or the municipal company)?

- 1.( ) I don't know
- 2.( ) It is treated in a WWTP
- 3.( ) It is discharged without treatment in a river, brook Guanabara Bay, beaches, lake, etc.
- 4.( ) Others. Specify: \_\_\_\_\_

D'. Currently, near your residence, there must be polluted canals, rivers or lakes, that smell bad and attract insects and animals that could have a negative influence on you and your family. This is due to the fact that your neighborhood sewage is not being treated.

The sewage, before being returned to rivers, bays or lakes, need to be conveyed to a treatment station where it shall be treated for not polluting the nature.

This is where my question comes:

- a) In order to properly treat your neighborhood sewage; or
  - b) to assure a good maintenance of this treatment....
- ... would you be willing to contribute with 100 reais per month?

- 1.( ) Yes (GO TO Q')
- 2.( ) No

E'. What if this value is 50 reais per month per residence. In this case, would you contribute?

- 1.( ) Yes (GO TO Q')
- 2.( ) No

F'. Then, how much would you be willing to contribute so that the sewage is properly treated before returned to nature?

- 1.( ) Something - Cite: R\$ I \_ I \_ I ,00 (GO TO Q')
- 2.( ) Nothing. Why? \_\_\_\_\_

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

(GO TO Q')

**G'. Does this residence use any other type of sewage disposal?**

- 01. ( ) Septic tank without outfall
- 02. ( ) Septic tank + drainage system
- 03. ( ) Septic tank + trench
- 04. ( ) Open air trench
- 05. ( ) Discharged or channeled directly into a river brook or sea
- 06. ( ) Discharged into the drainage system
- 07. ( ) Cesspit
- 08. ( ) Use of neighbor facilities
- 09. ( ) Other. Specify: \_\_\_\_\_

P/ULE  
P/K'

**H'. Do you use to clean your residence septic tank?**

- 1. ( ) Yes
- 2. ( ) No (GO TO K')

**I'. How often do you clean your septic tank?**

- 1. ( ) Each 6 months
- 2. ( ) Once a year
- 3. ( ) Each 2 years
- 4. ( ) Each 3 years
- 5. ( ) Others. Specify: \_\_\_\_\_
- 6. ( ) Don't know

**J'. What do you usually do with the septic tank sludge?**

- 1. ( ) Throw away with the garbage
- 2. ( ) Throw away in the nearby river or brook
- 3. ( ) Other. Specify: \_\_\_\_\_
- 4. ( ) Don't know

**K'. At the street where you live, are there sewage collection pipes?**

- 1. ( ) Yes
- 2. ( ) No (GO TO M')

**L'. Why isn't your residence connected to the sewerage system at your street?**

- 1. ( ) Financial problems
- 2. ( ) Problems related to CEDAE (or to the municipal sewerage company)
- 3. ( ) Convenience
- 4. ( ) Other. Specify: \_\_\_\_\_
- 5. ( ) Don't know

**M'. Do you know where the sewage collected by CEDAE goes (or the municipal company)?**

- 1. ( ) I don't know
- 2. ( ) It is treated in a WWTP
- 3. ( ) It is discharged without treatment in a river, brook Guanabara Bay, beaches, lake, etc.
- 4. ( ) Others. Specify: \_\_\_\_\_

**N'. Currently, near your residence, there must be polluted canals, rivers or lakes, that smell bad and attract insects and animals that could have a negative influence on you and your family. This is due to the fact that your neighborhood sewage is not being collected nor treated.**

The sewage, before being returned to rivers, bays or lakes, need to be collected and conveyed to a treatment station where it shall be treated for not polluting the nature.

This is where my question comes:

- a) In order to properly collect and treat your neighborhood sewage; or
- b) to assure a good maintenance of this collection and treatment.....

... would you be willing to contribute with 100 reais per month?

- 1. ( ) Yes (GO TO Q')
- 2. ( ) No

**O'. What if this value is 50 reais per month per residence. In this case, would you contribute?**

- 1. ( ) Yes (GO TO Q')
- 2. ( ) No

**P'. Then, how much would you be willing to contribute so that the sewage is properly collected and treated before returned to nature?**

- 1. ( ) Something - Cite: R\$ | \_ | \_ | .00 (GO TO Q')
- 2. ( ) Nothing. Why? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**HEALTH AND HYGIENE CONDITIONS**

**Q'. Is there toilet in your residence?**

- 1. ( ) Yes. How many? \_\_\_\_\_
- 2. ( ) There is no toilet (GO TO S')

**R'. Is this toilet exclusive for your residence or is it for collective use?**

- 1. ( ) Exclusive use of the residence
- 2. ( ) Collective use

**S'. Is there toilet pit at your residence?**

- 1. ( ) Yes
- 2. ( ) No (GO TO U')

**T'. Does it has a flushing device?**

- 1. ( ) Yes
- 2. ( ) No

**U'. I will mention some items and I would like to know which of them do you have at your residence toilet.**

Items	Have or not?	
	Yes	No
a) Piped water	1	2
b) Bathtub	1	2
c) Shower	1	2

**V'. Is there hot water at the bathtub or shower?**

- 1. ( ) Yes
- 2. ( ) No
- 3. ( ) It doesn't apply (there is not bathtub nor shower)

**W'. Does the water your family drink receive any treatment before consumption? IF YES: What treatment?**

1. ( ) Yes, filtration
2. ( ) Yes, boiling
3. ( ) Yes, chlorination
4. ( ) Yes, we buy mineral water
5. ( ) Yes, other. Specify: \_\_\_\_\_
6. ( ) No

**X'. I will mention some infectious diseases and I would like to know which of them you or any of your family members had in the past 12 months.**

Infections Diseases	Does anyone had ..... from August 2001 till now? Who? (CODE. P)	How much did you expend with the treatment.....?	How many leave days did you have to take?
a) Diarrhea		_____.00	____
b) Leptospirosis		_____.00	____
c) Schistosomiasis		_____.00	____
d) Elephantiasis		_____.00	____
e) Dengue fever		_____.00	____
f) Cholera		_____.00	____
g) Impetigo		_____.00	____
h) Scabies		_____.00	____
i) Tuberculosis		_____.00	____
j) Chagas disease		_____.00	____
k) Hepatitis A		_____.00	____
l) Typhoid fever		_____.00	____
m) Other (Specify)		_____.00	____

**Y'. In your opinion, what are the 3 main problems or needs of your community?**

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

**Z'. In your opinion, what are the 3 main health problems of your family and of your community?**

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

**A''. In your opinion, is the Guanabara Bay polluted?**

1. ( ) Yes
2. ( ) No (GO TO E'')

**B''. In your opinion, what is the main reason for the Guanabara Bay pollution?**

1. ( ) Oil spil
2. ( ) Industrial waste and sewage
3. ( ) Waste (non industrial)
4. ( ) Domestic sewage
5. ( ) Other. Specify: \_\_\_\_\_

**C''. Do you think the Guanabara Bay pollution affects you or someone at this residence?**

1. ( ) Yes
2. ( ) No (GO TO E'')

**D''. How the Guanabara Bay pollution affects you or someone at your residence?**

1. ( ) We cannot swim at the Bay beaches
2. ( ) We cannot swim at the beaches near the Bay (ex.: Copacabana, Ipanema, Icaraí in Niterói)
3. ( ) The natural beauty is affected
4. ( ) Bad smell
5. ( ) My work is affected by the pollution
6. ( ) Other. Specify: \_\_\_\_\_

**E''. And now, to finish, I will talk about some consumption goods and I would like to know if you or someone at this residence have these items.**

Do you have...	How many?
01) ...radio?	
02) Gas stove?	
03) Bike?	
04) Electric fan?	
05) Electric shower?	
06) Sound system?	
07) Color TV?	
08) Black and white TV?	
09) Videocasete?	
10) Refrigerator?	
11) Telephone?	
12) Mobile phone?	
13) Air conditioning?	
14) Washing machine?	
15) Motorcycle?	
16) Computer?	
17) Car?	
18) Vacuum cleaner?	
19) Freezer? (independent device or part of the refrigerator)	
20) Maid working on monthly basis?	

- Thank you for answering this interview -

REMARKS



***SUPPORTING 17***  
***ECONOMIC BENEFIT SURVEY***

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## SUPPORTING 17 ECONOMIC BENEFIT SURVEY

### 1. INTRODUCTION

The Study Team defined “value of Guanabara Bay with improved water quality” as economic benefit of sewerage network development, and the Study Team introduced Contingent Valuable Method (CVM) to assess the value. The Study Team conducted “Economic Benefit Survey” to estimate value of the Guanabara Bay with improved water quality, which is expressed by peoples’ willingness to pay for improvement of water quality, from June to August in 2003. This chapter reports methodology and results of Economic Benefit Survey, and estimation of beneficiaries.

### 2. OBJECTIVE OF THE SURVEY

The value of Guanabara Bay with improved water quality is calculated as the sum of peoples’ benefit. But it is very difficult to assess it directly. The objective of this Economic Benefit Survey is to grasp willingness to pay of beneficiaries for virtual wastewater treatment project, which has the same effects as sewer development.

### 3. SURVEY METHODOLOGY

The Study Team adopted an interview survey using questionnaires. It is necessary to prepare a scenario to explain the current situation of Guanabara Bay, virtual wastewater treatment project and benefit of the project, etc. in the survey. And it is also important to set appropriate decision branch about willingness to pay in the questionnaire. The Study Team used the following methodologies, and made efforts to minimize biases of the survey result.

#### 3.1 SAMPLING

The Study Team classified beneficiaries into three categories: resident (people living in Rio de Janeiro State)<sup>1</sup>, Brazilian tourist, and international tourist. Number of samples and survey sites by each category are listed in *Table 1*.

**Table 1 Survey Sites and Sampling**

	Residents	Brazilian tourists	International tourists	Total
Copacabana	40	40	20	100
Ipanema, Lebron	40	40	30	110
Botafogo, Flamengo	40	20	5	65
Ferry Terminal (Centro, Niterói)	40	5	5	50
Niterio beach	30	5	-	35
Praia de Ramos (Swimming facility near Fundao Island)	40	-	-	40
Total	230	110	60	400

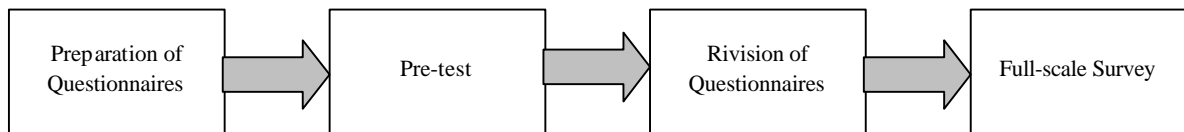
Source: JICA Study Team

<sup>1</sup> Brazilians and foreigners, living in Rio de Janeiro State more than one month, are treated as residents.

## 3.2 PROCEDURE

The survey was conducted under the following procedure in *Figure 1*. In “Preparation of Questionnaires”, a scenario, which explains alternative project, questions about interviewees’ profile are prepared. And clearness and appropriateness of this scenario were examined in the “Pre-test.” In the “Pre-test,” willingness of pay is asked not only by decision branch but also by open-ended answer.

Based on the result of “Pre-test,” the scenario and decision branch about willingness to pay were modified in “Revision of Questionnaires.” And after that the Study Team conducted full-scale survey.



**Figure 1 Procedure of the Survey**

Source: JICA Study Team

## 3.3 QUESTIONNAIRE

### 3.3.1 SCENARIO

The Study team set up a foundation which construct and operate a wastewater treatment plant in the scenario. The result of pre-test reports that a foundation is more appropriate than a government agency for implementation body of the wastewater plant, because interviewees don’t believe in efficient operation by government sector.

The study Team also set that benefit of the project is as same level as achievement of the Strategic Plan in 2020. The achievement of the Strategic Plan, which is expressed by the level of BOD in some points, was translated into the following sentence: “People can enjoy swimming without doubting water quality, and good water quality will influence other environment such as eco-system in the Guanabara bay.”

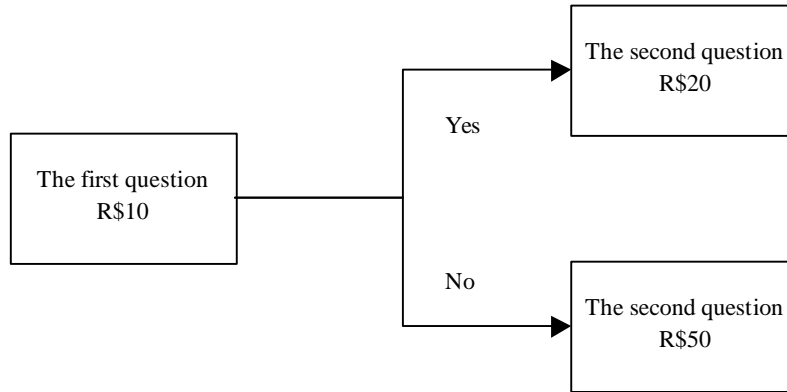
Based on these considerations, the Study team set the following scenario:

*“A Foundation constructs wastewater treatment plant near the bay and operate it to clean seawater. The plant is constructed and operated by contributions from households in Rio de Janeiro State and tourists. This project would improve water quality of Guanabara Bay, and people could have the following benefits:*

- *People will enjoy swimming in beaches (Botafogo, Flamengo, Niterói, Copacabana, Ipanema, and Leblon). People won’t doubt water quality.*
- *Eco-system in Guanabara Bay will recover and people can see fishes and marine creature more in the bay.*
- *People won’t smell bad and won’t see dirty seawater.”*

### 3.3.2 PAYMENT METHODOLOGY AND PAYMENT AMOUNT

The Study Team adopted double bound method for asking payment amount, because it supports to estimate good results with high precision under limited sample number. In the double bound method, interviewers ask willingness to pay to interviewees twice: As shown in *Figure 2*, interviewers ask interviewees whether they can pay R\$10 or not. If they can pay R\$10, interviewees ask to them whether they can pay R\$20 or not. And if they can't pay R\$20, interviewees ask to them whether they can pay R\$5 or not.



**Figure 2 Double Bound Method**

Source: JICA Study team

And payment vehicle was set as “contribution,” because the implementation body is not a government agency but a foundation. Interviewees seemed to answer their willingness to pay more easily under the assumption of “contribution.”

Based on the result of pre-test, the Study Team set the following three versions of decision branch for residents, Brazilian tourists and international tourists in *Table 2*. Number of samples in each version is presented in *Table 3*.

**Table 2 Versions of Decision Branch**

	First question	Yes in the first question	No in the first question
Version 1	10	20	5
Version2	20	30	10
Version3	30	50	10

Source: JICA Study team

(Unit: R\$)

**Table 3 No of Samples in Each Version**

	Residents	Brazilian Tourists	International tourists
Version 1	80	40	20
Version 2	75	35	20
Version 3	75	35	20

Source: JICA Study team

## 4. RESULT OF THE SURVEY

### 4.1 PROFILE OF INTERVIEWEES

Profiles of interviewees are presented in *Table 4*, *Table 5*, and *Table 6*. Residents, Brazilian tourists and international tourists showed the same responses as for the environment of Guanabara Bay.

The first response is concern about water quality problem in Guanabara Bay. Almost of interviewees, 97% of residents, 88% of Brazilian tourists and 86% of international tourists replied that they are concerning water quality problem in Guanabara Bay. And the other response is increasing frequency of visiting beaches/Rio de Janeiro. 70% of residents, 62% of Brazilian tourists and 66% of international tourists replied that if water quality of Guanabara Bay has improved, they would visit beaches/Rio de Janeiro more.

Otherwise, 65% of residents and 59% of Brazilian tourists replied that if water quality of Guanabara Bay has worsened, they would not visit beaches/Rio de Janeiro more.

These replies reports that residents, Brazilian tourists and international tourists recognize pollution of water in Guanabara Bay as serious problem, and they hope water quality should be improved in one way or another.

**Table 4 Profile of Interviewees: Residents**

Valid response	238 persons		
Interview point	Copacabana	48	Praia de Ramos 41
	Icarai	29	Lebron 28
Living place	Rio de Janeiro	176	Niterói 43
	São Gonçalo	11	
Gender	Male	126	Female 112
Age	Average	32.6	20-39 70
	40-59	23	0-19 7
Frequency of visiting beaches	146 days per a year		
Transportation mode to beaches	Bus	89	Walking 73
	Private car	59	
Transportation time	30 minutes		
Concern about water quality of Guanabara bay	Yes	230	No 7
If water quality has improved, do you visit beaches more?	Yes	158	No 67
If water quality has worsened, do you visit beaches less?	Yes	150	No 82

Source: JICA Study Team

**Table 5 Profile of Interviewees: Brazilian Tourists**

Valid response	103 persons			
Interview point	Copacabana	42	Ipanema	30
	Botafogo	23	Lebron	10
Origin State	São Paulo	28	Parana	18
	Minas Gerais	14	Bahia	12
Gender	Male	57	Female	48
Age	Average	31.3	20-39	70
	40-59	23	0-19	7
Length of Stay	16.3 days			
Times of Visiting	First time	40	Second and more	63
Frequency of Visiting	4.6 times per a year			
Purpose of Travel	Pleasure/vacation	61	Business/ incentive tour	21
	Convension	13	Others	9
Accompanying Person of Travel	Alone	33	Family/relatives	30
	Friends & buz associates	21	Tour group	15
Accommodation	Hotel/ apartment hotel	42	Famili & relatives house	44
	Apartment	5	Others	11
Concern about water quality of Guanabara bay	Yes	95	No	8
If water quality has improved, do you visit beaches more?	Yes	46	No	28
If water quality has worsened, do you visit beaches less?	Yes	36	No	25

Source: JICA Study Team

**Table 6 Profile of Interviewees: International Tourists**

Valid response	58 persons			
Interview point	Copacabana	27	Ipanema	21
	Botafogo	5	Niterói	4
Origin State	USA	10	Germany	9
	France	6	United Kingdom	6
Gender	Male	37	Female	21
Age	Average	34.8	20-39	42
	40-59	15	60-	1
Length of Stay	Brazil	17.4	days	
	Rio de Jneiro	11.2	days	
Times of Visiting	First time	48	Second and more	9
Purpose of Travel	Pleasure/ vacation	42	Business/ incentive tour	6
	Convension	9	Others	1
Accompanying Person of Travel	Alone	13	Family/relatives	27
	Friends & buz associates	16	Others	2
Accommodation	Hotel/ apartment hotel	46	Famili & relatives house	0
	Apartment	11	Others	1
Concern about water quality of Guanabara bay	Yes	50	No	8
If water quality has improved, do you visit beaches more?	Yes	38	No	20
If water quality has worsened, do you visit beaches less?	Yes	17	No	41

Source: JICA Study Team



## 4.2 WILLINGNESS TO PAY

Table 7, Table 8 and Table 9 show willingness to pay of residents, Brazilian tourists and international tourists. The second, third and fourth row of tables are decision branch of payment amount. The fifth, sixth, seventh and eighth row present number of interviewees who replied questions. For example, 13 interviewees replied that they could pay R\$10 in the first question, and could pay R\$20 in the second question in version 1 of Table 7. And 29 interviewees replied that they couldn't pay R\$10 in the first question, and couldn't pay R\$5 in the second question.

**Table 7 Willingness to Pay: Residents**

	First question (R\$)	Yes in the first question (R\$)	No in the first question (R\$)	YY (persons)	YN (persons)	NY (persons)	NN (persons)
Version 1	10	20	5	13	21	25	29
Version 2	20	30	10	7	14	13	42
Version 3	30	50	10	4	15	8	43

Source: JICA Study Team

**Table 8 Willingness to Pay: Brazilian Tourists**

	First question (R\$)	Yes in the first question (R\$)	No in the first question (R\$)	YY (persons)	YN (persons)	NY (persons)	NN (persons)
Version 1	10	20	5	7	14	5	8
Version 2	20	30	10	6	8	7	16
Version 3	30	50	10	4	5	16	8

Source: JICA Study Team

**Table 9 Willingness to Pay: International Tourists**

	First question (R\$)	Yes in the first question (R\$)	No in the first question (R\$)	YY (persons)	YN (persons)	NY (persons)	NN (persons)
Version 1	10	20	5	15	1	3	17
Version 2	20	30	10	7	0	6	5
Version 3	30	50	10	4	5	5	6

Source: JICA Study Team

## 5. ESTIMATION OF WILLINGNESS TO PAY

The Study Team estimated willingness to pay of beneficiaries from the survey result in Table 7, Table 8 and Table 9. The Study Team adopted "Random Utility Model." This model is based on utility function of beneficiaries, and highly consistent with economic theory. And this model is most commonly used in CVM analysis.

Basic idea of Random Utility Model is described below:

When an interviewee is asked to pay US\$100 for forestry preservation, he compares the following two cases.

- Case 1: He will pay US\$100, and forest will be preserved.
- Case 2: He won't pay US\$100, and forest won't be preserved.

If interviewee’s utility in Case 1 is larger than his utility in Case 2, the interviewee replied that he would pay US\$100 for forestry preservation. In Random Utility Model, utility function is estimated from the offered amount (US\$100 in case of this example) and the interviewees’ response, in the first. After the estimation of utility function, willingness to pay is calculated from the relation between offered amount and probability of interviewees’ reply.

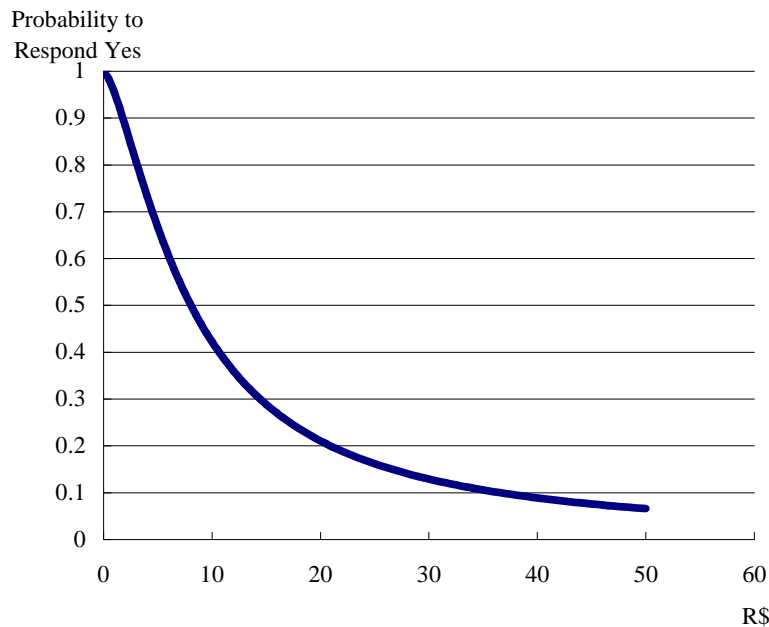
**5.1 RESIDENTS**

Table 10 and Figure 3 show estimation results of residents. The result is valid from low p-value (it is significant with 1%), and minus value of Ln (Bid) (it is log of offered amount). Median of the estimation result is R\$8<sup>2</sup>. Figure 3 illustrates that in case 50% of interviewees respond yes, willingness to pay is R\$8. Therefore the Study Team concludes that willingness to pay of residents is R\$8.

**Table 10 Estimation Results: Residents**

Parameter	Coefficient	t-value	p-value
Constant	3.0332	8.406	0.000***
Ln (Bid)	-1.4532	-10.170	0.000***
No of samples	234		
Log likelihood	-298.302		
Median	8		
Mean	13 <sup>3</sup>		

Note: \*\*\* p-value is significant with 1%  
 Source: JICA Study Team



Source: JICA Study Team

**Figure 3 Estimation Results: Residents**

<sup>2</sup> When willingness to pay is estimated, it is usual not to use mean but to use median for the estimated amount, because value of mean is strongly related with the shape of the function, and only 20-30% of interviews respond yes in value of mean.

<sup>3</sup> The figure come out when maximum payment amount is not infinite but R\$50.

## 5.2 BRAZILIAN TOURISTS

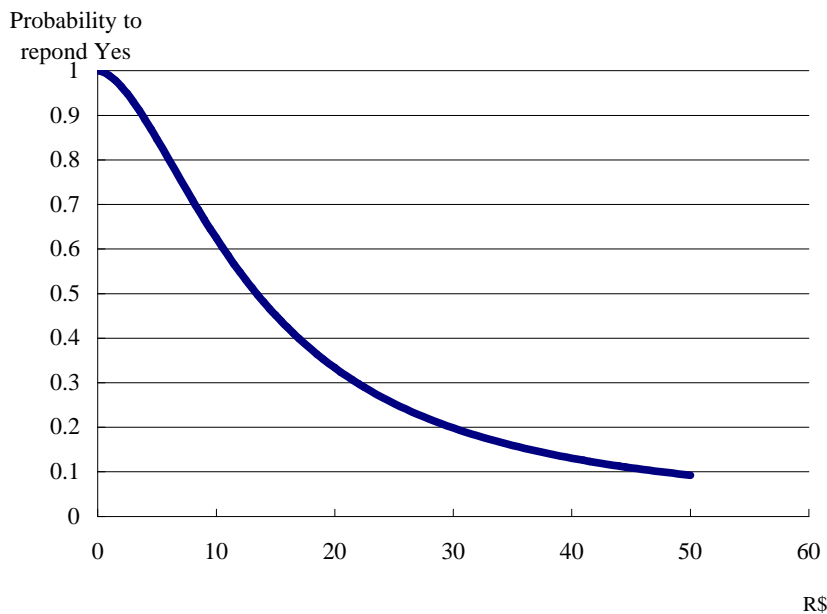
Table 11 and Figure 4 show estimation results of Brazilian tourists. The result is valid from low p-value (it is significant with 1%), and minus value of Ln (Bid) (it is log of offered amount). Median of the estimation result is R\$13. Figure 4 illustrates that in case 50% of interviewees respond yes, willingness to pay is R\$13. Therefore the Study Team concludes that willingness to pay of residents is R\$13.

**Table 11 Estimation Results: Residents**

Parameter	Coefficient	t-value	p-value
Constant	4.5005	8.436	0.000***
Ln (Bid)	-1.7337	-8.801	0.000***
No of samples	104		
Log likelihood	-139.767		
Median	13		
Mean	18 <sup>4</sup>		

Note: \*\*\* p-value is significant with 1%

Source: JICA Study Team



Source: JICA Study Team

**Figure 4 Estimation Results: Residents**

## 5.3 INTERNATIONAL TOURISTS

Table 12 and Figure 5 show estimation results of international tourists. The result is valid from low p-value (it is significant with 1%), and minus value of Ln (Bid) (it is log of offered amount). Median of the estimation result is R\$25. Figure 5 illustrates that in case 50% of interviewees respond yes, willingness to pay is R\$25. Therefore the Study Team concludes that willingness to pay of residents is R\$25.

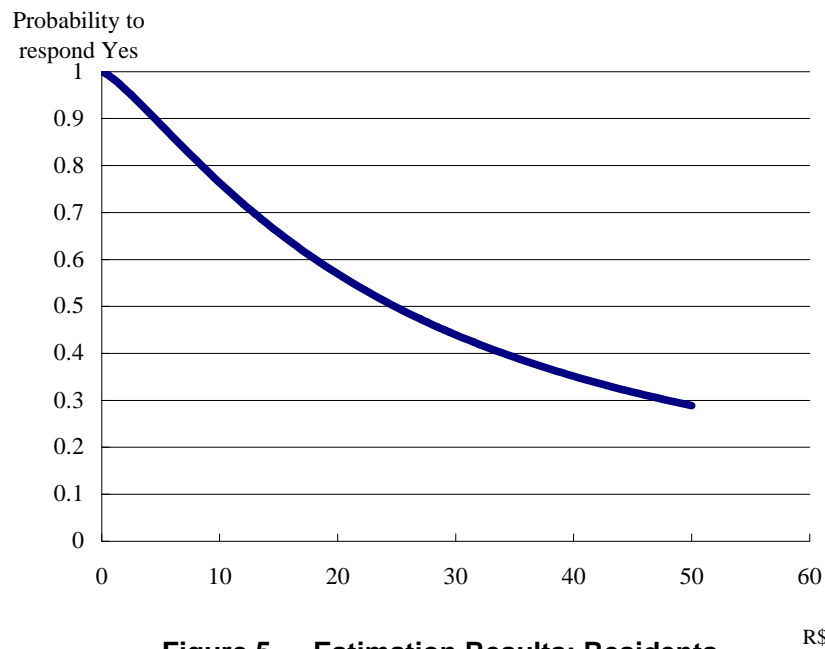
<sup>4</sup> The figure come out when maximum payment amount is not infinite but R\$50.

**Table 12 Estimation Results: Residents**

Parameter	Coefficient	t-value	p-value
Constant	4.1361	4.992	0.000***
Ln (Bid)	-1.2874	-4.757	0.000***
No of samples	58		
Log likelihood	-70.051		
Median	25		
Mean	28 <sup>5</sup>		

Note: \*\*\* p-value is significant with 1%

Source: JICA Study Team

**Figure 5 Estimation Results: Residents**

Source: JICA Study Team

## 6. ESTIMATION OF BENEFICIARIES

Economic Benefit of the Strategic Plan and the Priority Project is calculated from willingness to pay times number of beneficiaries. The Study Team estimated beneficiaries (population of Rio de Janeiro State, Brazilian tourist arrivals and international tourist arrivals) until 2020 under the following methods.

### 6.1 POPULATION OF RIO DE JANEIRO STATES

The Study Team estimates population of Rio de Janeiro State in the Chapter 4 of main report. The same methodology is used here. Thus, share of population in Rio de Janeiro State in Brazil will decrease from 8.44% in 2000 to 8.00% in 2020. The share has been declining since 1970. *Table 13* shows Population forecast of Brazil, which is estimated by IBGE, and population of Rio de Janeiro, which is calculated from the assumption described above. And *Table 14* shows annual population of Rio de Janeiro State until 2020.

<sup>5</sup> The figure come out when maximum payment amount is not infinite but R\$50.

**Table 13 Population Forecast of Brazil and Rio de Janeiro State**

	1991	2000	2005	2010	2015	2020
Brazil (000 persons)	146,825	170,143	181,341	192,040	201,517	209,705
Share of Rio de Janeiro State(%)	8.72	8.44	<b>8.30</b>	<b>8.18</b>	<b>8.08</b>	<b>8.00</b>
Annual Average Growth rate (%)	1.15	1.28	<b>0.94</b>	<b>0.86</b>	<b>0.72</b>	<b>0.60</b>
RJ State (000 persons)	12,807	14,367	<b>15,058</b>	<b>15,716</b>	<b>16,290</b>	<b>16,785</b>

Note: The JICA Study Team forecasts bold figures

Source: Brasil em números 2001 (Brazil in figures 2001), by IBGE

JICA Study Team

**Table 14 Annual Population of Rio de Janeiro State**

Year	Population (persons)	Annual average growth rate (%)
2000	14,367,083	-
2001	14,502,838	0.94
2002	14,639,876	0.94
2003	14,778,209	0.94
2004	14,917,849	0.94
2005	15,058,809	0.94
2006	15,188,177	0.86
2007	15,318,656	0.86
2008	15,450,257	0.86
2009	15,582,987	0.86
2010	15,716,858	0.86
2011	15,830,027	0.72
2012	15,944,010	0.72
2013	16,058,813	0.72
2014	16,174,444	0.72
2015	16,290,907	0.72
2016	16,388,559	0.60
2017	16,486,797	0.60
2018	16,585,624	0.60
2019	16,685,043	0.60
2020	16,785,058	0.60

Source: JICA Study Team

## 6.2 BRAZILIAN TOURIST ARRIVALS

Though Brazilian tourist arrivals was recorded in annual statistics of Rio de Janeiro State, it is not recorded in recent editions. According to previous annual statistics, Brazilian tourist arrivals in 1993, 94 and 95 is shown in *Table 15*, and the table reports that annual growth rate recorded 1.4%. Therefore the Study Team assumed that Brazilian tourist arrivals continue to increase the same percentage until 2020. *Table 16* shows Brazilian tourist arrivals until 2020.

**Table 15 Brazilian Tourist Arrivals in 1993, 94 and 95**

Year	1993	1994	1995
Tourist arrivals (persons)	9,082,000	9,205,000	9,329,665
Annual growth rate (%)		1.4	1.4

Source: JICA Study Team

**Table 16 Brazilian Tourist Arrivals until 2020**

Year	Tourist arrivals (persons)	Annual growth rate (%)
1995	9,329,665	
1996	9,456,019	1.4
1997	9,584,084	1.4
1998	9,713,883	1.4
1999	9,845,441	1.4
2000	9,978,780	1.4
2001	10,113,924	1.4
2002	10,250,900	1.4
2003	10,389,730	1.4
2004	10,530,440	1.4
2005	10,673,057	1.4
2006	10,817,604	1.4
2007	10,964,109	1.4
2008	11,112,599	1.4
2009	11,263,099	1.4
2010	11,415,638	1.4
2011	11,570,243	1.4
2012	11,726,941	1.4
2013	11,885,762	1.4
2014	12,046,733	1.4
2015	12,209,885	1.4
2016	12,375,246	1.4
2017	12,542,847	1.4
2018	12,712,718	1.4
2019	12,884,889	1.4
2020	13,059,392	1.4

Source: JICA Study Team

### 6.3 INTERNATIONAL TOURIST ARRIVALS

Table 17 presents international tourist arrivals in recent years. International tourist arrivals to Brazil have rapidly increased from 2 million in 1995 to 5.3 million in 2000, but it stayed around five percent in recent two years.

**Table 17 International Tourist Arrivals**

Year	Tourist arrivals (persons)	Annual growth rare (%)
1995	1,991,416	
1996	2,665,508	34
1997	2,849,750	7
1998	4,818,084	69
1999	5,107,169	6
2000	5,313,463	4

Source: Anuário Estatístico 2001, EMBATUR

According to the international tourist survey in 2000, Average Length of Stay in Brazil and Rio de Janeiro are 12.06 days and 7.47days, respectively. Therefore international tourist bed-nights in Brazil were 68 million in 2000.

*Table 18* shows destination for international tourists. 34.1% of international tourists visited Rio de Janeiro. Because some tourists visit more than two cities, sum of percentage exceeds 100%. The Study Team calculated international tourist bed-nights in Rio de Janeiro in the following formula:

*International tourist bed-nights in Brazil* × *Percentage of visiting Rio de Janeiro as destinations* ÷ *sum of percentage of destination* = *International tourist bed-nights in Rio de Janeiro*

Thus,

$$68 \text{ million} \times 34.1 \div 126.5 = 27 \text{ million}$$

And “international tourist bed-nights in Rio de Janeiro divide by Average Length of Stay in Rio de Janeiro” is international tourist arrivals in Rio de Janeiro in 2000.

$$27 \text{ million} \div 7.47 = 3.7 \text{ million}$$

**Table 18 Destination for International Tourists in 2000**

Cities	Percentage of destination for international tourists (%)
Rio de Janeiro	34.1
São Paulo	19.7
Florianópolis	18.7
Salvador	13.5
Foz do Iguaçu	12.9
Balneário de Camboriú	6.6
Porto Alegre	5.9
Recife	5.8
Fortaleza	5.4
Búzios	4.0
Total	126.5

Source: ESTUDO DA DEMANDA TURÍSTICA INTERNACIONAL 2000, EMBATUR

And the Study team assumed that international tourist arrivals to Rio de Janeiro would increase 4%, minimum growth rate in *Table 17*. *Table 19* shows international tourist arrivals until 2020 under this assumption<sup>6</sup>.

<sup>6</sup> From 1970 to 2000, annual average growth rate of international tourist arrivals to Brazil in every five years had been recording more than 10%, excluding from 1980 to 1985 (1.3%) and from 1985 to 1990 (-8.8%). At that time Brazil was facing foreign debt problem and hyperinflation. Therefore international tourist arrivals had not increased. If Brazil economy had not experience social and economic big trouble, it is possible to achieve 4% growth of international tourist arrivals.

**Table 19 International Tourist Arrivals to Rio de Janeiro State until 2020**

Year	Tourist arrival (persons)	Annual growth rate (%)
2000	3,704,246	-
2001	3,852,416	4.0
2002	4,006,512	4.0
2003	4,166,773	4.0
2004	4,333,444	4.0
2005	4,506,782	4.0
2006	4,687,053	4.0
2007	4,874,535	4.0
2008	5,069,516	4.0
2009	5,272,297	4.0
2010	5,483,189	4.0
2011	5,702,517	4.0
2012	5,930,617	4.0
2013	6,167,842	4.0
2014	6,414,556	4.0
2015	6,671,138	4.0
2016	6,937,983	4.0
2017	7,215,503	4.0
2018	7,504,123	4.0
2019	7,804,288	4.0
2020	8,116,459	4.0

Source: JICA Study Team

## 7. LOW WILLINGNESS OF PAY OF RESIDENTS

Comparing with Brazilian tourist and international tourist, willingness to pay of a resident seems to be low. And in spite of 90% of residents concerning about water quality problem of Guanabara Bay, and 70% of resident responding to visit beaches more in case of improvement of water quality, their willingness to pay is low level. These results seem to come from residents' low awareness of environment of Guanabara Bay.

Environmental education program will enable residents to be aware of the importance of environment of Guanabara Bay, and to increase willingness to pay to improve water quality of Guanabara Bay.



## **APPENDIX 17-I**

### **Interview Survey of Residents of Rio de Janeiro State Questionnaire**

**APPENDIX 17-I: INTERVIEW SURVEY OF RESIDENTS OF RIO DE JANEIRO STATE QUESTIONNAIRE**

Attached questionnaire below is version 1 for residents in Rio de Janeiro State.

**INTERVIEW SURVEY  
OF  
RESIDENTS OF RIO DE JANEIRO STATE**

**QUESTIONNAIRE**

Tourists staying more than a month are classified as inhabitants.

The Rio de Janeiro State is collaborating with Japan International Cooperation Agency (JICA) to manage and to improve the environment of Guanabara Bay. This interview survey aims to collect basic data on contributions of tourism related industries to the regional economy, and value of the environment of Guanabara Bay. The information collected from interviewee will be treated confidentially.

Thank you for kind cooperation.

A. General information of interviewee

1. Municipality:   
Neighborhood:
2. Gender: a.  Male b.  Female
3. Age: a.  years old
4. Frequency of visiting  
a.  (  )  
[Every day, per a day, per a week, per a month]
5. Transportation mode and time  
a.  Taxi b.  Bus  
b.  Metro d.  Train  
e.  Walk f.  Private car  
  
[Check all transportation mode]  minutes

## B. Evaluation of the environment of Guanabara Bay

Seawater of Guanabara Bay is polluted, because (1) wastewater from industries and household isn't collected completely, and (2) collected wastewater flows into the bay without treatment. You may concern bad smell and polluted water\* in the bay. [\*For example, change to black and red, and garbage, cans, bins and plastics float on the sea]

Water quality of the south part of the bay (that means south of Centro-Noteroi ferry line) seems to be improved recent few years. Now people can swim at beaches in Flamengo, Botafogo [see photograph].

Otherwise seawater of the north part of the bay is still polluted heavily. Dirty wastewater flow into the bay without treatment at downtown and north of Rio de Janeiro City [see photograph]. Most people don't want to swim even in the south part beach such as Copacabana, Ipanema, because they think water quality is not good for swim.

Q1. Do you concern about water quality problem in Guanabara Bay?

a.  Yes

b.  No

Q2 Please reply questions in the following assumption.

Assumption
<p>A Foundation, "Guanabara Bay Water Quality Improvement Fund" would be established. The foundation would construct wastewater treatment plant somewhere at the coast of Guanabara Bay. The plant would be constructed and operated by contributions from households in Rio de Janeiro State and tourists from outside of Rio de Janeiro State.</p> <p>Regulation on industrial wastewater and service level of sewerage network would keep current level in this assumption.</p>
<p>This project would improve water quality of Guanabara Bay, and people could have the following benefits:</p> <ul style="list-style-type: none"> <li>• People will enjoy swimming in beaches (Botafogo, Flamengo, Niterói, Copacabana, Ipanema, and Leblon). People won't doubt water quality. [Most of inhabitants think that seawater of these beaches is polluted and not suitable for swimming].</li> <li>• Eco-system in Guanabara Bay will recover and people can see fishes and marine creature more in the bay.</li> <li>• People won't smell bad and won't see dirty seawater.</li> </ul>
<p>Otherwise, if the project weren't conducted, seawater would be polluted more in accordance with population growth and regional economic development. In this case the following environmental changes would occur in the bay:</p> <ul style="list-style-type: none"> <li>• People cannot enjoy sun bathing and sports at beach, due to bad smell, water pollution and sand pollution.</li> <li>• Eco-system in Guanabara Bay will damage completely, and people could not find any marine creature in the bay.</li> <li>• People will smell bad and see change of colors more all over the place in the bay.</li> </ul>

Q2.1 Willingness to pay for the Project

Q2.1.1 Are you willing to pay R\$10 (US\$4) for contribution per a visit?

a.  Yes

b.  No

Q.2.1.2  
[Only persons who replied "Yes" in Q2.1.1]  
So are you willing to pay R\$20 (US\$8) for contribution per a visit?

a.	<input type="checkbox"/>	Yes	b.	<input type="checkbox"/>	No
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Q.2.1.3  
[Only persons who replied "No" in Q2.1.1]  
So are you willing to pay R\$5 (US\$2) for contribution per a visit?

a.	<input type="checkbox"/>	Yes	b.	<input type="checkbox"/>	No
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Q.2.1.4  
Please select a reason to reply  
[Select only one]

a.	<input type="checkbox"/>	It is important to maintain environment of Guanabara Bay.
b.	<input type="checkbox"/>	It is useful to pay contributions for people's daily life.
c.	<input type="checkbox"/>	Payment amount is low.
d.	<input type="checkbox"/>	The project will support public sector.
e.	<input type="checkbox"/>	Others Specify:

Q.2.1.5  
Please select a reason to reply  
[Select only one]

a.	<input type="checkbox"/>	It is important to maintain environment, but my willingness to pay is lower.
b.	<input type="checkbox"/>	It is not so important to maintain environment of Guanabara Bay
c.	<input type="checkbox"/>	Tourists from outside of RJ State should pay contribution
d.	<input type="checkbox"/>	Public sector should conduct the project.
e.	<input type="checkbox"/>	Others Specify:

Q2.1.6 [Only persons who replied “d.” in the Q2.1.5]

Are you willing to pay R\$10 (US\$4) for tax or charge if the project were conducted by public sector?

a.  Yes

b.  No

Q.2.1.7  
[Only persons who replied “Yes” in Q2.1.6]  
So are you willing to pay R\$20 (US\$8) for contribution per a visit?

a.	<input type="checkbox"/>	Yes	b.	<input type="checkbox"/>	No
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Q.2.1.8  
[Only persons who replied “No” in Q2.1.6]  
So are you willing to pay R\$5 (US\$2) for contribution per a visit?

a.	<input type="checkbox"/>	Yes	b.	<input type="checkbox"/>	No
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Q.2.1.9  
Please select a reason to reply  
[Select only one]

a.	<input type="checkbox"/>	It is important to maintain environment of Guanabara Bay.
b.	<input type="checkbox"/>	It is useful to pay contributions for people’s daily life.
c.	<input type="checkbox"/>	Payment amount is low.
d.	<input type="checkbox"/>	The project will support public sector.
e.	<input type="checkbox"/>	Others Specify:

Q.2.1.10  
Please select a reason to reply  
[Select only one]

a.	<input type="checkbox"/>	It is important to maintain environment, but my willingness to pay is lower.
b.	<input type="checkbox"/>	It is not so important to maintain environment of Guanabara Bay
c.	<input type="checkbox"/>	Tourists from outside of RJ State should pay contribution
d.	<input type="checkbox"/>	Public sector should conduct the project.
e.	<input type="checkbox"/>	Others Specify:

Q2.2 If the environment of Guanabara Bay were improved by the project, would you visit beaches more?

[Please explain benefits of the project once more.]

a.  Yes [Go to Q2.2.1]

b.  No [Go to Q2.2.2]

Q2.2.1 [Only persons who replied “Yes” in the Q2.2]

How often and how long would you visit beaches?

a. Frequency of visiting:

	( )
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[Every day, per a week, per a month]

Q2.2.2 [Only persons who replied, "No" in the Q2.2]

Please explain a reason to select "No"

- a.  Environment of Guanabara Bay is not related with my visit.
- b.  Even if water quality of Guanabara Bay is improved, I don't want to visit so much.
- c.  Others

Specify:

Q2.3 If the environment of Guanabara Bay went worse without the project, would you decrease visiting beaches?

[Please explain changes of environment without the project, and emphasize it is difficult to stay beach for sun bathing and beach sports in case of without-project. ]

- a.  Yes [Go to Q2.3.1]
- b.  No [Go to Q2.3.2]

Q2.3.1 [Only persons who replied "Yes" in the Q2.3]

How often and how long would you visit beaches?

a. Frequency of visiting:

	(     )
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[Per a week, per a month, per a year]

Q2.3.2 [Only persons who replied, "No" in the Q2.3]

Please explain a reason to select "No"

- a.  Environment of Guanabara Bay is not related with my visit.
- b.  Even if water of Guanabara Bay is polluted, I want to visit.
- c.  Others

Specify:

Q3 Comments and opinions on water quality in Guanabara Bay are appreciated.

Obligado/Obligada!