I Specialized Conference on Ecology, Management and River Restoration: Practices and Experiences. 2015

Lisbon University/FLUVIO Programme – Federal University of Bahia/MAASA

Salvador, Brazil, 27-28 July 2015

Main challenges involved in the urban rivers recovery by sewage systems consolidation. Ribeirão Jaguaré, São Paulo-SP.

Juliana C. de Alencar da Silva[1], Monica F. do Amaral Porto[2]

[1] Polytechnic School at the University of São Paulo, juliana.caroline.silva@usp.br
[2] Polytechnic School at the University of São Paulo, mporto@usp.br

Abstract

Man's relationship with the water resource is complex because extrapolates dependence on the level of biological survival, since society is shaped based on the use of this feature depends on it and also for power generation, locomotion, their production processes and leisure. Therefore the importance of quality maintenance of this resource is notorious, but unfortunately what we see in practice does not reflect the scale of importance. The rivers from the beginning of the formation of the great civilizations were taken as a synonym for wealth, for they are the providers of resources that allowed the development of these, and those companies are appropriately called hydraulic because of this direct relationship with the water. However, these days the bodies of urban water are part of a nonsense is given its significance in the past, because for most residents of large cities they represent only sources of problems, which are actually a result of the occupation does not planned urban space. In this context, the present study includes a critical analysis of the challenges involved in the recovery of urban rivers through consolidation of sewage systems, for both analyzed the river basin Jaguaré, situated in the municipality of São Paulo. The analysis of the basin shows that the process is complex and demands special attention to the recovery of the river is lasting.

Keywords: river recovery, water quality, sewage systems consolidation.

Introduction, scope and main objectives

Human development brings with it many challenges when it comes to man's relationship with the environment. On the one hand human activities have high potential to change the landscape on the other it is accelerated development of science dedicated to better understand the processes affected by human development and to seek measures to mitigate those impacts generated. The man, and every living thing, is dependent on the water, be it acting as sponsor of its vital or as a provider of resources for their development functions. However its development took in hand against the sustainable use of this resource and today we have many bodies of water degraded because of its inadequate management, particularly in urban areas.

For a long time the water bodies have suffered several interventions that condemned its biota, meeting many of them at present, with its natural functions nonexistent, mainly due to actions to control its regular floods. In Europe and the United States to recognize the importance of ecological function of rivers it occurred only after the industry and agriculture caused major damage to these environments.

Thus, many ecologists, in temperate countries were deprived of conduct studies in these ecosystems before these interventions (Bayley, 1995), similarly to what occurs in Brazil in urban areas.

One of the main causes of the water crisis in urban areas in Brazil is the degradation of water bodies as it prevents the use of this resource to satisfy internal demands (Teixeira & Porto, 2008). Big cities like São Paulo, for example, despite the abundant water network, due to the degradation of these water bodies in these urban centers, is required to get this feature in neighboring and less urbanized basins, such as the metropolitan area of São Paulo performing the transposition of 33m³ / s of water from the basins of the Piracicaba and Juqueri to the basin of the Alto Tiete (ANA / DAEE, 2013). Therefore, one notes the importance of water quality control not only aimed at improving the quality of life in the urban environment, but also for the preservation of water resources, which both depend.

The main factor affecting the water quality of water bodies on human influence is pollution. The Brazilian Law No. 6.938 / 81 defines pollution as the degradation of environmental quality resulting from activities that directly or indirectly harm the health, safety and people's well-being, and are actions that create conditions adverse to social activities and economic, adversely affect the biota and the aesthetic or sanitary conditions of the environment and launch materials or energy at odds with established environmental standards.

The point charges carry a lot of organic matter, so when discharged into the water body immediately there is the significant increase in oxygen consumption by decomposing organisms in the water body, ie, increase in its BOD. The continued launch of this organic load means that there is the proliferation of aerobic decomposing organisms, leading to the extinction of dissolved oxygen in water, which leads to death of these and other organizations dependent on oxygen. In the next step there is an increase of anaerobic decomposer organisms which are favored by an anoxic environment, and the lack of competition by other resources required for their metabolism. If the release is not stopped the situation remains, it is the process that is observed in the main rivers within the city of São Paulo, such as the rivers, Tietê and Tamanduateí. Although lifeless in the stretch that cuts through the urban area, the Tiete River goes through a self-purification process that makes its clean waters again downstream of the metropolitan region of São Paulo.

When it comes to point loads, beyond the issue of the lack of the collection system and sewage treatment, one of the biggest challenges faced is the depletion of valley bottoms, as the flow used in networks of public sewers in Brazil is mainly conduits free, or conduits that rely on gravity to drain the fluids transported, so the whole exhaustion a basin naturally tends to be directed towards the drainage channel, ie the water body. Rooms located close to the channel, because it-mostly negative thresholds (Residences which has its building installation of sewers naturally oriented Lot background), are difficult to exhaustion because demand the deployment of valley bottom collectors that it is not always easy to perform, and the absence of these collectors often results in the release of the residences in this situation sewage directly into the canal.

Water quality is a limiting factor for the occurrence of biota, so changes resulting from the discharge of pollutants, for example, can result in reduced diversity in aquatic ecosystem. Changes in water quality generate limitations for human use, for example, do not allow the polluted waters and recreational use advanced techniques require treatment for consumption. The city of Sydney in Australia, suffered long with the effects of peak flows that put contaminated water town in contact with the population, this problem was remedied with massive investments in the implementation of sewage treatment stations throughout the city and detention basins (Findlay & Taylor, 2006).

An extreme case of watershed degradation is the city of Mombasa in Kenya, where the degradation was so high that resulted in enhancement of treatment to the point that the system was simply abandoned. Although wetlands are efficient in water recycling process, they depend on the surrounding conditions to maintain its optimum, so changes in land use fees can compromise this service provided by watershed (Postel & Barton, 2005).

Case of study

The Ribeirão Jaguaré is located in the Alto Tiete basin in its Sub-basin called Penha - Pinheiros. The basin of the Alto Tiete possess an area of about 6mil square kilometers, covering 35 municipalities, 37% of its area occupied by urban areas. The basin is named for being the head of the Rio Tiete therefore is characterized by having courses of small water, where this natural feature coupled with high population concentration in it, results in a low water availability in the basin and is comparable to in northeastern Brazil (Silva & Porto, 2003).

The Ribeirão Jaguaré is located in the West Zone of São Paulo, the main access routes to the Avenida Marginal Pinheiros River and the Raposo Tavares highway. The basin of water body has an area of contribution of approximately 27 square kilometers, located almost in its entirety in the sub-prefecture of Butantã, whose use and occupation of soil is predominantly residential, there is still a small portion industries due the Raposo Tavares highway that cuts through the basin. Figure 1 below shows the contribution of basin of Ribeirão Jaguaré and its main lines.

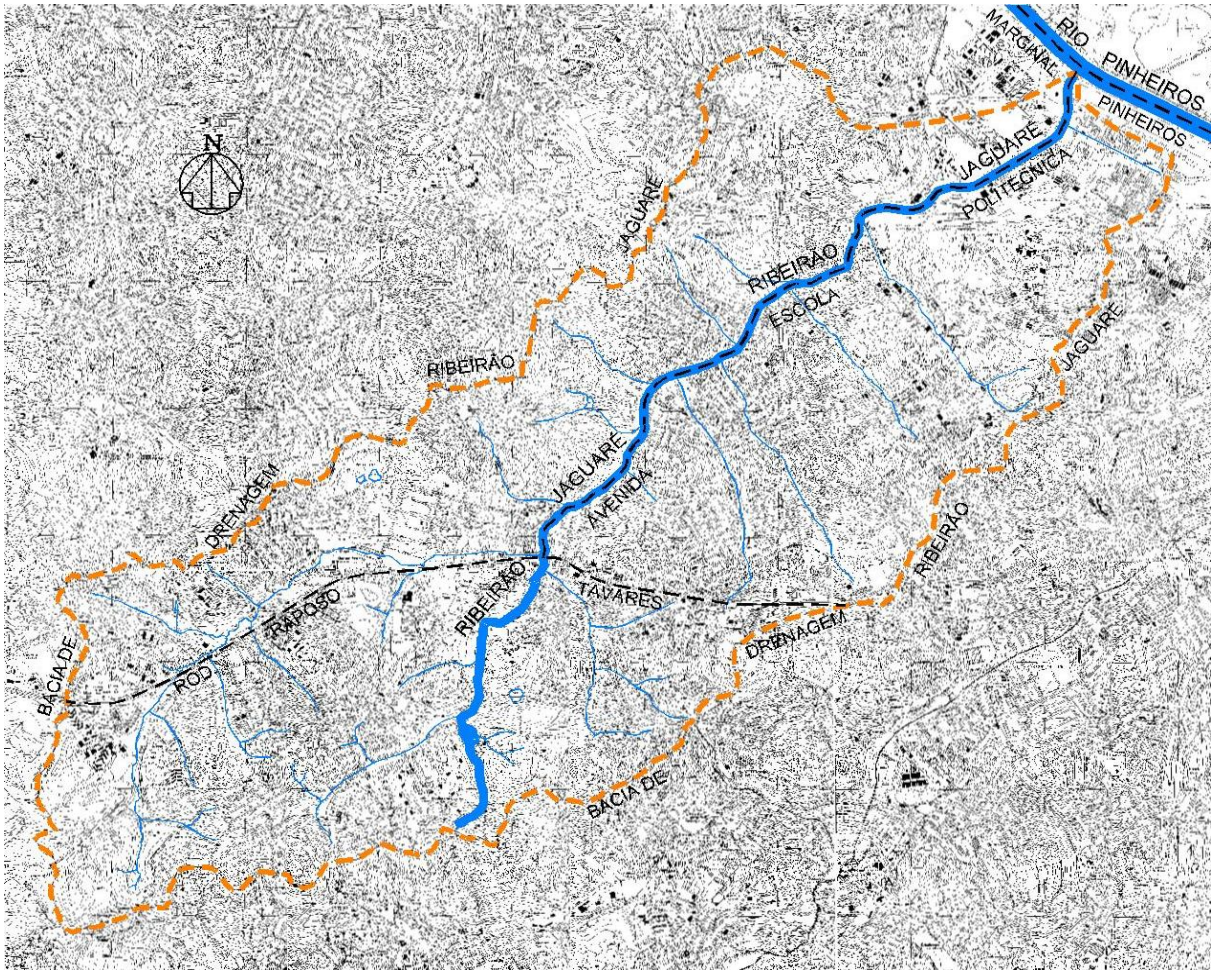

Fig. 1: Location of the study area.

Methodology

This study includes the study of the existing sewerage system in the skunk river basin in order to propose measures for its consolidation, with the installation of collection networks to promote the depletion of 100% of households in the basin; collectors trunk leading the effluents collected at the treatment system. Therefore the records exist of systems were used obtained from the SABESP and the São Paulo Municipal Government.

Results and discussion

The exhaust system of the basin has been studied and obtained the following result map that identifies the networks that release the effluent collected in the drainage system (in color) and networks that direct the effluent collected for treatment system (in gray), as shown in Figure 2. Table 1 below shows the flow rates calculated for the depletion of basins identified in Figure 2. The analysis of this map and Table (Figure 2 and Table 1) is possible extract that about 48% of collection networks basin still direct the effluent collected to the drainage system, totaling 569,48L/s of sewage, which contributes significantly to the degradation of water bodies in the basin.

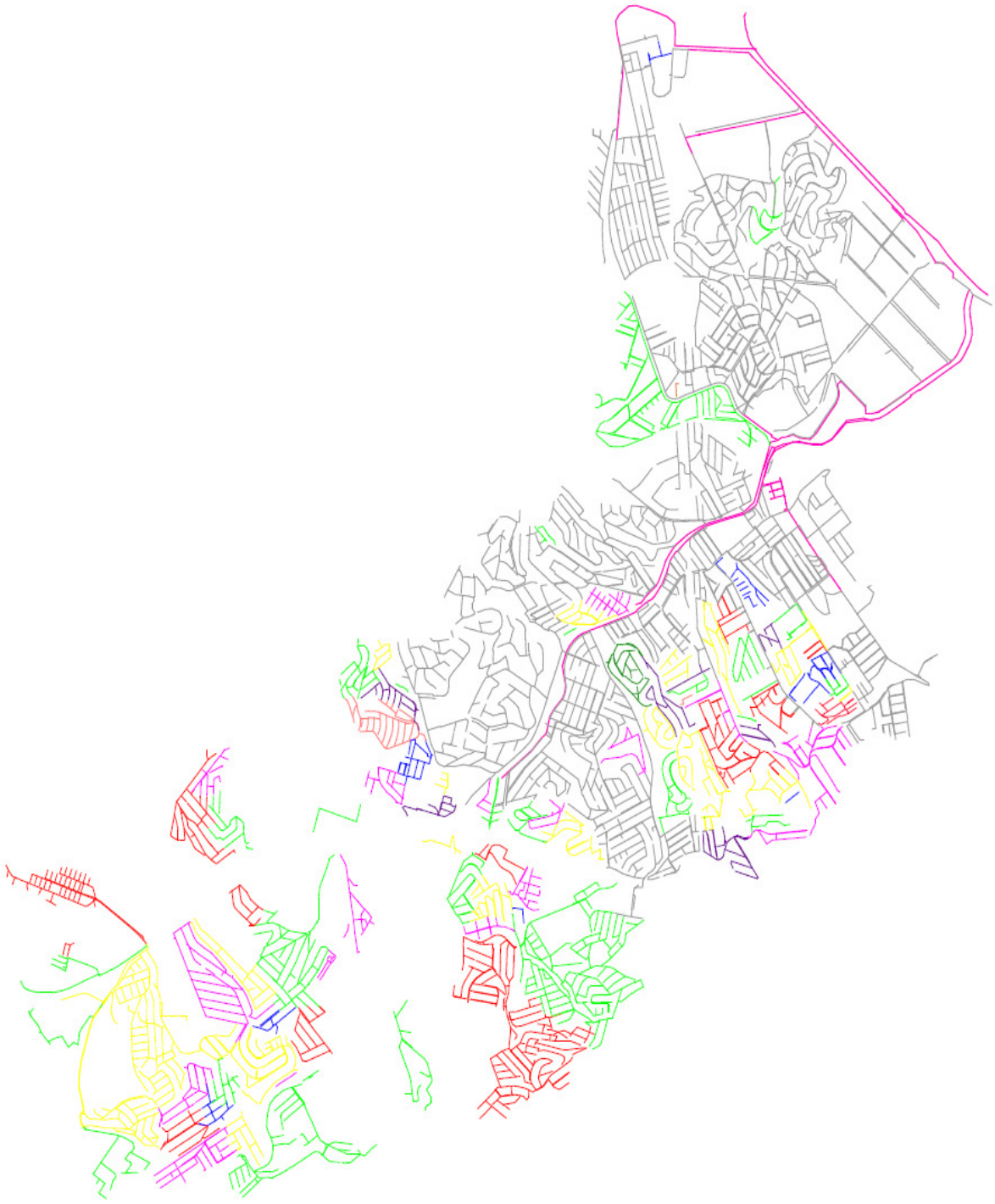

Fig. 2: Existing system and its sewage basins - Color: go to the river / Gray: goes to treatment.

Table 1: Flow Exhaust basin.

sewerage basin	Network extension (m)	Flow (L/s)	sewerage basin	Network extension (m)	Flow (L/s)	sewerage basin	Network extension (m)	Flow (L/s)
B1	1962,07	5,46	B32	179,61	0,50	B63	2101,38	5,85
B2	16975,86	47,25	B33	2426,71	6,75	B64	1430,88	3,98
B3	1089,69	3,03	B34	14811,37	41,22	B65	670,62	1,87
B4	2213,40	6,16	B35	16070,74	44,73	B66	746,66	2,08
B5	3393,72	9,45	B36	1202,89	3,35	B67	1171,02	3,26
B6	2181,35	6,07	B37	1395,94	3,89	B68	786,91	2,19
B7	987,51	2,75	B38	362,86	1,01	B69	1167,27	3,25
B8	1143,56	3,18	B39	1753,52	4,88	B70	666,49	1,85
B9	1301,53	3,62	B40	3821,86	10,64	B71	2020,85	5,62
B10	6194,90	17,24	B41	2036,49	5,67	B72	728,76	2,03
B11	188,87	0,53	B42	686,67	1,91	B73	263,29	0,73
B12	4634,27	12,90	B43	2818,66	7,84	B74	1396,25	3,89
B13	897,68	2,50	B44	1970,09	5,48	B75	1991,40	5,54
B14	1956,12	5,44	B45	132,03	0,37	B76	295,71	0,82
B15	2069,24	5,76	B46	1873,60	5,21	B77	5159,68	14,36
B16	6301,15	17,54	B47	1296,14	3,61	B78	411,13	1,14
B17	554,26	1,54	B48	3545,32	9,87	B79	1495,56	4,16
B18	1156,50	3,22	B49	4911,44	13,67	B80	1505,29	4,19
B19	1617,26	4,50	B50	1248,03	3,47	B81	416,16	1,16
B20	1860,99	5,18	B51	1240,30	3,45	B82	5357,91	14,91
B21	241,19	0,67	B52	1230,51	3,42	B83	2436,42	6,78
B22	5153,39	14,34	B53	836,08	2,33	B84	131,32	0,37
B23	3807,76	10,60	B54	1985,81	5,53	B85	576,89	1,61
B24	1565,01	4,36	B55	935,68	2,60	B86	918,98	2,56
B25	1241,97	3,46	B56	417,65	1,16	B87	2084,4	5,80
B26	601,21	1,67	B57	115,88	0,32	B88	1233,67	3,43
B27	499,28	1,39	B58	1627,93	4,53	B89	111,56	0,31
B28	1026,33	2,86	B59	1660,04	4,62	B90	11981,56	33,35
B29	2307,08	6,42	B60	1512,68	4,21	B91	2065,99	5,75
B30	1096,42	3,05	B61	837,69	2,33	B92	437,57	1,22
B31	1523,50	4,24	B62	160,55	0,45	CT	187358,32	521,46
						TOTAL	391967,74	1090,94

Based on the map and table, were designed sewage exhaust solutions for each of the basins, where it was found the need to implement 11,6 Km of new networks. The points studied were characterized by being areas of difficult exhaustion, valley bottom that requiring auxiliary works, such as slum urbanization, which makes the complex process. Figure 3 shows an exemple.

Fig. 3: Proposal for exhaustion of basin 21.

Conclusions

Based on the analysis of the sewage system of the river basin Jaguaré it was concluded that the pollution from point charges, by launching domestic sewage, still has significant influence over the pollution of the water body.

The basin of the Jaguaré is in an already consolidated load region and therefore with great portion of the population already served by sewage collection networks, however there is still a deficit in the system consolidation, since about 48% of the collected sewage They are still released into the drainage system. It identified the need for 11,6 Km deployment of new sewage collection networks for the system to be consolidated, which in itself would require an investment of 50 million of reais (based on basic cost of municipality of São Paulo), however many of the areas they operate in areas of social interest, requiring additional actions, such as slum urbanization, bringing the necessary investment and makes the process even more complex.

In addition, the consolidation of the total separate system is needed, through scanning the collection networks of sewers and storm drainage networks for complete isolation of the two systems.

References

ANA/DAEE - Agência Nacional de Águas e Departamento de Águas e Energia Elétrica – Dados de Referência da Outorga do Sistema Cantareira, Agosto de 2013.

Bayley, P. B. - Understanding large river: floodplain ecosystems.BioScience, 153-158, 1995.

Findlay, S. J.; Taylor, M. P. - Why rehabilitate urban river systems?. Area, v. 38, n. 3, p. 312-325, 2006.

Postel, S. L., and Barton H. T. - Watershed protection: Capturing the benefits of nature's water supply services. Natural Resources Forum. Vol. 29. No. 2. p. 98-108. Blackwell Publishing, Ltd., 2005.

Silva, R. T.; Porto, M. F. D. A. - Gestão urbana e gestão das águas: caminhos da integração. Estudos Avançados, v. 17, n. 47, p. 129-145, 2003.

Teixeira, C. A.; Porto, R. L. L. - Modelo matemático para gerenciamento de quantidade e qualidade da água em rios. Um estudo de caso: bacia do rio piracicaba. Revista de ciências ambientais, v. 2, n. 2, p. p. 79-104, 2008.