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To cite this article: A Azhar *et al* 2019 *IOP Conf. Ser.: Earth Environ. Sci.* **314** 012003

Pollution load capacity of Batang Kuranji River, Padang City

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Abstract. This study aimed to determine the pollution load capacity (DTBP) of Batang Kuranji River against the parameters of Total Suspended Solid (TSS), Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD). In general, pollutant sources are caused by developments and activities of urban communities such as domestic activities, industry, agriculture and other activities. This research is descriptive quantitative by using Qual2KW method with the sampling location point on the representative of land use located along the kuranji stem river as many as 24 sampling locations, which are divided into 24 segments, spatially from upstream to downstream. The results showed that the parameters of Total Suspended Solid (TSS) were seen from upstream to downstream in the area of sections 8, 10, 14 must be reduced pollution load of 648 kg / day (section 8), 15,552 Kg / day (section 10) and 22,032 Kg / day (section 14), this is due to (1) economic activities of the community in the agricultural sector, in the form of rice fields directly adjacent to the Batang Kuranji river which can cause erosion, (2) livestock sector activities in the form of chicken farming, where the community directly discarding the remnants of chicken feed is discharged directly into the river so that it can increase the pollution load of TSS parameters. Parameters of BOD in Section 6 and Section 16 must be reduced by a pollution load of 453.60 Kg / day (Section 6), 1,308.96 Kg / day (Section 16), This is due to this high pollutant source such as: (1) domestic / domestic waste activities, (2) rice field agriculture. Whereas the COD parameters in areas 3, 7, 14, 15, and 16 must be reduced by 3,862 kg / day (section 3), 16,783.20 kg / day (section 7), 3,149.28 Kg / day (segment 14), 9,629.28 Kg / day (section 15) and 22,589.28 Kg / day (section 16), this is because there are still many agricultural, plantation and livestock areas so that many sources of pollutants enter the Batang Kuranji river from chemicals organic so that the river water in Batang Kuranji can still accept pollution loads, for the COD parameter the approach is more inorganic chemistry and there are many inorganic chemical compounds in the disposal of liquid waste in the Company / Industry. With the quality conditions of the current Batang Kuranji River in the Padang City segment, control efforts are needed for the pollution. Related to the results of the study, and from the conclusions obtained, the efforts made for optimal control are the application of environmentally sound spatial principles.

1. Introduction

Padang city is the capital of West Sumatra Province. In Padang city, there is a river called the river of Batang Kuranji. The river flows in four (4) districts, namely (1) Kuranji Subdistrict, Subdistrict Pauh (2), (3) Sub Nanggalo, and (4) of North Padang sub district. Pauh, there are Sub on 8 (eight) village.

But the village irrigated River Rod Kuranji only four (4) wards, namely (1) the village Hull Hill, (2) Wards Quarts Tangah, (3) subdivisions of Kapalo Koto and (4) the village of Kampung Binuang inside. At Kuranji Subdistrict 9 (nine) village. But not all the keluarahan irrigated by Sungai Batang Kuranji. There are 5 (five) wards are irrigated by Sungai Batang Kuranji, namely (1) the village Korong, Gadang, Kalumbuk Village (2) and (3) the village Bottom Leech Kuranji, (4) and (5) Pasa Ambacang.

In Nanggalo there is 6 (six) village. In contrast to that Kecamatan Kuranji Pauh and not all neighborhood and flowed the river Rods Kuranji, in district Nanggalo to 6 wards, all of which is irrigated area the river Rods Kuranji. The subdistricts are (1) the village of Kampung Chi, (2) Desert Laweh Village, (3) the village Surau, Gadang, and (4) Wards Kurao Pagang, Lapai Village (5) and (6) Neighborhood Tabing Banda Gadang. Meanwhile, Padang Utara subdistrict has 7 (seven) the village, but the village irrigated River Rod Kuranji only three villages only. Each village was (1) the village of freshwater West, (2) the village of freshwater East, and (3) the village North Reef Ulak. Thus, it can be concluded that of the 4 existing sub-districts in the city of Padang, there were 18 (eighteen) villages which flowed the river Rods Kuranji. In other words, a Batang River Kuranji, Padang city segments are at 18 areas villages spread over four (4) districts.

In fact, a Batang Kuranji River is one of the rivers that pressure gets high enough. This is caused by the development and activity of the society of the city such as the activities of domestic, industrial, agricultural or other activities. Any existing community activities, especially those that reside on each village irrigated by Sungai Batang Kuranji is impacting on the quality of the river Rods Kuranji. In terms of demographics, Padang city from year to year has increased the number of inhabitants in quantity. Reported by BPS Padang in numbers (2013) that the population in the city of Padang has reached number 1,261,000 souls. Rate of population growth of the city of Padang which amounted to 2.23%, will project a large enough population.

Population growth will have implications for Padang City against adding space to a residential area. Neighborhoods will potentially against the pollution and destruction of the environment, because in the region that the occurrence of various activities of the society. These circumstances, of course, will have an impact on power support (carrying capacity) environments, especially in the environment of the river Rods Kuranji in terms of capacity against the burden of pollution caused by population growth.

To maintain the water quality of the river Rods Kuranji so as not to experience a decrease in the future, required a study of water quality of the River in the existing conditions. Research on water quality of the River in question is the determination of capacity of existing tamping. It is useful to know the potential or ability of the River in receiving waste is corrupted it. With the known capacity of the capacity of the River, a Batang Kuranji will be determined step forward other strategic measures related to control measures of the quality of the river water Rods Kuranji. Given the function of river water as one of the water resources in the form of a body of water, then it is very important that the determination of this capacity. In addition, the research capacity is considered urgent because of other variables that are in the system of the city, such as the rate of population growth, community activity pattern of the city, as well as the development of land use in city space is extremely complex, so It's hard to be examined in order to control the quality of the river water. On the contrary, through the determination of the power this pollution burden of tamping, then the results can be used as a foundation for controlling variables in such a complex above.

The formulation of the problem in this paper is: (a) How much is the pollution load capacity of Padang City Batang Kuranji River from upstream to downstream to TSS parameters; (b) How much is the pollution load capacity of Padang City Batang Kuranji River from upstream to downstream towards BOD parameters; (c) How much is the pollution load capacity of Padang City Batang Kuranji River from upstream to downstream towards COD parameters. The objectives of this study are: (a) Analyzing the pollution load capacity of Padang City Batang Kuranji River towards TSS parameters; (b) Analyzing the pollution load capacity of the Batang Kuranji River against BOD parameters; (c)

Analyzing the pollution load capacity of the Padang City Batang Kuranji River against the COD parameters.

Water quality management strategies with QUAL2Kw in the Bagmati River, Nepal, during the critical period (drought) to maintain targeted water quality where DO is a minimum of 4 mg / L or more; Maximum BOD 3 mg / L; Total N 2.5 mg / L; Total P 0.1 mg / L; water temperature is small or equal to 20◦C; pH in the range 6.5–8.5, taking into account modification of pollutant load, addition of discharge and local oxygenation. The results of the study indicate that local oxygenation is effective in maintaining minimum DO content in the river. The combination of modified wastewater, addition of flow and local oxygenation is suitable for maintaining permissible water quality limits [1]

1.1 Pollution Load Capacity

According to the decision of the Minister of the environment No. 110 Year 2003 that the pollution load capacity is the ability of the water at a water source to receive the input of the load without resulting in contamination of the water are being polluted. While the burden of pollution is the amount of a contaminant elements contained in water or waste water which is expressed in units of mass per time. [2]

Pollution of waters caused by loading various human activities that go beyond the capabilities of the amount recovered from the waters of self or other activities. Pollutants can be either solid chemical compounds (organic and inorganic) and pathogen bacteria all of which resulted in a decline in water quality and value to the waters as a source of raw water for various activities. Capacity is the ability of the environment to absorb the energy and matter, or other components that enter or put into it. [3]

1.2 Determination of the Capacity load of Pollution by Qual2KW Method

One method that can be used to determine the load capacity of the pollution of the river is by the method Qual2KW. This method is the development of Qual2 by the United States Environmental Protection Agency (US EPA). Development of the method of Qual2 is the final revision and Qual2E Qual2KW. Through this method can simulate or predict changes in the quality of the River from upstream to downstream if the flow of liquid waste is reduced or added. And thus, be aware of the load capacity of the pollution of the River in accordance with the criteria of quality raw environment that has been established.[4]

2. Methods

Research conducted is a quantitative descriptive, in determining the location of a sample of researchers using the applications of GIS (Geographical Information System) as well as using GPS (Geographical Portable System), the application can determine the distribution of land use and the coordinate points of sampling to be taken before taken directly spaciousness (location of sampling point from upstream to downstream is presented in Figure 1).

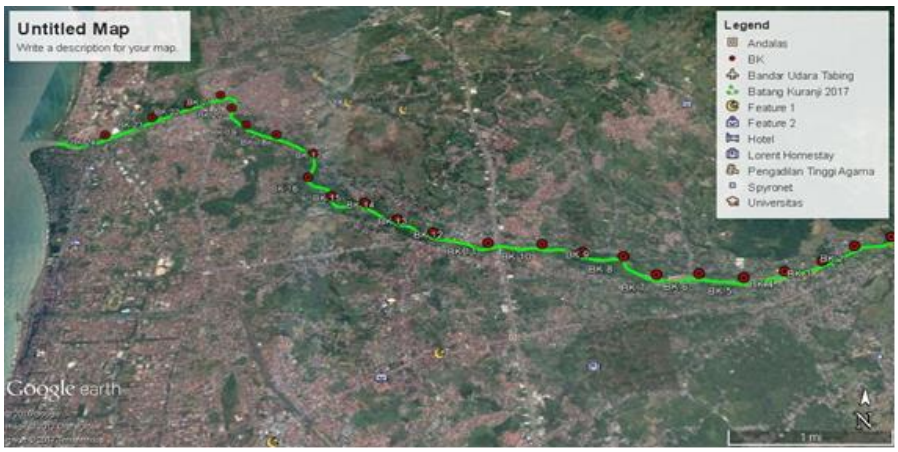

Figure 1. Location of Sampling Point River Batang Kuranji Padang City.

Determination of water quality parameters of river Rod Kuranji refers to government regulation Number 82 Year 2001 as indicated in table 1.

Table 1. Water quality parameter based on the Government Regulation Number 82/2001

No	Parameters	Unit	Tool	Method	SNI
1.	TSS	mg/l	Analytical balance	Gravimetric	06-6989.3-2004
2.	BOD	mg/l	Buret	Titrimetric	6989.72:2009
3.	COD	mg/l	Spectrophotometer	Spectrophotometry	6989.2:2009

The selected sampling technique is the grab sampling, where sampling is carried out as many as 1 (one) point for each sampling time. Provision of distance sampling is + 1/3 and 2/3 the width of the River at a depth of 1/2 meters + from the surface of the water stream by using an ordinary bottle or a plastic bucket.[5]

3. Results and discussion

3.1 Parameters TSS

Table 2. Pollution Load Capacity Batang Kuranji River Padang City to parameters TSS

No	Location	Range Site		Pollution Load	Capacity	Pollution Load Capacity	Description
		Up (km)	Down (km)	(kg/day)	(kg/day)	(kg/day)	
1	Location 1	12,80	12,30	129,60	9.072,00	-8.942,40	pollution load may be added
2	Location 2	12,29	11,70	3.888,00	6.480,00	-2.592,00	pollution load may be added
3	Location 3	11,69	11,20	6.480,00	6.480,00	0,00	pollution load may be added
4	Location 4	11,19	10,60	-3.888,00	6.480,00	-10.368,00	pollution load may be added
5	Location 5	10,59	10,00	1.296,00	6.480,00	-5.184,00	pollution load may be added
6	Location 6	9,99	9,48	1.296,00	6.480,00	-5.184,00	pollution load may be added
7	Location 7	9,47	8,95	1.296,00	6.480,00	-5.184,00	pollution load may be added
8	Location 8	8,94	8,40	7.128,00	6.480,00	648,00	pollution load must be reduced
9	Location 9	8,39	7,84	-5.184,00	6.480,00	-11.664,00	pollution load may be added
10	Location 10	7,83	7,25	22.032,00	6.480,00	15.552,00	pollution load must be reduced
11	Location 11	7,24	6,71	-2.592,00	6.480,00	-9.072,00	pollution load may be added
12	Location 12	6,70	6,17	-3.240,00	6.480,00	-9.720,00	pollution load may be added
13	Location 13	6,16	5,63	-6.480,00	6.480,00	-12.960,00	pollution load may be added
14	Location 14	5,62	5,10	28.512,00	6.480,00	22.032,00	pollution load must be reduced
15	Location 15	5,09	4,53	-25.920,00	6.480,00	-32.400,00	pollution load may be added
16	Location 16	4,52	3,98	-11.664,00	6.480,00	-18.144,00	pollution load may be added

17	Location 17	3,97	3,43	-3.888,00	6.480,00	-10.368,00	pollution load may be added
18	Location 18	3,42	2,89				
19	Location 19	2,88	2,35				
20	Location 20	2,34	1,81				
21	Location 21	1,80	1,27				
22	Location 22	1,26	0,72				
23	Location 23	0,71	0,35				
24	Location 24	0,34	0,00				
	Total			24.753,60	99.792,00	-75.038,40	

Parameter TSS on sections 8, 10 and 14 of the load should be reduced pollution of 648 kg/day (section 8), 15,552 Kg/day (section 10) and 22.032 Kg/day (section 14); This is caused due to (1) the economic activities of the community in the agricultural sector, in the form of Rice that is directly adjacent to the river Rods Kuranji that could lead to the occurrence of erosion, (2) the activity of the farm sector in the form of a chicken farm, where the community immediately dispose of the remains of chicken feed were disposed of directly to the river so that it can increase the burden of the pollution parameters of TSS.

From the results of this study when compared to the results of relevant research results can be seen monitoring parameter TSS in the Metro the city of Malang, showed increased from 1 station (Metro/hulu Sungai Karang Besuki Village) to station 2 (River span Metro/Village Pisangcandi) and 3 (Metro/River downstream of the village Bandungrejosari). TSS value at station 1 of 34.0 mg/l and then rising at 2 stations of 50.4 mg/l and increases at 3 stations of 62.6 mg/l. This is due to an increase in TSS values of river water on Metro stations 2 and 3, due to the large number of rather the function of the land into a residential/woke up around Metro basin, causing the soil solids-solids entering the river flow through run off increasing [6]

3.2 Parameter BOD (Biochemical Oxygen Demand)

Table 3. Pollution Load Capacity Batang Kuranji River Padang City to parameters BOD

No	Location	Range Site		Pollution Load	Capacity	Pollution Load Capacity	Description
		Up (km)	Down (km)	(kg/day)	(kg/day)	(kg/day)	
1	Location 1	12,80	12,30	152,93	583,20	-430,27	pollution load may be added
2	Location 2	12,29	11,70	141,26	259,20	-117,94	pollution load may be added
3	Location 3	11,69	11,20	145,15	375,84	-230,69	pollution load may be added
4	Location 4	11,19	10,60	145,15	440,64	-295,49	pollution load may be added
5	Location 5	10,59	10,00	149,04	427,68	-278,64	pollution load may be added
6	Location 6	9,99	9,48	907,20	453,60	453,60	pollution load must be reduced
7	Location 7	9,47	8,95	0,65	518,40	-517,75	pollution load may be added
8	Location 8	8,94	8,40	0,65	453,60	-452,95	pollution load may be added

9	Location 9	8,39	7,84	0,65	388,80	-388,15	pollution load may be added
10	Location 10	7,83	7,25	142,56	453,60	-311,04	pollution load may be added
11	Location 11	7,24	6,71	142,56	388,80	-246,24	pollution load may be added
12	Location 12	6,70	6,17	142,56	453,60	-311,04	pollution load may be added
13	Location 13	6,16	5,63	142,56	440,64	-298,08	pollution load may be added
14	Location 14	5,62	5,10	142,56	557,28	-414,72	pollution load may be added
15	Location 15	5,09	4,53	142,56	635,04	-492,48	pollution load may be added
16	Location 16	4,52	3,98	1.944,00	635,04	1.308,96	pollution load must be reduced
17	Location 17	3,97	3,43	0,00	635,04	-635,04	pollution load may be added
18	Location 18	3,42	2,89	0,00	635,04	-635,04	pollution load may be added
19	Location 19	2,88	2,35	0,00	0,00	0,00	
20	Location 20	2,34	1,81	0,00	0,00	0,00	
21	Location 21	1,80	1,27	0,00	0,00	0,00	
22	Location 22	1,26	0,72	0,00	0,00	0,00	
23	Location 23	0,71	0,35	0,00	0,00	0,00	
24	Location 24	0,34	0,00	0,00	0,00	0,00	
Total				2.498,04	6.829,92	-4.331,88	

Parameters BOD on sections 6 and 16 must be reduced load pollution of 453.60 Kg/day (section 6), 1,308.96 Kg/day (section 16). This is because in this segment very high polluters source such as: (1) the activity of the household/domestic, industrial waste (2) and (3) rice paddy agriculture.

From the results of this study when compared to the results of relevant research Results can be seen monitoring parameters BOD on the Metro the city of Malang, showed increased from station 1 to station 3. The value of BOD at station 1 for 4.7 mg/l, the 2 stations of 6.1 mg/l and the 3 of 6.25 mg/l, soaring numbers BOD on River Metro can originate from organic materials derived from domestic waste and agricultural. [6]

3.3 Parameter COD (Chemical Oxygen Demand)

Table 4. Pollution Load Capacity Batang Kuranji River Padang City to parameters COD

No	Location	Range Site		Pollution Load	Capacity	Pollution Load Capacity	Description
		Up (km)	Down (km)	(kg/day)	(kg/day)	(kg/day)	
1	Location 1	10,57	10,10	1.425,60	4.406,40	-2.980,80	pollution load may be added
2	Location 2	10,00	9,67	777,60	3.304,80	-2.527,20	pollution load may be added
3	Location 3	9,66	9,17	7.128,00	3.265,92	3.862,08	pollution load must be reduced
4	Location 4	9,16	8,12	-2.073,60	3.304,80	-5.378,40	pollution load may be added
5	Location 5	8,11	7,62	-1.036,80	3.304,80	-4.341,60	pollution load may be added
6	Location 6	7,61	6,67	-648,00	3.304,80	-3.952,80	pollution load may be added

7	Location 7	6,66	6,04	20.088,00	3.304,80	16.783,20	pollution load must be reduced
8	Location 8	6,03	5,54	-12.960,00	3.304,80	-16.264,80	pollution load may be added
9	Location 9	5,53	5,14	-6.480,00	3.304,80	-9.784,80	pollution load may be added
10	Location 10	5,13	4,64	-1.296,00	3.304,80	-4.600,80	pollution load may be added
11	Location 11	4,63	3,99	1.555,20	3.317,76	-1.762,56	pollution load may be added
12	Location 12	3,98	3,22	1.101,60	3.330,72	-2.229,12	pollution load may be added
13	Location 13	3,21	2,07	1.036,80	3.330,72	-2.293,92	pollution load may be added
14	Location 14	2,06	1,65	6.480,00	3.330,72	3.149,28	pollution load must be reduced
15	Location 15	1,64	0,80	12.960,00	3.330,72	9.629,28	pollution load must be reduced
16	Location 16	1,64	0,80	25.920,00	3.330,72	22.589,28	pollution load must be reduced
17	Location 17	1,64	0,80	-41.472,00	3.330,72	-44.802,72	pollution load may be added
18	Location 18	1,64	0,80	0,00	0,00	0,00	
19	Location 19	1,64	0,80	0,00	0,00	0,00	
20	Location 20	1,64	0,80	0,00	0,00	0,00	
21	Location 21	1,64	0,80	0,00	0,00	0,00	
22	Location 22	1,64	0,80	0,00	0,00	0,00	
23	Location 23	1,64	0,80	0,00	0,00	0,00	
24	Location 24	1,64	0,80	0,00	0,00	0,00	
Total				28.058,40	50.751,36	-22.692,96	

Parameters COD in Area 3, section 7, 14, 15 dan section 16 must be reduced load its pollution of 3,862 Kg/day (section 3), 16,783.20 Kg/day (section 7), 3,149.28 Kg/day (section 14), the 9,629.28 Kg/day (section 15) and 22,589.28 Kg/day (section 16);

This is because there are still many areas of agriculture, forestry and animal husbandry so that the source of the many polluters went into the Batang Kuranji River comes from organic chemistry so that river water Batang Kuranji can still accept the burden of pollution, to his approach is rather to the COD parameter inorganic chemistry and inorganic chemical compounds of this many on the disposal of liquid waste on a company/industry.

When compared with the results of relevant research can be seen that the results of the monitoring of the parameters COD in River Metro Malang denotes increased from station 1 to station 3. The value of COD at station 1 for 11.11 mg/l, at 2 stations of 15.97 mg/l and the 3 of 17.56 mg/l. high COD Numbers, indicating the greater the level of pollution that occurs, increasing the value of COD Metro caused by river water waste disposal were sourced from the area woke up/residential and farming areas around the river [6]

4. Conclusion

For the Parameter Total Suspended Solid (TSS) viewed from upstream to downstream in sections 8, 10, 14 it pollution burden must be reduced of 648 kg/day (section 8), 15,552 Kg/day (section 10) and 22.032 Kg/day (section 14), the parameters of the BOD on the area roads 6 and segment 16 it pollution burden must be reduced of 453.60 Kg/day (section 6), 1,308.96 Kg/day (section 16), to the COD Parameter on the sections 3, 7, 14, 15, and 16 roads must be reduced load it pollution of 3,862 Kg/day (section 3), 16,783.20 Kg/day (section 7), 3,149.28 Kg/day (section 14), the 9,629.28 Kg/day (section 15) and 22,589.28 Kg/day (section 16).

With the quality conditions of the River at Batang Kuranji existing segment of the city of Padang at the moment, it takes the efforts of control of pollution. Related to the research results, and of conclusions, efforts are being made to the optimal control is the application of spatial environmental environmentally. The arrangement of space that will be able to control the pollution of Sungai Batang Kuranji is resting on two aspects, namely (1) the restructuring of the space, and (2) of regulation pattern space. To the two aspects of this subject matter, focused towards the area that has the area of DAS Batang Kuranji in Padang city.

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