

waterfront development

international seminar, exhibition,
excursion, networking development
2nd-3rd August 2006 in Jakarta Indonesia

Proceedings

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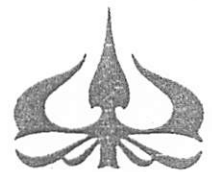
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Integrated Water Resources Management for Waterfront Development in Ciliwung River Basin

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Abstract

The Ciliwung river is running along a line from South (Bogor) to North through the city. The Ciliwung River waters crossing along the line are heavily polluted by gray water from households, commercial buildings, together with discharges from industries, pesticide and fertilizer run-off from agricultural land, solid waste, and fecal matter from overflowing or leaking septic tanks. Furthermore, its condition will be the water quality alteration. The changes of the land use without take note of the Area Planning or Regional Planning will change the land function and increasingly the quality and quantity of waste entering to the river. The Jakarta Bay waters are subject to huge inputs of terrigenous and anthropogenic nutrients from 13 rivers discharge sewage and agricultural runoff, which are Citarum River, Bekasi River, Ciliwung River, Marunda (Blencong) River, Karang River, and Angke River, etc. Territorial water of Jakarta Bay pertained by a natural territorial water of contamination. The conserve of water resources will involve in the management of water that needs to be performed in integrated way such as conservation, utilization and damage control. the integrated watershed and coastal management is necessary by development management in arrange and implemented the integrated planning to utilize and protect the river ecosystem from up to down stream and also all its the natural resources.

Keywords : Land use, water quality, integrated water resources management

A. Introduction

The Ciliwung river is running along a line from South (Bogor) to North through the city. The upstream is located in Gede Pangrango mountain, run through the Bogor city, Depok City and on through Jakarta. The downstream is located in Jakarta Bay. The Ciliwung River is used to be the source of water supply system. Due to the condition of the river in Jakarta, nowadays the function of this river has been changed. The long of the river from up to down stream about ± 76 km, with the catchment area about 322 km^2 .

The Ciliwung River waters crossing along the line are heavily polluted by gray water from households, commercial buildings, together with discharges from industries, pesticide and fertilizer run-off from agricultural land, solid waste, and fecal matter from overflowing or leaking septic tanks. Furthermore, its condition will be the water quality alteration. The changes of the land use without take note of the Area Planning or Regional Planning will change the land function and increasingly the quality and quantity of waste entering to the river.

Jakarta Bay a semi-enclose bay is estuaries ecosystem, located to the North of Jakarta

City near the Java Sea. The boundaries of Jakarta Bay spread out from Tanjung Kait in the west to Tanjung Karawang in the East with the coastal line ± 89 km. The Jakarta Bay waters are subject to huge inputs of terrigenous and anthropogenic nutrients from 13 rivers discharge sewage and agricultural runoff, which are Citarum River, Bekasi River, Ciliwung River, Marunda (Blencong) River, Karang River, and Angke River, etc. Beside its importance as being the site of the international seaport, Jakarta Bay is also a source of livelihood for fishermen and also acts as a recreation as well as tourist action areas.

The effort to harmonize all the stakeholder and sciences needs, the integrated watershed and coastal management is necessary by development management in arrange and implemented the integrated planning to utilize and protect the river ecosystem from up to

down stream and also all its the natural resources.

This paper will describe about :

1. Land use alteration in Ciliwung River
2. Water Quality alteration of Ciliwung river from up to down stream river
3. Water quality of Jakarta Bay
4. Integrated River Basin and Coastal Management

B. Change of Land Use in Ciliwung River Basin

In general, land use is classified into five (5) classes (1) land use for agriculture, (2) land use for wet land and water body, (3) land use for settlement, (4) land use for industrial estate, and (5) land use for business services. The table below indicates the change of land use in Ciliwung river basin from 1970 to 2000.

undeveloped plot of land decreased drastically. This is indicated by land use change percentage for agriculture and green open space area, wet land and water body as well. In 1970, the percentage of land use for the two classes is 66% of total River basin or about 25,687,99 hectares. However, in 2000, the area of undeveloped land use only 38% of total River basin or leaving only about 15,079,84 hectares.

The high development for settlement in the river banks makes the river basin narrower that in turn, decreasing the capacity of water body. This condition affects to the decrease of river basin quality. Starting from 1980, the land use for settlement rose fast particularly in South Jakarta and city of Depok. During 1990-2000, the settlement area development are spreading widely to Bogor and Ciawi which are in Bogor Regency. Meanwhile, the

Table 1.

Land Use Alteration of Ciliwung Watershed in 1970 – 2000

Land Use	1970		1980		1990		2000	
	Hn	% area of watershed	Hn	% area of watershed	Hn	% area of watershed	Hn	% area of watershed
UNDEVELOPED AREA								
Land Farming and Green Open Space	15,312.13	39.55	13,817.70	35.69	13,066.61	33.75	10,478.55	27.07
Wet land and Water Body	10,375.86	26.80	8,656.87	22.36	5,222.77	13.49	4,601.29	11.88
Sub Total	25,687.99	66.35	22,474.57	58.05	18,289.38	47.24	15,079.84	38.95
DEVELOPED AREA								
Settlement	12,060.00	31.15	12,385.21	31.99	13,984.18	36.12	14,410.05	37.22
Industry	193.58	0.50	1,711.24	4.42	2,470.07	6.38	3,883.20	10.03
Business Services	774.32	2.00	2,144.86	5.54	3,972.25	10.26	5,342.79	13.80
Sub Total	13,027.90	33.65	16,241.31	41.95	20,426.50	52.76	23,636.04	61.05
Total	38,715.89	100.00	38,715.88	100.00	38,715.88	100.00	38,715.88	100.00

The table above indicates timespan period of forty (40) years. During these times, the



development of industrial and business-services area occur mostly in downstream region, precisely, in areas in Jakarta. In the main, as compared in map of land use from 1970 to 2000, it is seen that the composition of undeveloped and developed area are reversible.

Conversely, the developed area comprising land use for settlement, industrial estate and trade service, rises two fold. In 1970, the percentage of land use of three classes are about 33% from river basin area or approximately 13.027,90 hectares. Meanwhile, in 2000 it rises about 61% of the river basin or about 23.636,04 hectares. The change of land use of agriculture to settlement

and commercial use make the land solid. This will affect to the rise of waterflow, steaming capacity and absorption into the ground. Further more, this condition will give impact to the accumulation of riverwater pollution. The following illustration depicts the fluctuation of undeveloped land use area.

C. The Water Quality of Ciliwung River

The change of land use, solidity level and high activity will directly cause the change in water quality. The result of measurement to the water quality in 1993 and 2005 can be seen in figure 3.

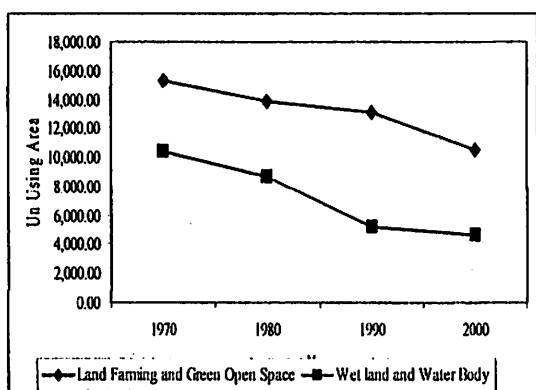


Figure 1.

Change of Natural Land Use Ciliwung River Basin in 1970- 2000

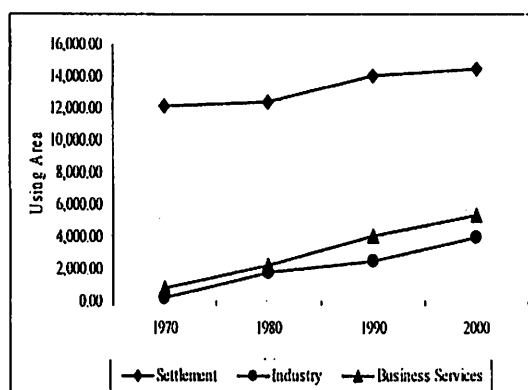


Figure 2.

Change of Developed Land Use Ciliwung River Basin in 1970-2000

Table 2.

Land use around Ciliwung River

Land use	Upstream	Middle Area	Downstream
Open Space	21%	1.3%	2%
Settlement	51%	58%	62%
Industry	3%	10%	14%
Street	12%	7%	4%
Office Park	2%	7%	11%
Trade Park	11%	5%	7%

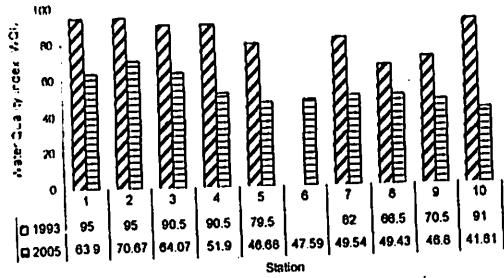


Figure 3.

Comparison of Water Quality Index of Ciliwung River on Each Research Station in 1993-2005.

Information :

Station (1) Cisarum, (2) Gadag, (3) Kedung Halang, (4) Srengseng Sawah, (5) Kalibata, (6) Kampung Melayu, (7) Manggarai, (8) Guntur, (9) Karet Tengsin and (10) Teluk Gong

In figure 3, it is seen that during 12 years timespan there is a decrease in Water Quality Index Value (WQI). The index in 1993 ranges from 66,5 to 95,0 (Poor- Fair category), while in 2005, it ranges between 41,81 – 70,67 (Poor – Fair category). The decrease of IKA value in station 1 is 32,74%, station 2 is 25,61%, station 3 is 28,62 %, station 4 is 42,65%, station 5 is 41,28%, station 7 is 39,58%, station 8 is 25,67%, station 9 is 33,62% and 54,05% for station 10. Generally, the decrease of WQI in Ciliwung River is

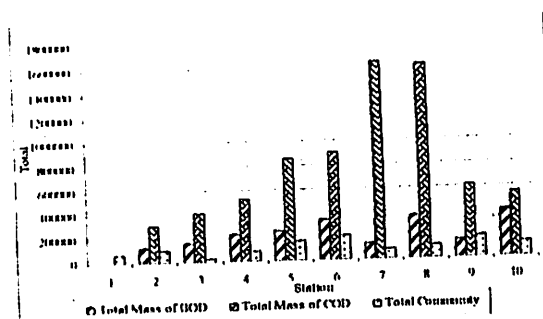


Figure 4.

Relation Between and BOD and COD mass

33,38% occurs during 12 years period. This decrease depicts that there has been change to the water quality of Ciliwung river caused by change of land use. The population growth effected to the total mass which is entering to the river. Figure 4 shows relation between total population and BOD and COD mass. Total mass accumulated in Manggarai and Guntur.

D. Pollution Impact to the River in Jakarta Bay

The water in Jakarta Bay receives inputs from various activities across the beach as well as from the river. The activities vary causing the pollution is much polluted, in turn, making a decrease in the quality of Jakarta Bay waters. The rivers flowing into the Jakarta Bay are generally narrower river due to many settlements and industrial activities in the river banks. Therefore, the rivers contain wastes discharged from settlement, industrial estates, business area and other activities. Figure 5 shows the measurement result of COD in observer station.

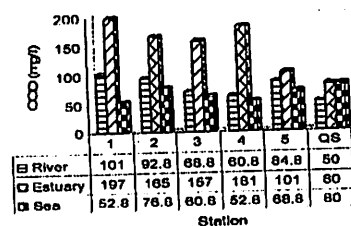


Figure 5.

COD measurement in observer station.

Information:

- 1 Marina Station
Ciliwung River
Ancul Estuary
Marina Sea
- 2. Karang Station
Mampang River
Karang Estuary
Karang Sea
- 3. Angke Station
Angke River
Angke Estuary
Angke Sea
- 4. Cengkareng Station
Cengkareng River
Cengkareng Estuary
Cengkareng Sea
- 5. Kamal Station
Dadap River
Kamal Estuary
Kamal Sea



COD concentration in the river ranges between 60,80 – 100,80 mg/l and all rivers have exceeded the specified quality of value. The highest COD concentration is in Ciliwung River. This is because more than 50 industrial estates are across Ciliwung river basin and still added with domestic wastes.

COD concentration in estuary is ranging from 100,80 – 196,8 mg/l and in all observer station in estuary, they have exceeded the specified quality of value. Highest COD concentration is in Ancol estuary because there is a seaport where ships berthing there causing oil waste. In addition, increasing waste coming from Ciliwung river causes the pollution content in Ancol estuary rises. Estuary is a pollutant trap area so that coming-in wastes will be caught there and accumulated in estuary region.

COD concentration in sea is ranging from 52,8 – 76,8 mg/l and in all observer station they are still below the specified quality of value. The low level of this COD is caused by great volume and seafloor making the pollutant melted.

E. IWRM implementation to Prevent and Control Damages in Ciliwung River Basin

The conserve of water resources will involve in the management of water that needs to be performed in integrated way such as conservation, utilization and damage control. Integrating some aspects into a plan is highlighted so that the natural resources management can be performed in a consistent way and must be followed by all stakeholders. This will make the high-speed of Jakarta development to metropolis city can be done

by taking the environment support ability into account. Some efforts that can be performed by people to maintain the water quality are among others listed in Table 2.

F. Conclusion

1. In 1970, the undeveloped plot of land area is 66% of the total of river basin or about 25.687,99 hectares. But in 2000, the undeveloped use is about 38% of river basin are or about 15.079,84 hectares.
2. Water Quality Index (WQI) in 1993 is ranging from 66,5 – 95,0 (Medium to Excellent category), while in 2005 it ranges from 41,81 – 70,67 (Poor – Medium category). Generally the decrease of Ciliwung river Water Quality Index is 33,38% during 12 years period. The decrease of Water Quality Index depicts that there has been change to the quality of Ciliwung river caused by change of land use.
3. Land use around Ciliwung river varies in up, middle and downstream areas. Vacant land in upstream area is 21%, 13% in middle area and 2% in downstream side. The land use for settlement, industrial area and business district are increasingly high in downstream area.
4. The COD concentration of the river is ranging from 60,80 – 100,80 mg/l, the highest is in Ciliwung river. COD concentration in estuary ranges from 100,80 – 196,8 mg/l and in all observer station in estuary, they have exceeded the specified quality of value. Estuary is the area of pollutant trap so that the wastes are caught and accumulated in estuary areas.

Table 3.

Some Efforts to Maintain The Water Quality

No	Caused	Program
A. Water Pollution Control Program		
1	Domestic waste	a. Waste Treatment base on public Participation b. Filter Waste Drainage Construction c. Septic tank Communal setup
2	Cattle waste	a. Identification of source and pollutants type b. Management of Training and Model of cattle waste c. Socialisation, Training and management of cattle waste
3	Industrial Waste	a. Identification of source and pollutants type b. To participate in PROKASIH c. Waste water Treatment Plan Implementation
4	Solid Waste	a. Solid Waste Management base on public participation b. Application of 3 R c. Controlling of Solid waste throw to the waters
5	Agriculture Waste	a. Identification of source and pollutants type b. To use the fertilizer as procedure requirement c. Organic Fertilizer Utilization
B. Environmental Damage Control Program		
6	Critical Land	a. Reboisatation b. Rehabilitation & Planting along the river bank c. Protected the forest people

		d. Forest city e. Bloc Grant f. Agroforestry g. Soil and Land Farming Conservation h. Gully Control i. Contour Cropping j. Check Dam Development k. Brujong construstion l. Debit and Sediment Monitoring
7	Decrease of land absorptions	a. Conservation of Situ b. Infiltration well c. Reservoir Dam Development d. Communal Pond Development
C. Spatial Planning Program		
8	Violation of spatial planning	a. Law Enforcement b. Planning Program Revised c. Monitoring System and Spatial Planning Controlling d. Zoning Regulation up Stream Arrangement e. Spatial Planning Socialisation
D. Law Enforcement Program		
9	Weak of Law	a. Law Enforcement b. Socialisation Regulation Act
E. Increasing of Public Participation Program		
10	Low of the environmental care	a. Socialization b. Training c. Forum Development
11	Economical Utility	a. Public participatory b. Training to enhancement the public skill
12	Weak of Facilities	a. To develop and increase the Sanitation Facilities b. To increase the simple waste treatment installation

References

Anonim. "Pemaduserasian Rencana Tata Pengaturan Air DAS Ciliwung – Cisadane terhadap Rencana Tata Ruang Kawasan Bopunjur dan Jabodetabek". Direktorat Jenderal Penataan Ruang, Departemen Permukiman dan Prasarana Wilayah. 2002.

Badan Pengelolaan Lingkungan Hidup Daerah (BPLHD) Propinsi DKI Jakarta. "Rencana Kerja Daerah Prokasih Visi 2005 Ciliwung". 2001.

Boon, P.J., P. Calow, and G.E. Petts. *River Conservation and Management*. John Wiley & Sons. 1992.

Deviani, M.V. "Kualitas Perairan Teluk Jakarta Ditinjau dari parameter DO, BOD dan COD". Laporan Tugas Akhir. Jurusan Teknik Lingkungan FALTL Universitas Trisakti. 2004.

Diana, H., Ferianita, M., Nugrahadi, A dan Sitawati, A. "Perubahan Guna Lahan terhadap Kualitas Air di DAS Ciliwung". Lembaga Penelitian Universitas Trisakti, Jakarta. 2005.

Radiansyah, A. D. "Tantangan dalam Upaya Mengintegrasikan Pengelolaan Daerah Aliran Sungai Ciliwung". Forum Pemimpin Daerah dan Lokakarya Pembangunan Berkelanjutan Wilayah Pesisir dan Laut Indonesia, 27 April 2006. Jakarta. 2006.

Tebbut, T.H.Y. *Principles of Water Quality Control*. Fourth edition. Pergamon Press, Oxford. 1992.