Feasibility of *Embung* (basin retention) in Green Open Space Area over Institut Teknologi Sumatera (ITERA)

Tastaptyani Kurnia Nufutomo[1,*], Fitralia Elyza[1]

[1]*Environmental Engineering, Institut Teknologi Sumatera,*
Jl. Terusan Rya Cudu, Way Hui, Lampung Selatan, 35365, Lampung, Indonesia

ITERA has six potential *embung* (reservoir) as a habitat for fresh water flora and fauna, for place of learning and as water tourism. The function of *embung* (reservoir) is in accordance with ministry PUPR regulation No. 9/2015 is about using water resources, the *embung* can be utilized as rain retention basin, and aquaculture activity. Water quality in *embung* (reservoir) will decrease along with many anthropogenic activites that take place around the *embung*. This study aims to determine the feasibility of *embung* water quality and customized with ministry Environmental regulation of water quality management and water pollution control No. 82/2001. *Embung* (reservoir) in ITERA is belonging to the second class category of water quality management. The purpose of research was to analyze water quality parameters including temperature, phosphate, nitrate, BOD, Turbidity, pH, DO, TSS, and Coliform. There are three *embung* (reservoir) to be sampled on composite. *Embung* A is located near the highway, *Embung* B is located near the north entrace gate of ITERA and *Embung* C is located near LPPM ITERA building. The output of our research will be a source of data reference for follow up in the identification of water pollution and as a form of water quality management of the *embungs*.

Keywords: Water quality, Water pollution, *Embung*, Retention basin, ITERA.

1. INTRODUCTION

The existence of development in ITERA will have an impact on the environmental especially in this environment around the *embung* ITERA has 6 *embungs* in every open space with a total area 19.5 Ha. The largest *embungs* has an area 5500 m^2 it's used for freshwater habitat of Sumatera. The smallest *embung* has an area 1100 m^2, was used for water treatment plant. The function of *embung* is expected to be used as a field laboratory to support the application of technology, realizing the fulfilment of renewable energy to the community and carry out conservation of water within the Institut Teknologi Sumatera (ITERA). Water is natural resources that have a very important function for human life and other live things as well as the basic capital in the development [1]. Because of that it is necessary to see the feasibility of *embung* water quality for used as a fresh water habitat especialy for flora and fauna and also for water tourism and water treatment plant.

Water resources, *embung* can be utilized as rain water container (PAH), fish cultivation and freshwater flora [2], therefore the quality of water is tested feasibility by government regulation [3] and it is about the management of water quality and water pollution.

The feasibility of water should have several parameters of water quality, the parameters are physical parameters are include pH, temperature and turbidity. The chemical parameters are including DO, TSS, BOD, Nitrate and Phosphate. The biological parameter is Coliform total. The aim of this study is for determine the feasibility of *embung* water quality and quantity which is used as a habitat for fresh water and place for water tourism arenas. The priority of this study is as a management of *embung* water pollution from ongoing development in ITERA and from human activities.

Email Address: tastaptyani.kurnia@tl.itera.ac.id

The functions of *embung* [4] are:
   a. Body of *embung*, the function is for restrained the water
   b. Pond of *embung*, for accommodate rain water
   c. Building tapping of *embung*, for remove the water in the pool when needed
   d. Distribution network of *embung*, consist of a series pipes and the function is for bring the water from the pond to distributed to a reservoir
   e. Abundant building of *embung*, for drain the flood from the pond to the valley and secure the body of *embung* and against from evaporation.

Embung in ITERA consist of 6 (six) *embungs*, and located in green open space with different functions. The functions of six embungs are:
   a. *Embung* for freshwater habitat of Sumatera, with an area of 5.500 m^2
   b. *Embung* for Sumatran freshwater flora habitat, with an area 2.300 m^2
   c. *Embung* for hydraulics laboratory, with an area 2.900 m^2
   d. *Embung* for water treatment plant, with an area of 1.100 m^2
   e. *Embung* for the rowing sports arena, with an area of 2.100 m^2

Water Quality Index is used National Sanitation Foundation Water Quality Index (NSF-WQI). NSF WQI has been used by various environmental experts and can describe water quality based on physical and chemical parameters. NSF WQI has five water quality rating criteria, which are excellent, good, medium, bad and very bad [5].

2. METHODOLOGY

A.   Time and Location
This study was conducted from April to August 2017, and the location at Institut Teknologi Sumatera (ITERA), Way Hui, South Lampung. Water sampling was conducted in three *embungs* with two sampling points in water body, inlet and outlet by composite sampling. For observation points was determined based on several water quality parameters. Sampling at each station is taken at three points within 50 m. This sample is taken during on the dry season (July-August). This study has sampling in three *embungs* for now preliminary condition of *embung*.

B.   Measurement Methods
The measurement of water quality parameters is adjusted for research purposes, usually measuring water quality using physical, chemical, and biological parameters. In this study the parameters of water quality measured are listed in Table I. Parameter measurement in situ and ex situ. This study measure 9 parameters of water quality based on water quality index and regulation of water quality management and water pollution control.

It's consists of temperature, pH, Nitrate, Phosphate, TSS, DO, BOD, Coliform and Turbidity.

Table I. Parameters and Methods of Measurement

Parameter	Unit	Method	Information
Temperature	^{0}C	Thermometer	In Situ
pH	-	Electrode	In Situ
Nitrate	mg/L	Spectrophotometer	Ex situ
Phosphate	mg/L	Spectrophotometer	Ex situ
TSS	mg/L	Electrode	Ex situ
DO	mg/L	Titration	Ex situ
BOD	mg/L	Titration	Ex situ
Coliform	MPN/ 100ml	MPN	Ex situ
Turbidity	NTU	Electrode	In situ

C.   Data Collection and Analysis
Analysis the data is using index number of NSF-WQI, the NSF-WQI range value will be shown according to environment quality criteria [6].

$$WQI = \Sigma_i^n =_1 w_i . l_i \qquad (1)$$

where, WQI is NSF water quality index (scale 0-100), Wi is weighing constant retrieved from NSF-WQI index weight listed on table, and Ii is Characteristic-I sub index value retrieved from NSF-WQI.

3.   RESULT AND DISCUSSION
The result of parameter measurement and water quality rate for each *embung* are showed in Table 2 until Table 4.

Table 2. Result of Embung A

Parameter	Unit	Result	Q value	W (weight)	Quality index
Coliform	(avg/ 100 ml)	1600	20	0.16	3.2
TSS	mg/L	78	85	0.07	5.95
DO	mg/L	8.9	6	0.17	1.02
pH	-	7.34	93	0.11	10.23
Turbidity	NTU	3.2	90	0.08	7.2
BOD	mg/L	5	56	0.11	6.16
Nitrat	mg/L	0.1	97	0.1	9.7
Phosphate	mg/L	0.037	99	0.1	9.9
Temperature	^{0}C	32.5	10	0.1	1
Total					54.36
Quality Rate					Medium

Table 2 is result of *embung* A, total of WQI is 54.36 and it's showed the water quality is medium category. It can be used for aqua culture and watering the plantation, but not for drinking water. The conductivity one of parameter for the power of water transfer the electricity is 49 µs/cm.

Table 3. Result of Embung B

Parameter	Unit	Result	Q value	W (weight)	Quality index
Coliform	(avg/ 100 ml)	1600	20	0.16	3.2
TSS	mg/L	18	84	0.07	5.88
DO	mg/L	7.9	6	0.17	1.02
pH	-	7.05	89	0.11	9.79
Turbidity	NTU	2.8	93	0.08	7.44
BOD	mg/L	7	46	0.11	5.06
Nitrat	mg/L	0.2	97	0.1	9.7
Phosphate	mg/L	0.03	99	0.1	9.9
Temperature	^{0}C	31.2	10	0.1	1
Total					52.99
Quality Rate					Medium

Table 3 is result of *embung* B, total of WQI is 52.99 and it's showed the water quality is medium category. It can be used for aqua culture and watering the plantation. The conductivity of *embung* B is 0.0049 µs/cm.

Table 4. Result of Embung C

Parameter	Unit	Result	Q value	W (weight)	Quality index
Coliform	(avg/ 100 ml)	920	23	0.16	3.68
TSS	mg/L	20	84	0.07	5.88
DO	mg/L	7.9	6	0.17	1.02
pH	-	7.97	85	0.11	9.35
Turbidity	NTU	2.6	91	0.08	7.28
BOD	mg/L	15	20	0.11	2.2
Nitrat	mg/L	0.3	97	0.1	9.7
Phosphate	mg/L	0.041	100	0.1	10
Temperature	^{0}C	32.9	10	0.1	1
Total					50.11
Quality Rate					Medium

Table 4 is result of *embung* C, total of WQI is 50.11 and it's showed the water quality is medium category. It can be used for Water Habitat, and recreation. The conductivity number is 0.095 µs/cm.
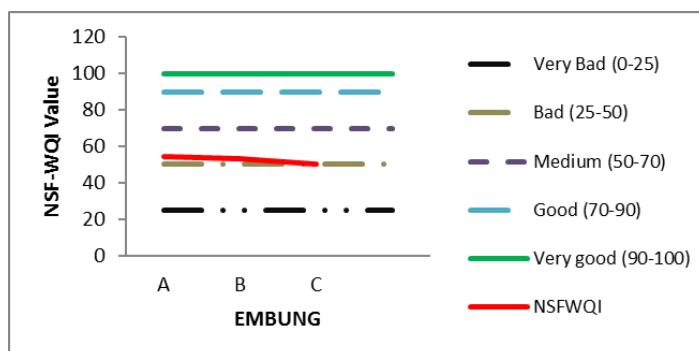

Figure 1. Water Quality Index of embung

After we know the quality index, we have to compare in graphic from range index NSF WQI. Range is between 0 – 100. Water quality index results in figure 1 that *embung* A is 54.36 for quality index number and it means that *embung* is medium contaminant. It is valid to *embung* B and C. *embung* B is 52.99 and *embung* C is 50.11 for quality index number. Both of *embung* has medium water contaminant. That index represented about water quality by range. Range 0 – 25 is represented very bad 25 – 50 is bad, 50 – 70 is medium, 70 -90 is good, 90 – 100 is very good. Now range 90 – 100 is rare to find in Indonesia, because already contaminated with anthropogenic activity, irrigation and industrialization waste also has effect for water pollutant.

4. CONCLUSION

Water quality in *embung* based on riparian areas has agricultural activity, or the occurrence of building construction will occured the water quality contaminant. Water in *embung* A and B can use for watering the plantation or water treatment plant. Feasibility of *embung* used for habitat fresh water, or water tourism arenas is *embung* C based on parameter observation and result NSF WQI.

Reference
1. Hendrawan, D. *Kualitas Air dan Situ di DKI Jakarta*. **2005** Makara Vol. 9, No.1 pp. 13-19.
2. Indonesian Government Regulation No. 09/2015. *Penggunaan Sumber Daya Air*.
3. Indonesia Government Regulation No.82/2001. *Pengelolaan Kualitas Air dan Pengendalian Pencemaran Air*.
4. Fauzani, D. **2012**. *Pengembangan Model Matematis Untuk Menentukan Profil Optimum dari Embung Sederhana*. (Thesis) FTSL ITB.
5. Marganof, Darusman, L.K, Riani, F., Pramudya, B. **2007**, *Analisis Beban Pencemaran, Kapasitas Asimilasi dan Tingkat Pencemaran dalam Upaya Pengendalian Pencemaran Danau Maninjau*. *Jurnal Perikanan dan Kelautan*. Vol. 12, No. 1 pp.8-14.
6. Oram, Brian. **2014**. Calculating NSF Water Quality Index. Water Testing, Monitoring The Quality of Surface waters. http://www.waterresearch.net/index.php/watertreatment/water-monitoring/monitoring-the-qualty-of-surfacewaters. Accessed at 22 May 2018: 10.00 a.m.