

STUDY ON THE EFFECTIVENESS OF THE ECOSYSTEM MANAGEMENT OF SAGULING AND JATILUHUR DAM; AN INTEGRATED MANAGEMENT OF CITARUM WATERSHED

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Abstract. Watershed (Daerah Aliran Sungai/DAS) is an integrated aquatic ecosystem with its terrestrial sub-ecosystem from upstream to downstream. With such an integrated nature, the management of both the ecosystem and its sub-ecosystem calls for integrated management. Over the past 30 years Citarum river basin management has provided many benefits to the sustainable development and the ecosystem around it. However, there remain some problems such as: pollution, decreased water level, damage of coastal areas, the lack of availability of clean water, flood, degraded quantity and quality of water in the reservoir of forest along the Citarum that has greatly affected the management of water resources and Ecosystem watershed Reservoir along the Cisadane. Therefore, ICWRMIP programs that have been implemented since 2008 with eight superior programs raise a question. Based on a multi-disciplinary research conducted by the Faculty of Science and Technology of Jakarta State Islamic University, this paper seeks to investigate the effectiveness of its management. The results of the analysis of noise, air quality, and water quality analysis of physical chemistry and microbiology of the two reservoirs in Citarum (Saguling and Jatiluhur) in October 2013 showed the overall parameters are still within the environmental quality standards, meaning that the water reservoir is still safe for consumption or for cultivation. However, the measurement of the degree of the program success associated with the user groups showed a value of 53.25 HPI. It indicates the level is under standard. This means that some groups of people are not satisfied with the implementations of ICWRMIP programs. It recommends that the programs need further evaluation to be better implemented. This research might raise awareness on a better management of environment in the community.

Keywords: Management of reservoirs, effectiveness.

INTRODUCTION

Watershed (Daerah Aliran Sungai/DAS) is an integrated aquatic ecosystem with its terrestrial sub-ecosystem from upstream to downstream. With such an integrated nature, the management of both the ecosystem and its sub-ecosystem calls for integrated management. Over the past 30 years Citarum river basin management has provided many benefits to the sustainable development and the ecosystem around it. However, there remain some problems such as: pollution, decreased water level, damage of coastal areas, the lack of availability of clean water, flood, degraded quantity and quality of water in the reservoir of forest along the Citarum that has greatly affected the management of water resources and Ecosystem watershed Reservoir along the Cisadane. Therefore, ICWRMIP programs that have been implemented since 2008 with eight superior programs raise a question., this paper seeks to investigate the effectiveness of its management. According to the condition of Citarum fact sheet consists of 8 main problems are: (1) Pollution, (2) Decrease of Water resources, (3) miss management on coastal areas. (4) Flooding. The frequency of floods in West Java increased. (5) Water Quality of reservoir and (6). Forest degradation.

Islamic views on the significance of ecosystem management along Citarum Reservoirs are also very relevant, very concerned about Islamic environment and the sustainability of life on earth. Many verses of the Qur'an and hadith that explains, encourages and even requires every man to sustain life and the lives of other creatures on earth. Islamic view also leads to concepts related to the rescue and conservation of the environment (natural) inseparably fused with the concept of the oneness of God (tawhid), sharia, and morals.

The program will fund a range of activities in the water sector related to water management and Raw necessary to begin management of water resources in an integrated manner in the Citarum Watershed. These activities were selected based on a "map" or a strategic investment plan for water resources management in the Watershed (DAS) is an integrated Citarum. This plan establishes an agreed set of activities will be implemented in the future up to the year 2023 are required to achieve the main goals of the management of water resources in an integrated manner. Initial estimate of the overall cost to implement activities in this strategic investment plan is approximately \$ 3.5 billion.

The beneficiaries of this investment program is resident in the Citarum River basin and Jabodetabek, water users in agriculture and industrial water supply through the channel gets WTC. In particular, the investment program has been designed to meet the needs of the various elements in the Citarum watershed stakeholders, and assist communities to plan and execute their own efforts in water management and raw. The expected result is the creation of water resource management and better integrated, where the government and the community work together in partnership to achieve a common vision.

METHOD

The study was conducted in September 2013 until November 2013 to take place in several locations, among others, the location of the primary data that ecosystems along the Citarum Reservoirs. In this research refers to the stage of research results Suasni et al (LIPI, 2009) (Figure 1.).

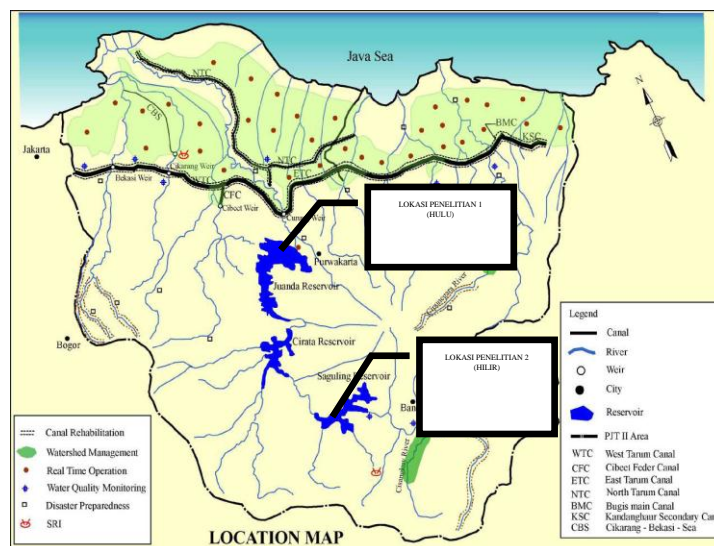


Figure 1. Ecosystem Research Sites Throughout Citarum Reservoirs

Data collection was done through sampling and surveys in the study area as well as secondary data from relevant agencies. Determination of sampling sites in the study area based on a conceptual study of the effectiveness of the approach by looking at the distribution of locations that are part of the reservoir ecosystem management form below ICWRMIP Program. Components include sampling water reservoir raw water of chemical physical components such as: temperature, pH, salinity, DO, COD, CO₂, and NH₃ DHL. As well as air and noise components are tested in Lab.Karsa Buana Lestari Environmental Laboratory (KBL). Other primary data forms a reservoir ecosystem management efforts along the Citarum and the effectiveness of program implementation ICWRMIP have been obtained by performing in-depth interviews and a survey to various agencies and the other respondents.

Methods of data collection both primary data and secondary data from every component of the environment is presented in the following section: Physical and chemical data of reservoir water samples will be obtained from the CSPA Cirata, Jatiluhur Saguling and IUGR. Data sample reservoir

water will be taken from the water reservoir, which is at the point Cirata, Saguling and Jatiluhur. Primary data will be retrieved using laboratory methods and of the location of the observation. Secondary data will be taken from interviews and literature studies.

Data Processing and Analysis

a. Environmental Quality.

Data analysis of the results of the environmental components include components of the Air, Noise, Biota and Raw Water in both Jatiluhur reservoir and Saguling using the physical analysis and chemical biology. The results of the distribution of was processed using GIS (Geografic Information System) to see the distribution pattern of each parameter were observed.

a. Effectiveness Program. The results of the questionnaire level of satisfaction and success of this program were analyzed using the method to determine whether a program SME ICWRMIP are effective or not in terms of success and satisfaction of the people taken from the data ICWRMIP overall program evaluation indicators along the Citarum (2 Saguling and Jatiluhur). The data used in this study is the survey data conducted in order to seek ways of increasing the effectiveness of the program ICWRMIP. General Models HPI General mathematical model of SME methods commonly used in measuring the index of satisfaction and success of a program. HPI values calculated using the "weighted average value" of each element of the service. In calculating the index of people's satisfaction with the services studied 14 elements, each element of the service have the same weights with the following formula: 0.071. To obtain the value of the HPI program ICWRMIP used service units approach the average value weighted by the following formula:

Next: To facilitate interpretation of the SME ratings of between 25-100 then the results of the above assessment is converted to the value of the base 25, with the following formula:
 HPI = Unit x 25

Given the service units have different characteristics, it is possible for each unit of service:

- a. Adding elements deemed relevant
- b. Give different weights to 14 (fourteen) is the dominant element in the service unit to record the total weight of all elements remain 1 (Table 2).

Table 2. Value Perception, HPI Interval, Interval Conversion SMEs, Service Quality and Performance

Unit Device processing.

Perception Value	Interval Value (IKM)	Interval Value Coversion (IKM)	Service quality	Service Quality performance (Unit)
1	1,00 - 1,76	25,00 - 43,75	D	Not Good
2	1,76 - 2,50	43,76 - 62,50	C	Enough
3	2,51 – 3,25	62,51 -81,25	B	Good
4	3,26 – 4,00	81,26 – 100,00	A	Very Good

a. Processing by computer . Data entry and can be done with the index by computer calculating program / system data base.

b. Manually processing

1). Data from the completed questionnaires every respondent entered into the form elements ranging from 1 (U1) up to 14 elements (U 14) such as: procedure services, criteria of services, clear, discipline, responsibility, capable, time of services, fairnes, dignity, normal, certainty, safety and security of srvcies.

2). The next step to obtain an average value per element of care and service unit value indices are as follows:

a). The average value per service element

The value of each element are summed services (down) according to the number of questionnaires filled out by the respondent, then to get the average value per element of service, amount of the value of each element of the service divided by the number of respondents who fill. To obtain the weighted average value per service element, the average number of values per service element multiplied by 0.071 as the value weighted average weights.

b). The index value of service

To avoid the service unit value indices, by summing the 14 elements of the value weighted average.

3). Testing of Data Quality

Public opinion of data has been entered in each of the questionnaire, respondents are prepared by classifying the data collected by age group, gender, education and employment last.

This information can be used to determine the profile of the respondents and the tendency of the answers given, the analysis of material objectivity.

4). Report of Preparation Index (HPI)

The satisfaction of activities and community index of the success of any service-related government agencies especially ICWRMIP, compiled with the main material as follows:

1. Index per service element

Based on community satisfaction index calculations, the total value of each unit of service is obtained from the amount of the average value of each element of the service. While the composite index score (combined) for each unit of service, an amount of the average value of each element of service multiplied by weighing the same, namely 0.071. Example: If it comes to the average value of each element of the service unit then to determine the value of the index service unit shall be calculated as follows:

$(3,45 \times 0,071) + (2,65 \times 0,071) + (3,53 \times 0,071) + (2,31 \times 0,071) + (1,55 \times 0,071) + (3,12 \times 0,071) + (2,13 \times 0,071) + (2,43 \times 0,071) + (3,21 \times 0,071) + (1,45 \times 0,071) + (1,93 \times 0,071) + (2,31 \times 0,071) + (3,03 \times 0,071) + (1,56 \times 0,071) = \text{index value was } 2,46.$

1. Thus the service unit value index results can be summarized as follows:

a. HPI value after conversion =

Index Value x Value Basis =

$2.462 \times 25 = 61.55$

b. Quality of service C

c. Less well service unit performance

2. Priorities Quality Improvement Services In improving the quality of service, priority on elements that have the lowest value, event element has a value high enough to be retained.

RESULTS AND DISCUSSION

Jatiluhur management program and current Saguling

Currently in 2013, is the fourth year the implementation ICWRMIP Citarum. In accordance with the road map ICWRMIP there are 6 stages. The first stage is the Phase 1 Project. Starting from 2009 until 2014.

Phase 1 consists of 9 ICWRMIP program activities with funds amounting to Rp. 1:03 trillion To 9 ICWRMIP Activity in Phase 1 consists of:

Rehabilitation channel west Tarum

- a. Improved management of land and water
- b. Treatment of community-based water and sanitation
- c. The water quality improvement action plan
- d. Protection of the environment and biodiversity in the upstream area
- e. Structuring of space
- f. flooding process in the upstream region
- g. Designs for improvement of Bandung water supply

h. Strategies of adaptation to climate change

Quality Components

Physical component analysis of the results of biological chemistry in the two reservoirs in Citarum as follows:

Ambient Air Quality

- a. Air Quality Parameters Parameters of ambient air quality and noise are monitored SO₂, NO₂, CO, O₃, and TSP (Dust).
- b. sampling points Sampling locations of ambient air quality and noise levels in the area of Jati Luhur Reservoir by 2 points, namely point UA.1 = Central Area (06 ° 52'10, 6 "LS; 106 ° 29'53, 1" E) and UA point. 2 = Downstream area (06 ° 52'09, 0 "S; 106 ° 29'55, 5" E).
- c. time of sampling Time sampling was conducted on 20 September 2013 at 11:15 to 18:15 pm
- d. sampling methods Sampling is carried out through field observations and sampling of ambient air quality and noise levels for subsequent analysis in the laboratory.
- d. results of the sampling **showed in Table 3 and Table 4.**

Table 3. Air Quality

No	Parameter	Unit	Quality Standard*	Result**		Methode
				UA.1	UA.2	
1.	Sulfur Dioxida (SO ₂) **)	1 Jam	900	201	148	SNI 19-7119.7-2005
2.	Carbon Monoxida (CO **)	1 Jam	30.000	1541	1235	SNI 7119.10-2011
3.	Nitrogen Dioxida (NO ₂) **)	1 Jam	400	46	40	SNI 19-7119.2-2005
4.	Oxidan (O ₃) **)	1 Jam	235	14	5	SNI 19-7119.8-2005
5.	Dust(TSP)	1 Jam	-	91	85	Gravimetri

No. PP. 41, 1999; National Ambient Air Quality Standards; Parameters have been accredited

** Source: PT. KarsaBuana Lestari (KBL), 20 September 2013

CENTRAL RESERVOIR UA.1 = area (06 ° 52'10, 6 "LS; 106 ° 29'53, 1" BT)

UA.2 = DOWNSTREAM RESERVOIR area (06 ° 52'09, 0 "S; 106 ° 29'55, 5" E)

Table 4. Weather Data Field Measurement Results September 2013 *

No	Parameter	Result	
		UA.1	UA.2
1	Temperature	31,5° C	31,0° C
2	Humidity	42% RH	43% RH
3	Wind direction Dominantly	East	East
4	Climate	Cloud	Cloud

*Source: PT. KBL, September 2013

Air quality in the two observation points in space using GIS analysis is shown as follows (Figure 2).

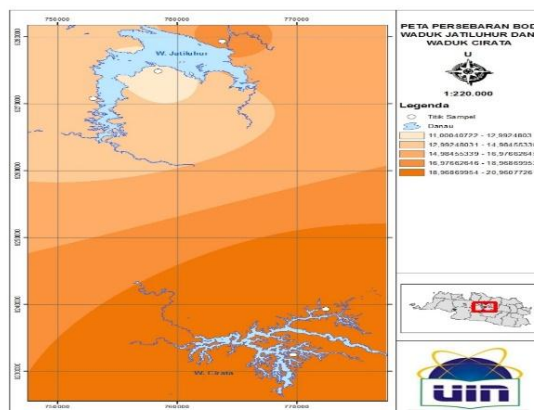


Figure 2. Analyze Spatial and Temporal Air Quality Levels in Jatiluhur

Noise Levels

Component noise level sampling should not be performed. However, to find out the source noise level of activities undertaken and their impact on surrounding activities, then the sampling is done on the level of noise is monitored in general.

- a. Parameters monitored noise is the noise level around the noise source
- b. Sampling Location Sampling locations in the level of noise made Jatiluhur Reservoir area, namely in K.3 = Area CENTRAL RESERVOIR (06 ° 52'10, 6 "LS; 106 ° 29'53, 1" E) and K.4 = Area DOWNSTREAM RESERVOIR (06 ° 52'09, 0 "S; 106 ° 29'55, 5" E) (Appendix 2).
- c. Time Sampling Time Sampling conducted at the stage of operations on 20 September 2013
- d. Method of Sampling Sampling is carried out through direct measurement using a sound level meter.
- e. Sampling Results Recapitulation noise level measurement results are presented in Table 5.

Table 5. Noise Data

Sample code	Time of Measurement	Results *	Unit **
K.4	15.50 – 16.00	67	dB (A)

Table 5 Results of Noise Quality Analysis at the point CENTRAL RESERVOIR K.3 = area (06 ° 52'10, 6 "LS; 106 ° 29'53, 1" E) and K.4 = Area DOWNSTREAM RESERVOIR (06 ° 52'09, 0 "S; 106 ° 29'55, 5" E). **

* Sampling Method: 04-3901.3-1995 ISO Quality Standard for industrial areas 70dB

** Source: PT. Karsa Buana Lestari (KBL), 20 September 2013

BML *** = Decree of the Minister of Environment No.. 48. 1996

About Noise standards for industrial areas 70 dBA.

The quality of observation noise at 2 points in space using GIS analysis is shown as follows (Figure 3).

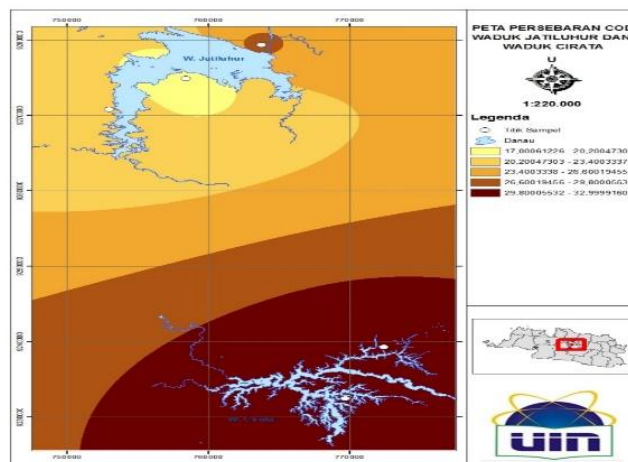


Figure 3. Analyze Spatial and Temporal Noise in Jatiluhur

Water Quality

- a. Impact and Source of Impact, Raw Water Quality Sampling conducted in order to evaluate the quality of the environment, especially due to the activity of Raw water pond activities and other activities at the location of the reservoir.
- b. Parameters to be monitored Raw water quality parameters were monitored water quality Raw refers to households with physical properties parameters are: dissolved solids (TDS), odor, turbidity, taste, color, and temperature; chemical properties, namely: iron (Fe), fluoride (F), cadmium (Cd), hardness (CaCO₃), Chloride (Cl), chromium (Cr⁶⁺), manganese dissolved (Mn), Nitrate as N, Nitrite as N, pH, zinc (Zn), sulfate (SO₄), lead (Pb), detergents (MBAs), organic matter (KMnO₄), and microbiology is the Total Coliform (MPN), fecal coliforms.

- c. Purpose Sampling to determine the impact of reservoir management activities to changes in Raw water.
- d. Method of Sampling Sampling carried through in situ measurements (temperature and pH) and water sampling using a water sampler for subsequent analysis in the laboratory.
- e. Sampling Location For the quality of the raw water reservoirs, sampling carried out at the point K.3 = Area CENTRAL RESERVOIR (06 ° 52'10, 6 "LS; 106 ° 29'53, 1" E) and K.4 = DOWNSTREAM RESERVOIR Area (06 ° 52 '09, 0 "S; 106 ° 29'55, 5" E).
- f. Sampling Results Raw water observation points in the point AB 1 = Area CENTRAL RESERVOIR (06 ° 52'10, 6 "LS; 106 ° 29'53, 1" E) and AB 2 = Area DOWNSTREAM RESERVOIR (06 ° 52'09, 0 "LS ; 06 ° 29'55, 5 "E). showed in Table 6

Table 6. Water Quality

No	Physic	Unit	Standar Quality *)	AP.1	AP.2	AP.3	AP.4	AP.5
1	Temperature	C	Dev 5	29,2	29,1	28,2	28,4	27,0
2	Residu	mg/L	2000	111	210	116	92	81
3	Residu suspended	Skala NTU	400	18	8	4	6	4
No	Chemical	Satuan	Baku Mutu *)	AP.1	AP.2	AP.3	AP.4	AP.5
1	pH	-	8,5	8	7	7	6	7
2	BOD 5 days 20C	mg/L	12	21	21	18	14	11
3	COD	mg/L	100	33	31	27	22	17
4	DO	mg/L	0	4	4	4	4	4
5	Total fospat P	mg/L	5	0,02	0,01	0,02	0,02	0,1
6	Nitrat	mg/L	20	0,01	0,1	0,005	0,02	0,01
7	Cobalt	mg/L	0,2	<0,01	<0,01	<0,01	<0,01	<0,01
8	Boron	mg/L	1	<0,2	<0,2	<0,2	<0,2	<0,2
9	Cadmium	mg/L	0,2	0,1	0,1	0,1	0,1	0,05
10	Chrom	mg/L	1	<0,002	<0,002	<0,002	<0,002	<0,002
11	Cuprum	mg/L	0,2	0,1	0,1	0,1	0,05	0,05
12	Timbal	mg/L	1	<0,008	<0,008	<0,008	<0,008	<0,008
13	Zinc	mg/L	2	<0,005	<0,005	<0,005	<0,005	<0,005
No	Microbiology	Unit	Quality Standart *)	AP.1	AP.2	AP.3	AP.4	AP.5
1	Fecal coliform	Sum/ 100 ml	2000	520	500	500	410	320
2	Total coliform	Sum/ 100 ml	10000	8900	8500	8400	7800	7600

Parameter of Physic

All parameter in Saguling and Jatiluhur in inlet , middle or outlet is good (Peraturan Menteri Kesehatan RI No. 416/MENKES/PER/IX/1990)

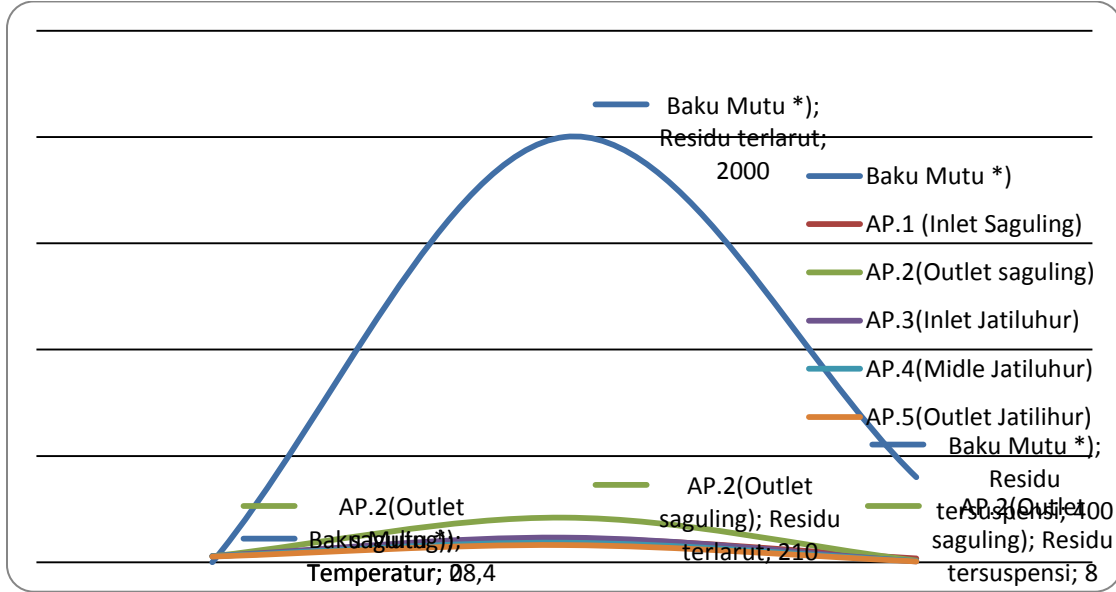


Figure 4. Parameter of Physic in two DAM

Parameter of Chemistry

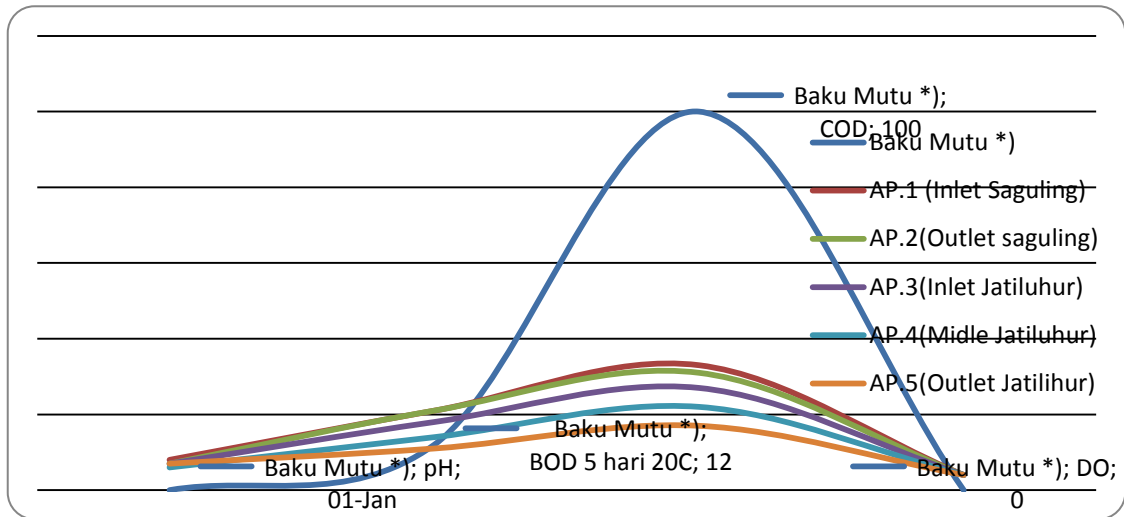


Figure 5. Parameter of Chemistry

All parameter in Saguling and Jatiluhur in inlet , middle or outlet is good (Peraturan Menteri Kesehatan RI No. 416/MENKES/PER/IX/1990)

Quality of Microbiology

Showed in Table 7.

Table 7. The Quality of Microbiology in Two Dam

No	Microbiology	Unit	Quality Standard	AP.1	AP.2	AP.3	AP.4	AP.5
1	Fecal coliform	Jml/ 100 ml	2000	520	500	500	410	320
2	Total coliform	Jml/ 100 ml	10000	8900	8500	8400	7800	7600

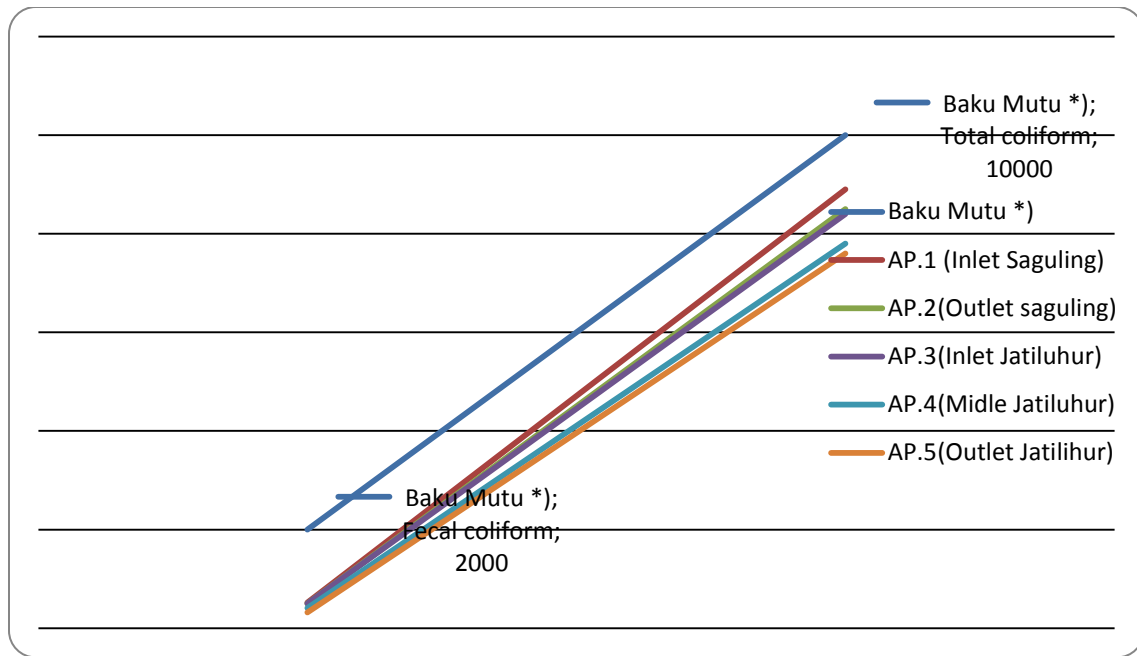


Figure 7. Microbiology

Based on figure 7. All parameter in Saguling and Jatiluhur in inlet , middle or outlet is good

ICWRMIP program in two reservoirs in the Citarum watershed.

Preparation of Questionnaire Satisfaction Index and Program Success Index Questionnaires community Satisfaction Index (HPI) is presented as follows:

After preparation of the questionnaire were made and distributed at random to groups or individuals in the community ICWRMIP locations. Further is to determine the value of HPI and Index Value Success Program through the following steps:

1. Determining Weights weighted average scores. To obtain the weighted value weighted average used the following formula:

For the same case in Reservoir Jatiluhur researchers have devised a questionnaire Item 14, which is a translation of the 14 elements of the service. So that the weighted average value of the weights can be determined in the same manner, namely: 1/14 or 0071

To facilitate interpretation of the SME ratings of between 25-100 then the results of the above assessment is converted to the value of the base 25, with the following formula:

$$HPI = \text{Unit} \times 25$$

Total of Value per unit perception obtained a value of:

Given the service units have different characteristics, it is possible for each unit of service:

Adding elements deemed relevant Give different weights to 14 (fourteen) is the dominant element in the service unit to record the total weight of all elements remain 1.

If compared by Index of Table 2.3. The conclusion is that ICWRMIP : Is poor condition. Because 53.25 By interval from 43.76 to 62.50. It shows that the service program of ICWRMIP given a grade of C or unfavorable category.

CONCLUSION

Based on Data of the Environmental quality and the effectiveness of ICWRMIP. That is very significant if we state that The ICWRMIP in the first phase must be evaluate high recommended. This because start on the end of 2014. The government must have the policy to improve or to cancel that program in the next stage.

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