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Regional Case Study

Determining Water Quality Status and Assimilation Capacity of Pollutant Loads in West Lombok Regency

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Abstract

Babak watershed is one of the essential watersheds in Lombok Island providing water supply for irrigation, fish pool, drinking water supply, and micro-hydro power plant. Excessive human activities degrade the water quality of Babak watershed, and more pollutants are present in the water column. Thus, this study aims to determine Babak watershed's water quality status and assimilating capacity to plan effective and holistic mitigation measures properly. The study calculates the pollution index (PI) using a formula based on the Minister of Environment No.115/2003 Decree and assimilating capacity (AC) based on the Minister of Environment No.110/2003 Decree. The results found that Babak watershed is lightly polluted, defined by exceeding chemical parameters such as DO, total phosphate, nitrite, and dissolved iron (Fe). Similarly, these parameters (total phosphate, nitrite, and Dissolved iron (Fe) also reached the maximum assimilation capacity of Babak watershed to contain and self-purify these pollutants from the water column. Thus, planning mitigation and adaptation measures are required to prevent further contaminations in this watershed.

Keywords: Assimilation capacity; babak watersheds; dissolved iron (fe); do; pollution index; total phosphate

1. Introduction

Water is a major component needed to support humans and nature. Of 71% of total water, only 2,4% can be used as freshwater on the Earth's surface (Gleick, 1993). One of these freshwaters is found in surface water or rivers. The river is commonly used for daily activities such as bathing, dishwashing, laundry, drinking water supply, irrigation, and habitat for biota and plants. Continuous applications of rivers may produce high loads of pollutants in the water column and disrupt supply and demand chain, human health, and water crisis (Wang and He, 2022). According to Thorslund et al. (2021), human activity and climate change significantly contribute to river water degradation. Thus, it is wisely said that dense populations are most likely creating more contamination for rivers.

Babak River is one of the watersheds that administratively flow through three regencies, namely West Lombok regency (42.26% of watershed areas), Central Lombok regency (55.76%), and East Lombok regency (1.98%) (BWSNT1, 2014). According to its designations, Babak watershed is highly used for irrigation, fish pool, drinking water supply, and micro-hydro water plant (Seruni, 2015). of all the regencies that flowed by this watershed, the watershed in West Lombok regency is one of the most vulnerable areas, which is most likely polluted as 20 villages and close to Kebon Kongok Landfill. Cited from detik.com (Viqi, 2023), Babak watershed in West Lombok regency experienced the most severe contaminations of microplastics compared to five provinces in Indonesia, such as East Java, North Sumatera, Bangka Belitung, and Central Sulawesi. While, information on water quality (physical, chemical, and microbiological) for watersheds is not available. Thus, determining the water quality and assimilating capacity is required for the initial stage of designing proper treatments and managing probable contaminations.

Physical, chemical, and microbiological parameters are often applied to determine the water quality of a river, such as pH, turbidity, total dissolved solids (TDS), total suspended solids (TSS), dissolved oxygen (DO), phosphate, nitrate, metals, and total Coliform (Divya and Solomon, 2016; Dunca, 2018; Widodo et al., 2019). Determination of each parameter's value in the watersheds can be carried out by in-situ or laboratory testing. The values of each parameter are then compared with water quality class 2 (based on the 6th attachment of government regulation No. 22 of 2021 on environmental protection and management) and calculated to define the pollution index (PI) using the equation in Minister of Environment No.115/2003 on determining water quality status. The pollution index method is often and recently used by several case studies in determining initial river water quality in Indonesia to design control measures and to determine pollutant sources (Ramdlan and Azmiyati, 2022; Sari and Wijaya, 2019; Widodo et al., 2019). Afterward, the values of each parameter can also be used to estimate the assimilating capacity of pollutant loads by calculating the difference between the maximum pollutant load (BPM) value and the actual pollutant load (BPA) value (Mujib et al., 2022). If the actual pollutant load value is higher than the maximum pollutant load, then it can be concluded that the river water can no longer contain the pollution loads that accumulated in the watershed.

Based on the elaborated problem above, it can be seen that data on Babak watershed quality are not available. Minimum data and information on prior watershed conditions can be challenging steps to design strategies or recommendations for controls, managements, or treatments. Thus, this study aims to determine the water quality status and assimilation capacity of pollutant loads in Babak watersheds in West Lombok Regency. Limited information regarding the existing conditions of water quality and the capacity of the Babak River for pollutant loads can make it difficult to formulate strategies or recommendations for management and control if a pollution event occurs. Water pollution in watersheds could be catastrophic to ecosystem functions and services they provide (Wang et al., 2021). Thus, over recent decades, there have been increasing concerns about understanding the connectivity for watershed quality and health and anthropogenic activities (Meynell et al., 2021). The interaction of social-ecological systems is considered as wicked problems that need to be solved by understanding the complex connectivity between human and natural systems to maintain the sustainability of ecosystem services (Adrianto, 2023; Anderies et al., 2004; Berkes et al., 1998; Elliott and O'Higgins, 2020; Ostrom, 2009). Thus, determining the status of water quality and the capacity to carry the pollution load of the Babak River in West Lombok Regency is an initial stage to understanding the properties and behavior of natural systems that are affected by human developments so that mitigation efforts for pollution occurred or potentially to exist can be controlled effectively and efficiently in the future. Based on the problems described above, this research is very necessary as a first step to determine the quality and level of water pollution in the Babak River, West Lombok Regency. Thus, the findings obtained from this research can be used as a basis for formulating strategies for controlling river pollution that occurs in this region. This research is considered compulsory as a first step to determine the quality and pollution index (PI) in the Babak watershed, West Lombok regency. Thus, the findings obtained from this research can be used as a basis for preparing strategies for controlling river pollution that occurs in this region.

2. Methods

This study was conducted in the Babak watershed in West Lombok Regency by taking two water samples in each location representing upstream, middle, and downstream of Babak watershed. In total, six water samples were taken using the grab sampling method. The grab sampling method is a method used to take samples at a certain location and at a certain time. The sampling is expected to represent pollutants and water quality measurements in the water column (Ramadhani et al., 2020). Water samples were taken out on a sunny day simultaneously, considering the ease of access, cost, and time constraints of the study. Several data are flowrates, temperature, and electrical conductivity (DHL). The remaining parameter value for each water sample was tested in a laboratory, such as DO, total suspended solids (TSS), turbidity, Chemical Oxygen Demand (COD), Biochemical Oxygen Demand (BOD), Phosphate, Nitrate, Nitrite, Dissolved Fe, Dissolved Cu, Total *Coliform* and *Escherichia coli*. Water samples were examined at the Environmental Laboratory of the Mataram College of Environmental Engineering (STTL), West Nusa Tenggara Province. Locations of each water sampling are presented in the Table below.

Table 1. Water sampling locations

No	Sampling Sites	Coordinates	Administrative Areas
1	T1	−8.625080, 116.168987	Montong Are, Montong Are village
2	T2	−8.629082, 116.149238	Karang Kuripan Baru, Kediri village
3	T3	−8.629933, 116.138744	Reot, Bagik Polak village
4	T4	−8.640813, 116.125817	Jerneng, Bagik Polak village
5	T5	−8.647949, 116.097011	Karang Bongkot, Karang Bongkot village
6	T6	−8.647140, 116.085595	Bongor, Taman Ayu village

Flow rates of this watershed were measured by the floating method. The floating method is a simple method to estimate the flow rate of a river by estimating the flow velocity and cross-section area. The velocity is estimated by measuring the time taken for a floating object to travel a measured distance downstream along the river (Ngoma and Wang, 2018). For the analysis of physical, chemical, and microbiological parameters, all parameters were conducted using specific methods based on the Indonesia National Standard (SNI) depicted in the Table Below.

Table 2. Analysis methods for physical, chemical, and microbiological parameters

No	Parameters	Unit	Methods of Analysis
Physical Parameters			
1	Temperature	^{o}C	SNI 6989.23-2005
2	Electrical Conductivity (DHL)	mS/cm	SNI 6989.1-2019
3	TDS	mg/L	SNI 06-6989.27-2004
4	TSS	mg/L	SNI 06-6989.3-2004
5	Turbidity	NTU	SNI 06-6989.25-2005
Chemical Parameters			
1	pH	-	SNI 6989.11:2019
2	COD	mg/L	SNI 06-6989.2-2009
3	BOD	mg/L	SNI 6989.72-2009
4	DO	mg/L	SNI 6989.72:2009
5	Total Phosphate	mg/L	IK.MM/7.2/01/13
6	Nitrate	mg/L	SNI 06-2480-1991
7	Nitrite	mg/L	SNI 06-6989.92004

No	Parameters	Unit	Methods of Analysis
8	Dissolved Fe	mg/L	SNI 6989.6-2009
9	Dissolved Cu	mg/L	**SNI 06-6989.25-2005**
Microbiological Parameters			
1	Total Coliform	MPN/100m L	**SNI 01-2332.1-2006**
2	***Escherichia coli***	**MPN/100 mL**	**SNI 01-2332.1-2006**

Determination of water quality status, namely in the form of calculating the Pollution Index from physical and chemical parameters, is carried out in accordance with the Decree of the Minister of the Environment No. 115 of 2003 on Guidelines for Determining Water Quality Status. The water quality standard value that will be used for calculations and data analysis is class 2 water quality standard which refers to Government Regulation No. 22 of 2021 on Implementation of Environmental Protection and Management Appendix VI. The formula for calculating the Pollution Index is as follows equation (1)

$$IP_j = \sqrt{\frac{(\frac{C_i}{L_{ij}})_M^2 + (\frac{C_i}{L_{ij}})_R^2}{2}} \tag{1}$$

Where, IPj is Pollution Index for designation (j), Lij isconcentration of water quality parameters listed in the Water Designation Standard (j), Ci is concentration of water quality parameters (i), (Ci/Lij)R is average Ci/Lij value average, $(Ci/Lij)_M$ is maximum Ci/Lij value. The IPj class in measuring water quality status is:

Table 3. PI class

Skor IPj	Status
0 ≤ IPj ≤ 1,0	Good
1,0 ≤ IPj ≤ 5,0	Lightly Polluted
5,0 ≤ IPj ≤ 10	Moderately Polluted
IPj ≥ 1,0	Heavily Polluted

Analysis of river water pollution load is determined using the mass balance method. This method calculates the average flow concentration from all research locations by determining the final flow quality. The formula used in equation (2):

$$CC_{RR} = \frac{\Sigma CC_{ii}QQ_{ii}}{\Sigma\, QQ_{ii}} = \frac{\Sigma\, MM_{ii}}{\Sigma QQ_{ii}} \tag{2}$$

Where C_R is the average concentration of water quality parameters in the last stream; while Ci is the concentration parameter in the i^{-th} stream, and Qi and Mi are the flow discharge and mass parameters in the i^{-th} stream, respectively. As for the carrying capacity value of river water pollution load, the determination is made by calculating the value of Maximum Pollution Load (BPM) and Actual Pollution Load (BPA). The formula used in equation (3)

$$BPA = Q \times C \times K \tag{3}$$

Where BPA is the actual pollution load (kg/day), Q is river water discharge (m^3/s), C is parameter concentration (mg/L), and K is a constant (86.4). Next, to calculate BPM, use the formula following equation (4):

$$BPM = Q \times C_{max} \times K \qquad (4)$$

Where BPM is the maximum pollution load (kg/day), Cmax is the parameter concentration in accordance with class 2 quality standards Government Regulation no. 22 of 2021 (mg/L), and K is a constant (86.4).

3. Result and Discussion

3.1. Water Quality of Babak Watershed in West Lombok Regency

3.1.1. Physical Parameters

The tests were conducted to determine the physical quality of water which consists of measuring the parameters of temperature, turbidity, electrical conductivity, TDS, and TSS. For Babak watershed temperature, at each sampling site it was found that the river water temperature ranging from 29-30°C. This shows that the water condition of the Babak River is in normal condition. Temperature is closely related to the ability of water to absorb oxygen from the air so that microbes can decompose organic matter, thus, high temperature can disrupt the health of aquatic ecosystems (Effendi et al., 2015). Normal water temperature is characterized by water conditions having a temperature range between 20°-30°C (Effendi, 2003 & Sumarlin et al., 2021).

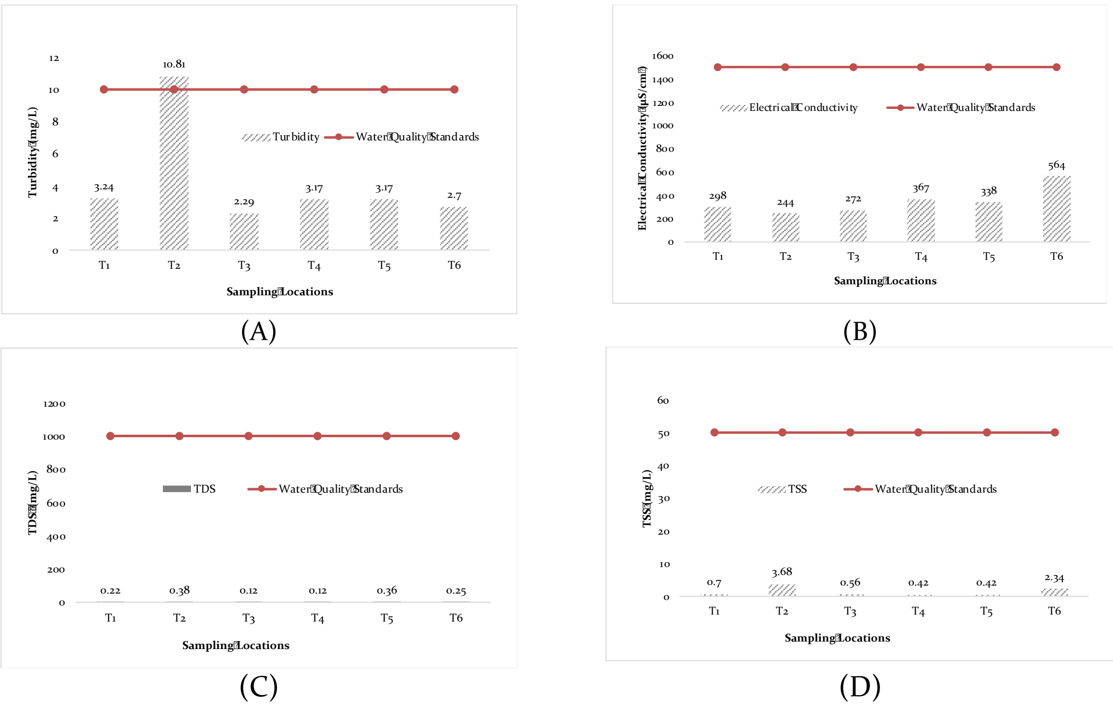


Figure 1. Turbidity (A), electrical conductivity (b), total dissolved solids (c), and total suspended solids (d) in Babak Watersheds

Similarly, other physical parameters (parameters such as turbidity, electrical conductivity, TDS, and TSS) are still within the water quality standard for class 2. Except for turbidity at T2, namely in Kediri village which has slightly higher turbidity (10,81 NTU) than other locations. High turbidity in T2 is likely caused by high concentration of TSS in that location as the sampling point is closed with the sewage outlet from public settlements (depicted in Figure 1 D). However, turbidity level is still complied with the permissible limits. According to Isnan (2016), the turbidity level for drinking water is a maximum of 5 NTU and for clean water a maximum of 25 NTU (PERMENKES No. 492/2010). Electrical conductivity for Babak watershed fell below maximum limits ranging from 244 - 565 µS/cm. Furthermore, the majority values for TDS and TSS for this watershed are below 10 mg/L. These values generally depicts that there are no contaminations from physical parameters. The values of each physical parameter can be seen in the following figure.

From the results shown in the Figure above, it can be concluded that the water quality of the Babak River is not physically polluted. This is validated by the test results for each parameter which complies with water quality standards. Even though, in T2, the turbidity level is spiking compared with others. High turbidity is often caused by domestic waste, surface runoff, and erosion and is closely related to TSS (Huey and Meyer, 2010; Sutapa et al., 2021). As can be seen in T2, there is most likely a slight positive relationship between turbidity and TSS, yet it is not quite significant.

3.1.2. Chemical Parameters

The following parameters to assess are determining watershed quality by testing chemical parameters such as pH, DO, BOD, COD, dissolved Fe, dissolved Cu, Total Phosphate, Nitrate and Nitrite. In pH measurements, at each sampling site, the pH of the Babak watershed was found to be between 6.65 - 6.91. This condition shows that the pH of the watershed is in good condition for aquatic health, namely 6.5 - 7.5 (Naillah et al., 2021). The increase in the degree of acidity (pH) is usually influenced by the content of organic and inorganic waste in the waters (Sumarlin et al., 2021).

For DO, it was found that only T6 had a DO concentration that met the water quality standard, namely 6 mg/L. Meanwhile, the remaining water samples of Babak River Water at T1 -T5 found that the concentration of DO did not comply with the required water quality standards class 2. Concentrations of DO at T1 to T5 are respectively 1.4 mg/L, 1.2 mg/L, 0.8 mg/L, 0.3 mg/L, and 0.9 mg/L (Figure 2). Low DO contents in those sampling points are caused by the activities of people who regularly wash and bathe around the river. The activities are closely related to detergent usage or other cleaning compounds that can produce foam due to the presence of surfactant compounds in water. Foam that arises from the reaction disrupts the process of free oxygen diffusion into the water (Latuconsina and Prasetyo, 2022). According to Larasati et al. (2021), the surfactant content in detergent causes the foam to cover the water so that the process of oxygen diffusion from the air into the water becomes slower.

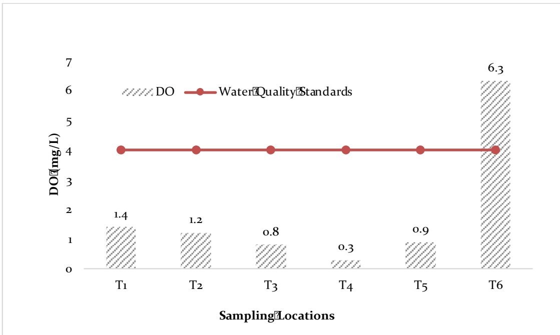
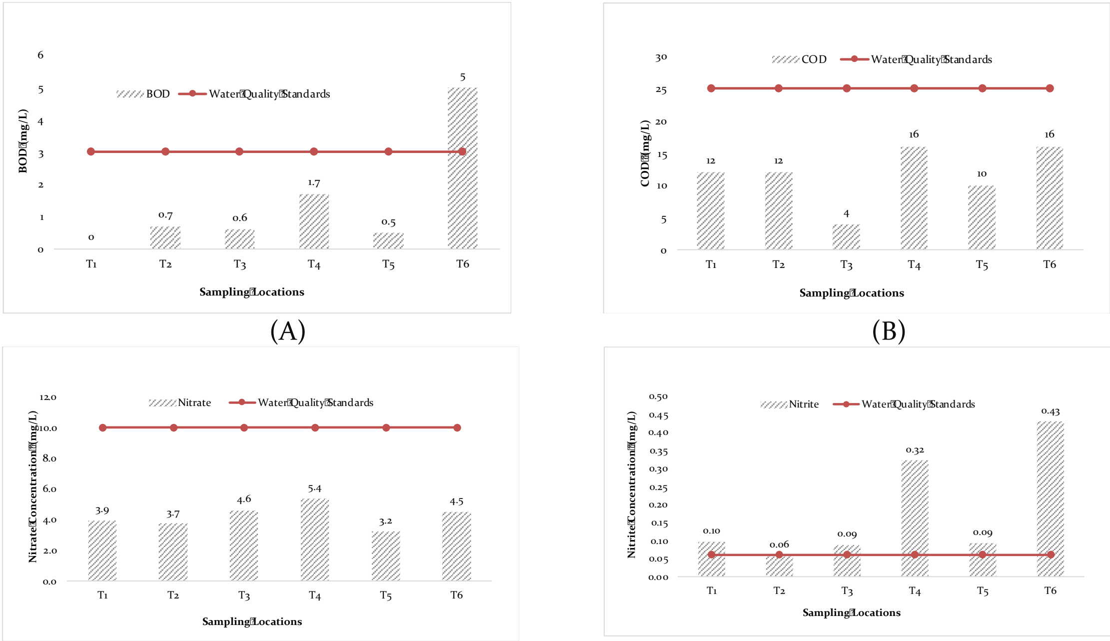


Figure 2. Dissolved Oxygen (DO) concentration in Babak Watershed.

In general, the concentration of COD and BOD in watersheds indicates the amount of oxygen needed to decompose other substances. COD concentration itself is the amount of chemical oxygen required to decompose all organic matter contained in water. In contrast, BOD concentration represents the amount of dissolved oxygen needed by bacteria to oxidize almost all dissolved organic substances and some organic substances suspended in water. The analysis showed that BOD and COD concentrations in the Babak watershed still met the permitted water quality standards at each sampling site, except for the BOD parameter at T6, which exceeded water quality standard, namely 5.0 mg/L. High BOD content at this point can be influenced by the small number of microorganisms. When the microorganism presence that is required to decompose organic substances in water is low, the substrate breakdown process becomes insignificant (Koda et al., 2017; Royani et al., 2021). According to Koda et al. (2017) & Royani et al. (2021), this condition is usually caused by toxic contents (such as heavy metals), which have an impact on reducing the enzyme activity of microorganisms.

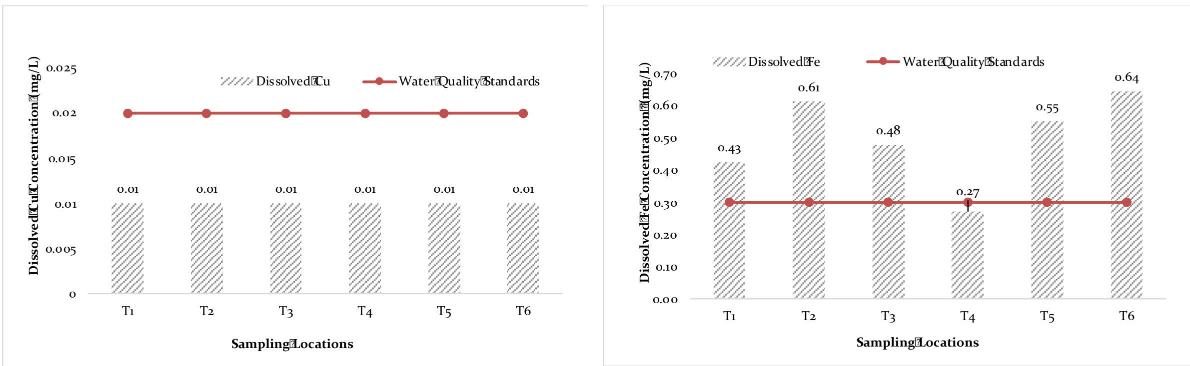


(A) (B)

(C) (D)

Figure 3. Concentration of BOD (A), COD (B), and Heavy metals (Dissolved Cu (C) and Fe (D)) in Babak Watershed

As can be seen in Figure 3 D above, the concentrations of the heavy metal (dissolved Fe) in the watershed are at the threshold or exceed the required quality standard, namely 0.3 mg/L. Excessive Dissolved Fe concentration can infiltrate the organism's body and act as a poison (Koda et al., 2017; Royani et al., 2021; Yudo, 2006). According to Ekström et al. (2016), high concentration of dissolved Fe is likely caused by transported organic soils. Meanwhile, Dissolved Cu concentrations are below the required water quality standard, namely <0.010 mg/L at each watershed sampling site.



(A) (B)

Figure 4. Concentration nitrate and nitrite in Babak Watershed

Nitrogen compounds (nitrate and nitrite) have a role in stimulating the growth and development of aquatic organisms as well as the protein synthesis of aquatic biota in the waters (Hendrayana et al., 2022 & Jusuf et al., 2023). These two compounds, together with ammonium, are intermediate compounds from the nitrogen compound transformation phase. Typically, nitrate concentrate in the water column is higher than the nitrite concentration as nitrite compound is unstable in the presence of oxygen and is easily oxidized to nitrate (Jusuf et al., 2023). This condition is verified by the results of analysis on water samples in Babak watershed, nitrite concentration is much less than the nitrate concentration. The nitrate concentrations in the Babak watershed at each sampling site were still below the specified water quality threshold (Figure 4 A).

Meanwhile, nitrite concentrations in the Babak watershed appear to be at the threshold level and exceed water quality standards permitted at every sampling site for class 2 water quality standards, namely 0.06 mg/L (Figure 4 B). The presence of excess nitrites in water can cause problems for water health. Nitrite itself is a transitional form (intermediate) of ammonia and nitrate gas so that the excess nitrite content in the water causes the dissolved oxygen content in the water to decrease and changes the water condition to anaerobic (Rejito, 2019).

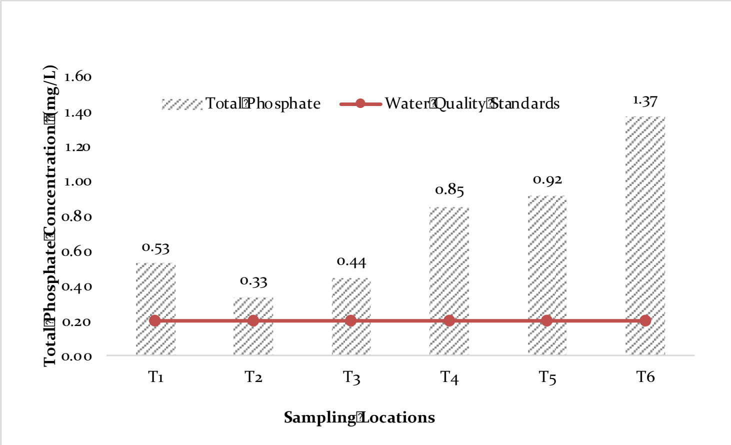
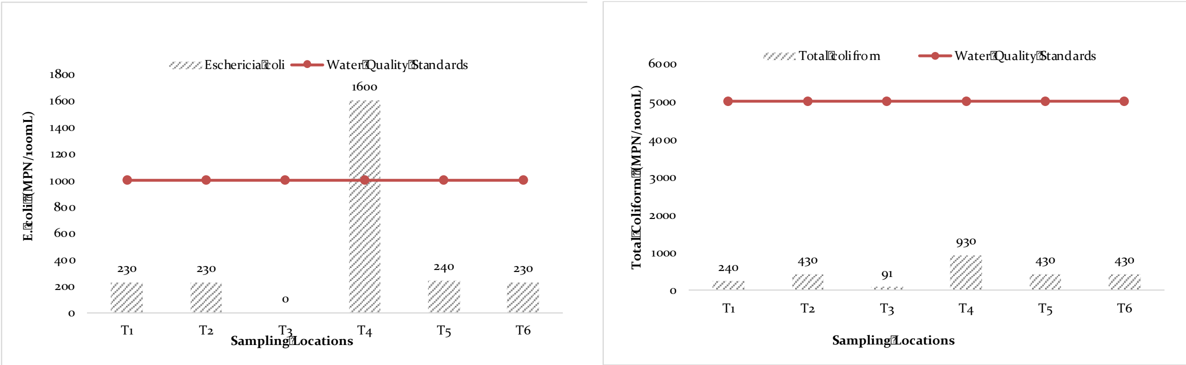


Figure 5. Concentration Total Phosphate in Babak Watershed

Phosphate content in waters is closely associated with decreasing water quality. High phosphate concentration can cause eutrophication in water bodies. This condition is portrayed by the presence of foam and blooming algae which can disrupt the photosynthesis process of plants or phytoplankton (Akinnawo, 2023; Wulandari et al., 2021). Disruption of photosynthesis occurs due to the presence of algae covering the water surface which prevents sunlight penetration into the water column and then causes a reduction in environmental health and a decrease in the dissolved oxygen concentration in the water (Tungka et al., 2016). Based on laboratory test results, the total phosphate concentration at each sampling site exceeds the required water quality standard (0.2 mg/L) by Government Regulation No. 21/2020 on Environmental Protection and Management. The highest total phosphate concentration in Babak watershed was obtained at T6 (Downstream), namely 1.373 mg/L. This condition is quite worrying if it continues and can potentially cause eutrophication in the future.

3.1.3. Microbiological Parameters

Aside from physical and chemical parameters, one of the indicators that can be used to determine water quality is microbiological parameters. Microbiological parameter test is carried out to determine the number of microorganisms in water, such as the number of *Escherichia coli* and Total *Coliform*. *Escherichia coli* bacteria is one of the bacteria that is commonly used as an indicator of aquatic health (to determine whether the aquatic environment is polluted or not). This bacterium is categorized as a pathogenic microorganisms originating from human and animal faces (Effendi, 2003). Meanwhile, Total Coliform is all types of aerobic, facultative anaerobic, and rod-shaped bacteria. Total Coliform is also usually used to determine river water quality due to input into river water from domestic waste (Puspitasari et al., 2018). The existence of these two parameters used if they are higher than the quality standard reflects the quality of biologically polluted waters. Contamination by these two parameters caused by microorganisms is usually found in human urine and feces (Adrianto, 2018). In laboratory test results, the concentrations of Escherichia coli and Total Coliform at each river water sampling site were still below the water quality standards, apart from T4, the concentration of these bacteria exceeded the threshold, namely 1600 MPN/100mL. This condition indicates that at the location where the river water sampling was taken there was an accumulation of pollutants originating from human urine and feces, as this water sampling point is located in domestic waste disposal from community settlements. The number of *Escherichia coli* and Total *Coliform* is presented in the following Figure.



(A) (B)

Figure 6. The number of *E. coli* (A) and Total *Coliform* (B) in Babak Watershed

3.2. Pollution Index (PI) of Babak Watershed in West Lombok Regency

Based on the results of laboratory analysis of water quality at 6 (six) water sampling sites, pollution index calculations were carried out for several physical and chemical parameters such as TDS, TSS, pH, Nitrite, Nitrate, Phosphate, DO, BOD, COD, Dissolved Fe, and Dissolved Cu. The calculations are carried out by referring to the Decree of the Minister of Environment No. 115 of 2003 on Guidelines for Determining Water Quality Status. The results of the pollution index calculation for the Babak water are presented in the following Table.

Table 4. Pollution Index (PI) value in Babak Watershed in West Lombok Regency

No	Sampling Locations	Pollution Index Value	Category
1	T1	1.599	Lightly Polluted
2	T2	1.876	Lightly Polluted
3	T3	4.221	Lightly Polluted
4	T4	4.342	Lightly Polluted
5	T5	4.229	Lightly Polluted
6	T6	3.923	Lightly Polluted

From the Table above, the pollution index at all sampling sites for Babak watershed was categorized as lightly polluted. If we look at the distribution of pollution index values, the results of the pollution index (PI) show that the Middle and Downstream parts of the Babak watershed (T3 to T6) have higher values compared to the Upstream parts. Pollution Index (PI) values in the Middle and Downstream range from 3.923 to 4.342. The Pollution Index (PI) value in the Middle and Downstream parts of the Babak watershed is considered relatively high and is approaching the moderately polluted category, especially at T3 to T5. The high Pollution Index (PI) in these parts of the watershed is due to several things as follows:

1. At T3, high community activities in the Babak River, such as laundry and cleaning, eating and drinking utensils, and bathing.
2. At T4, a drainage outlet from community settlements flows into the Babak watershed.
3. At T5, near the Karang Bongkot settlement.
4. At T6, located around ±500m from the Kebon Kongok landfill.

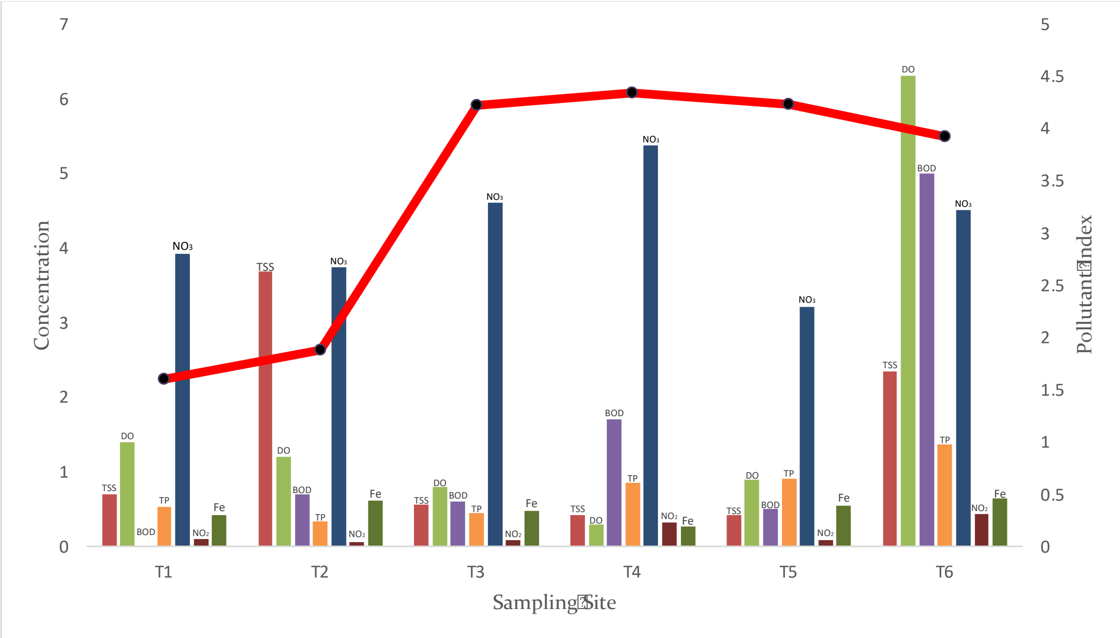


Figure 7. Pollution Index, physical, and chemical parameter concentrations in each sampling site

The water pollution index of the Babak watershed in West Lombok Regency shows that there is an accumulation of pollutant loads flowing from Upstream (T1-T2), Middle (T3-T4), and Downstream (T5-T6), resulting in an increase in the pollution index value in the Middle and Downstream parts. If we closely look at the data from laboratory tests, pollution that occurred in the Babak watershed, West Lombok Regency, was caused by TSS and several chemical pollutions. In Figure 7, it can be seen the general trend of increasing concentration of parameters flowing from upstream to downstream. PI values in the middle to downstream in Babak watershed were higher than Berenyok River, but they fell into a similar category (lightly polluted) (Ramdlan and Azmiyati, 2022). PI values compared to other rivers in Indonesia have lower PI values, yet the values are quite relatively close to PI values in the Cipeusing River (station 1) (Suriadikusumah et al., 2021; Widodo et al., 2019). According to Suriadikusumah et al., (2021), no mitigation and adaptation leads to higher PI value in the following year. Thus, it is suggested that mitigation measures are required to prevent the increasing PI value that could lead to water quality degradation and human health.

3.3. Assimilation Capacity of Babak Watershed in West Lombok Regency

Assimilation capacity is the ability of water bodies to assimilate contaminants/pollutants so that pollution does not occur in water bodies (self-purification). According to the Decree of the State Minister for the Environment No. 110/2003 on guidelines for determining the carrying capacity of water pollution loads on water sources, the calculation of the assimilation capacity of pollution loads can be conducted using a simple method, namely the Mass Balance method. Mass Balance is a method that calculates several components/parameters at point sources and non-point sources of pollution to determine the average concentration of downstream flows (Hidayat, 2022). Based on the field study, the flow rates of this watershed at each sampling site are presented below.

Table 5. Flowrates of each Sampling Site in Babak Watershed

Sampling Sites	Flowrates (m^3/s)
T1	0.896
T2	0.868

Sampling Sites	Flowrates (m^3/s)
T3	0.68
T4	1.19
T5	1.628
T6	1.284

The tabulation of calculation results for the water capacity of the Babak River is shown in the Table below.

Table 6. Results of the assimilation capacity of the Babak Watershed pollutant loads using the mass balance method

Parameters	Units	BPM	BPA	Assimilation Capacity Values
TDS	kg/day	96.969,6	24,21	96.945,39
TSS	kg/day	4.848,5	122,34	4726,14
DO	kg/day	387,9	185,79	202,09
BOD	kg/day	290,9	60,95	229,96
COD	kg/day	2.424,2	1.159,26	1.264,98
Total Phosphate	kg/day	19,4	78,00	-58,61
Nitrate	kg/day	969,7	405,80	563,90
Nitrite	kg/day	5,8	18,67	-12,85
Dissolved Fe	kg/day	29,1	48,58	-19,49
Dissolved Cu	kg/day	1,9	0,97	0,97
Escherichia coli	MPN/day	96.969,6	43.138,94	53.830,66
Total Coliform	MPN/day	484.848,0	43.576,24	441.271,76

In Table 6 above, the assimilation capacity of pollutant loads in the Babak watershed has been exceeded in several parameters, namely Total Phosphate, Nitrite, and Dissolved Fe. In addition, parameters such as DO and Dissolved Cu are about to reach the ability of water bodies to assimilate these pollutants. This emphasizes the importance of designing mitigation-adaptation strategies and measures to prevent the decline in water quality that occurs so that the capacity of this river is maintained and not exceeded, such as by carrying out the pre-treatment process for domestic/industrial waste that will flow/flow into the region (Della Pavita et al., 2014).

4. Conclusions

From the results of the Babak watershed, it can be concluded that Babak watershed, West Lombok Regency, is lightly polluted based on the values of PI in all sampling sites. Pollution index values obtained in the Middle and Downstream parts are quite high, ranging from 3.923 to 4.342. This pollution is proven by the concentration of several parameters exceeding the permissible limits, such as DO concentration, total phosphate, nitrite, and dissolved Fe. Whilst, the capacity to carry the pollutant loads of the Babak watershed, West Lombok Regency, such as total phosphate, nitrite, and dissolved Fe, have been exceeded. Apart from that, DO and dissolved Cu are also getting closer to the maximum value of the river's ability to assimilate the increased pollutants in this river. Thus, mitigation and adaptation strategies are essential to maintain the water quality and ecosystem health of the Babak watershed. Especially the application of technological intervention such as domestic wastewater plants, to eradicate the contaminant load from public settlements. In addition, identifying human activities that contribute to water quality degradation can give valuable information to understand social interactions with nature systems through community engagement and locally appropriate regulations or norms.

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