

JURNAL
SAINTEK PERIKANAN - UNIVERSITAS DIPONEGORO

FORMAT REVIEWER

JUDUL :
**MANAGEMENT OF SEKETAK RIVER, CENTRAL JAVA, INDONESIA BASED ON
DETERMINATION OF WATER QUALITY STATUS AND POLLUTION LOAD
APPROACH**

Kisi-kisi komentar dari Reviewer untuk perbaikan naskah review

1. Adakah sesuatu yang baru dalam naskah ini?

Ya

2. Apakah materi masuk dalam bidang cakupan jurnal?

Masuk dalam scope jurnal

3. Apakah judul naskah sesuai dengan isinya?

Sesuai

4. Apakah penulisan abstrak ditulis secara informatif sesuai dengan isi?

Cukup

5. Apakah penjabaran tujuan sesuai/dianggap cukup untuk menggambarkan materi naskah?

Ya

6. Apakah materi dan metoda dijelaskan dengan detail?

Ya

7. Apakah hasil penelitian dipresentasikan secara cukup dan jelas?

Cukup Jelas

8. Apakah tabel-tabel cukup, atau terlalu banyak?

Cukup

10. Apakah interpretasi dan kesimpulan masuk akal berdasarkan data dan konsisten dengan tujuan?

Ya

EVALUASI

Tulislah rekomendasi sesuai dengan status dari naskah :

1. Dapat diterima tanpa revisi apapun

2. Dapat diterima dengan revisi minor

3. Dapat diterima dengan revisi mayor

4. Tidak dapat diterima

Management of Seketak River, Central Java, Indonesia Based on Determination of Water Quality Status and Pollution Load Approach

Commented [U1]: UPPERCASE

ABSTRACT

Abstract- Due to the presence of renowned universities, Tembalang, Semarang City, is experiencing rapid development. However, this development ~~not only~~ brings positive impacts but also raises environmental issues, one of which is river pollution. Seketak River, a ±10.5 km long river that has its headwaters in Banyumanik Subdistrict and empties into Diponegoro University's Education Reservoir, is one of the affected areas. This river pollution has the potential to disrupt water quality and aquatic biota life. The source of pollution is suspected to come from domestic, industrial, and livestock waste around the Seketak watershed. Therefore, intensive research was conducted to analyze the status of water quality and pollution load based on point sources. This research aims to provide recommendations for proper management and control of pollution. Data were collected during the transitional season (dry to rainy) using the Pollution Index (IP) method based on the Decree of the Minister of Environment No. 115 of 2003 and the Pollution Load (BP) method. The research involved four sampling points, each representing a pollutant source (industry, settlement, campus, and livestock), with two repetitions. The results showed that the average IP value of Seketak River was in the lightly polluted category, referring to the Class II Quality Standard of PP No. 22 of 2021. In the first repetition, the IP value was 2.87, while in the second repetition it reached 3.26. The Pollution Load Analysis identified 5 variables that exceeded the maximum load including Nitrite, Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), iron (Fe) and lead (Pb). These findings emphasize the importance of integrated management efforts to mitigate pollution in Seketak River.

Formatted: Font: Not Italic

Formatted: Indent: Left: 0"

Formatted: Font: Not Italic, Strikethrough

Formatted: Font: Not Italic

Keywords: Index Terms- Water Quality Status; Pollution Index (PI); Load Pollution; Seketak River; lightly polluted.

Formatted: Indent: Left: 0"

INTRODUCTION

Tembalang Sub-district, Semarang City, Indonesia, is experiencing rapid development due to the presence of several renowned universities, which has led to an increase in domestic, commercial, and social activities in the area. This rapid growth not only brings positive impacts, such as economic improvement and easy access to education but also puts pressure on the environment, especially aquatic ecosystems. The development of infrastructure and settlements has the potential to affect the quality of the surrounding ecosystem. River conditions can worsen because they are influenced by several factors including population growth, reduced water catchment areas, and increased riverside settlements (Nurlianti et al., 2022). One of the important rivers in this area is Seketak River, which has its headwaters in Banyumanik Subdistrict and empties into Tembalang Subdistrict, precisely at the Diponegoro University Education Reservoir. This reservoir has a strategic function in maintaining the stability of the local ecosystem, preventing flooding, increasing water absorption, and supporting various business activities. In addition, the reservoir is also utilized as a recreational area, such as a fishing spot, and a source of water for the surrounding community for daily needs. However, increased pressure from human activities can potentially disrupt the quality and sustainability of this ecosystem if not managed properly. Research by Hudiyah and Saptomo (2019) shows that poorly managed human activities can cause water pollution in water sources, including rivers.

Since ancient times, rivers have been considered strategic areas that are the center of human life. Settlements, economic activities and infrastructure often develop around rivers. Rivers have an important role as those that can support people's lives (Putri et al., 2019). However, modernization has drastically changed the function of rivers. Currently, many rivers are used inappropriately as dumping grounds for domestic and industrial waste. Uncontrolled human activities, such as rapid urbanization, industrialization, as well as non-point waste disposal from urban areas, have caused degradation of river quality (Gautam et al., 2019). This is also the case in Banyumanik and Tembalang sub-districts, where rapid population growth has worsened the condition of the river. The high level of community activity is often followed by an increase in the amount of waste found in river bodies. Many people still consider the river as the easiest option to dispose of waste without considering the long-term impact on the environment. Water quality can change according to environmental developments caused by human activities (Mumpuni et al., 2020). This condition increases the levels of pollutants in the river, such as organic matter, heavy metals, and other pollutants. A decrease in water quality can be caused by increased human activities that produce waste in an area (Lusiyana et al., 2020). One of the impacts arising from river water pollution is an increase in nutrient content, causing eutrophication (Indriyani et al., 2020). Although rivers have the natural ability to perform self-purification, they have a limited capacity and depend on the amount and type of incoming pollution load. According to the Ministry of Environment and

Forestry, around 75% of river water in Indonesia is heavily polluted. This is caused by the activity patterns of people living along the riverbanks, where domestic waste and other activities have a direct impact on water quality (Ajiansyah and Surdin, 2016). This study aims to determine the status of water quality based on water quality parameters, such as pH, temperature, Total Suspended Solid (TSS), Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), nitrite (as N), total phosphate, lead (Pb), and iron (Fe). The analysis was conducted using the pollution index method to provide a comprehensive picture of river water quality conditions. In addition, this research also aims to calculate the pollution load to determine the level of pollution occurring in Seketak River. Through an in-depth analysis of these variables, the research on Seketak River is expected to provide a clear and in-depth picture of the environmental condition and become the basis for better policies in the effort to conserve and restore water quality, especially in minimizing the negative impacts of human activities on water quality and aquatic ecosystems. Monitoring water quality status is an important part of supporting river management efforts through the PROKASIH (Program Kali Bersih), an Indonesian government program dedicated to conserving the aquatic environment, especially the river.

MATERIALS AND METHODS

Study Area

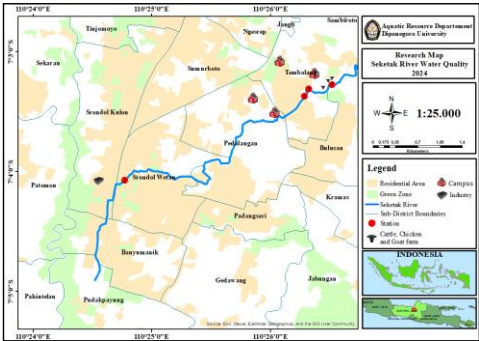


Figure 1. Map of Sample Point

This study was conducted in October 2024, coinciding with the transition season from dry to rainy season, in Seketak River. The river is located in Semarang City, stretching across Banyumanik and Tembalang Subdistricts with a length of approximately ±10,571 meters. Sampling locations were determined based on strategic point sources to illustrate variations in river conditions.

Station 1 was located near the iron factory with coordinates S: 7°44.44" and E: 110°24'46.48". This location was chosen because it has great potential to generate chemical and organic

waste that can significantly affect river water quality. Station 2 is located in a dense area with residential areas, student boarding houses, and shops, with coordinates S: 7°3'22.11" and E: 110°26'17.54". This location illustrates the influence of domestic waste generated from the daily activities of the community and students. Station 3 is located around the Diponegoro University campus area, with coordinates S: 7°5'51.27" and E: 110°43'86.55". This point is important to show the impact of academic activities and campus facilities on river water quality. Station 4 is located near cattle, chicken, and goat farming areas, as well as agricultural activities, with coordinates S: 7°5'47.05" and E: 110°44'18.81". This location was chosen to understand the effect of organic waste from livestock farming and agricultural fertilizer residues on the river ecosystem (Figure 1). Activities such as agriculture, livestock, settlements, and industrial waste disposal contribute to the decline in water quality (Sofiana et al., 2022).

Determination of the coordinates of each sampling point was carried out using a GPS device and then plotted using ArcGIS Desktop 10.3 software to map the exact distribution of locations. Sampling was carried out using a purposive sampling method, namely the deliberate selection of sample points to illustrate each category of pollutant sources. This method ensures that the data obtained covers a variety of river conditions from industrial, domestic, academic, and agricultural activities. This research is expected to provide a comprehensive picture of the condition of water quality in Seketak River and the level of pollution that occurs along the river.

Analysis Procedures

There are several variables used in this study including TSS (gravimetric method), BOD (incubation method for 5 days at 20°C), COD (spectrophotometric closed reflux method), total phosphate (spectrophotometer method with ascorbic acid reduction), nitrite (spectrophotometric method), lead and iron (Atomic Absorption spectrometry (SSA) method).

Data Analysis

Determination of water quality status using primary data taken directly from the field and using secondary data in the form of appendix VI of Indonesian government regulations 22 of 2021 concerning the implementation of Class II environmental protection and management as a reference for the quality standards used. Analysis of water quality status using the Pollution Index refers to Indonesian Minister of Environment Decree Number 115 of 2003 concerning guidelines for determining water quality status. This method shows a quantitative description of the condition of pollution in waters based on each station. The following is the equation used to calculate water quality status with the pollution index (PI):

Commented [U3]: Any repetition for each station? more better if authors mention it

Formatted: Indent: First line: 0"

Commented [U2]: Map is not visible, please make it bigger (1 column)

$$PI_j = \sqrt{\frac{\left(\frac{C_i}{L_{ij}}\right)^2 R^2 + \left(\frac{C_i}{L_{ij}}\right)^2 M^2}{2}} \dots \dots \dots (1)$$

PI_j is the pollution index for designation (j), then the function L_{ij} is the concentration of water quality variables listed in the quality standard, and C_i expresses the concentration of water quality variables obtained from the analysis of water samples in the field. The R value is an index that shows the average level of pollution of all parameters. The value of M is the maximum value that will show one dominant variable to affect water quality. PI_j can be calculated with the following steps:

1. Clustering variables which, if low, will affect water quality
2. Calculate the C_i/L_{ij} value of each variable at each station based on repetition.
3. If the water quality decreases as a result of a decrease in the concentration of a variable, use the formula (L_{ij}/C_i) as in the DO variable.
4. If the value of (C_i/L_{ij}) > 1 then use the (C_i/L_{ij})_{New}

Determination of water quality status based on pollution index:

Table 1. Determination of Water Quality Status	
Value of PI	Description
0,0 < PI _j < 1,0	Meet Quality Standards
1,0 < PI _j < 5,0	Lightly Polluted
5,0 < PI _j < 10,0	Moderately Polluted
PI _j > 10	Severely polluted

Source: Minister of Environment Decree Number 115 of 2003

Data on the levels of pollutant elements including Total Suspended Solid (TSS), pH, temperature, Dissolved Oxygen (DO), Nitrite (As N), Total Phosphate (As P), Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Iron (Fe) and Lead contained in water at each sampling point were calculated with the actual pollutant load using the equation,

$$BP_A = Q \times C_M \dots \dots \dots (2)$$

This equation is to determine the actual pollutant load in the waters of the Seketak watershed, with the Q component being the measured discharge with units (m3/sec), the C_M component being the actual concentration with units (kg/day). In order to determine the maximum pollutant load that the waters can receive, the following equation is used,

$$BP_M = Q \times C_{BM} \dots \dots \dots (3)$$

This equation is to determine whether the maximum pollutant load in the waters of the Seketak watershed exceeds the maximum pollution load or not, with the Q component being the measured discharge with units (m3/sec), the C_{BM} component being the concentration (Standard standards based on Indonesian Government Regulation Number 22 of 2021 concerning the Implementation of Class II Environmental Protection and

Management) with units (mg/liter). Through this calculation, it can be concluded that the pollutant load contained in Seketak River is still below the maximum acceptable limit or not.

RESULT

General Condition of Seketak River

Based on the statistical data of land use of Tembalang Subdistrict, Semarang City, Indonesia in 2023 studied by Ahmada and Sarifudin (2023), land use in the Tembalang area consists of several types, with residential areas covering 32.98% of the total area of 4195.401 hectares. In addition, there is 6.99% of land used for agriculture, 51.47% for moorland, and 0.27% for Open Green Space (Figure 2). The largest land use in Tembalang Sub-district is residential area and moorland which covers a total area of 3543.286 Ha.

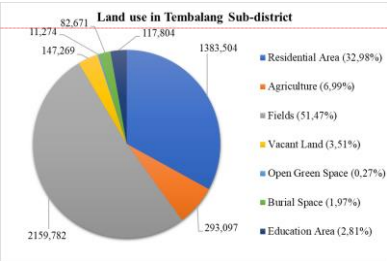


Figure 2. Land use in Tembalang Sub-district, Indonesia
Source : Ahmada dan Sarifudin (2023)

The density of settlements in the Tembalang area is one of the main factors that has the potential to cause increased pollution in Seketak River. Dense domestic activities such as the disposal of household waste, garbage and other pollution can affect the water quality in the river. In addition, changes in land use, such as land conversion into residential areas, can also increase the pollution load entering the river ecosystem.

Physical Parameters

The results of the research conducted at four stations in Seketak River with two repetitions showed quite diverse water quality characteristics based on the observed variables. The water quality data of Seketak River for repetition I and II are presented in Table 2 and Table 3. One of the important variables observed is temperature, which has a significant influence on the quality of aquatic ecosystems.

The water temperature in Seketak River ranges from 29.2°C to 33.2°C. Based on the Government Regulation of the Republic of Indonesia Number 22 of 2021 concerning class II water quality standards, this value exceeds the normal temperature standard for water, which ranges from 28°C to 31°C (Safitri, 2019). Increased water temperature can reduce dissolved oxygen

Commented [U4]: ??

(DO) concentration, which is one of the important indicators of water quality. Low DO reduces the ability of aquatic organisms to survive, potentially leading to a decrease in biodiversity and disruption of the food chain (Suriadikusumah, 2020).

Environmental factors such as the presence of vegetation on the riverbank also affect water temperature. Vegetation functions as a natural shade, absorb radiation emitted by long waves, and creates a microclimate that can reduce evaporation, maintain soil temperature, and stabilize water temperature (Dallas, 2008). Therefore, the presence of sufficient vegetation can help maintain the thermal quality of water.

In addition to temperature, Total Suspended Solid (TSS) concentration was also observed in this study. The measured TSS values ranged from 5.1 mg/L to 21.74 mg/L, which is still below the quality standard threshold. However, high TSS concentrations can increase water temperature due to greater heat absorption (Marlina et al., 2017). TSS is also influenced by factors such as river current velocity, human activities, and the presence of sediment on the riverbed (Pamuji et al., 2015). Controlled TSS concentration is important to ensure that there is no excessive deposition that can reduce light penetration into the water, which in turn disrupts the photosynthesis process of aquatic organisms. In the context of Seketak River, maintaining a stable flow rate and reducing activities that can increase sediment load is one of the strategic steps in water quality management.

Chemical Parameters

The degree of acidity (pH) is an important parameter in aquatic ecosystems because it functions to balance the acid and base content and the concentration of hydrogen ions in the water. In Seketak River, the pH concentration was recorded to range from 7.5 to 9.3, where the pH is close to the normal value of 7. Factors that affect pH include acid rainfall, biological activity in water, and pollution from industrial or household waste, such as detergents, which can disrupt the chemical balance of water (Gazali et al., 2013).

In addition to pH, another parameter observed was Dissolved Oxygen (DO), with concentrations ranging from 4 to 6.4 ppm. These values indicate that the DO concentration is still above the class II quality standard (4 ppm) according to applicable regulations. DO is produced from the photosynthesis process of plants and algae, as well as through air diffusion. DO is very important for the respiration of aquatic biota and microorganisms in the process of decomposition of organic matter. A decrease in DO levels below the minimum limit indicates polluted water conditions, so it is important to maintain the balance of the ecosystem.

The Biological Oxygen Demand (BOD) concentration in Seketak River ranges from 15 to 22 mg/L. BOD describes the amount of oxygen required by microorganisms to decompose organic matter. High BOD values indicate an increase in organic

waste content in the waters, which can trigger ecosystem damage. On the other hand, Chemical Oxygen Demand (COD) concentrations ranged from 33 to 48 mg/L, with the highest value recorded at station 3 in the first test (48 mg/L). These concentrations far exceeded the established class II quality standards, indicating a significant chemical pollutant load. COD concentrations are influenced by other variables such as DO, TSS, and pH, with an influence that can reach more than 90% (Sihotang et al., 2021).

The concentration of nitrite (NO_2^-) in Seketak River was recorded to range from 0.21 to 0.66 mg/L, with all values exceeding the quality standard set for class II. The highest concentration value was found at station 1, followed by station 4 which is a farming area. This indicates that nitrite pollution in the river mainly comes from livestock activities and runoff of organic matter into the water body. Nitrite levels in water are usually very low, especially in uncontaminated waters. Safe drinking water quality standards, as set by the World Health Organization (WHO) and Government Regulation of the Republic of Indonesia Number 22 of 2021, require that the concentration of nitrite in water should not exceed 0.1 mg/L. Nitrite is highly toxic to aquatic organisms, especially fish, and its presence in high concentrations can indicate serious water pollution conditions. Nitrite is usually found in the aquatic environment due to the decomposition of organic matter and metabolic products of organisms (Setyowati et al., 2016). Nitrite and Nitrate are naturally produced from the phytoplankton nitrogen cycle (Yasa et al., 2024). High nitrite content has the potential to disrupt the balance of aquatic ecosystems and is toxic to aquatic organisms, especially if the concentration exceeds the threshold that can be tolerated by aquatic biota. Nitrite is harmful to aquatic ecosystems because it can interfere with the ability of the blood of aquatic organisms, especially fish, to transport oxygen. Nitrite can bind to hemoglobin in fish blood (Wahyudi et al., 2014), forming methemoglobin that is unable to carry oxygen, a condition known as "methemoglobinemia". This can cause respiratory stress or even death in fish and other aquatic organisms if nitrite concentrations are too high (Aini and Parmi, 2022).

Meanwhile, the concentration of total phosphate (PO_4^{3-}) in Seketak River showed relatively low values, ranging from 0.01 to 0.13 mg/L, with all measurement results still below the established quality standards. The highest concentrations were recorded at stations 1, 3, and 4, which are thought to come from anthropogenic activities such as the use of fertilizers on agricultural land or domestic activities around the area. Although the total phosphate value is still within safe limits, phosphate still plays a major nutrient role in algae growth, which can trigger eutrophication if the concentration is too high. The main source of phosphate in waters usually comes from human activities, such as domestic waste (detergent, soap, food waste), industrial waste, and agricultural runoff containing fertilizers

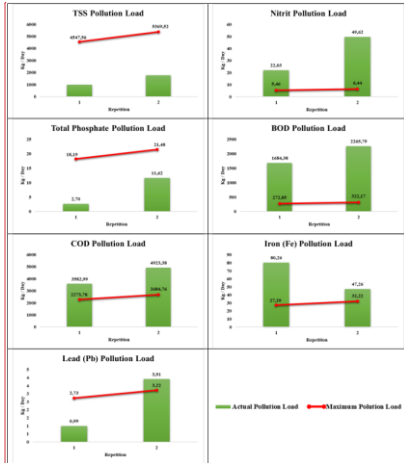


Figure 4. Pollution of Seketak River

Discussion

The results of the Pollution Index and Pollution Load analysis show that there is an influence of human activities on changes in the water quality of Seketak River. Industrial and livestock activities also show an influence on changes in water quality as shown in station 1 (pollutant source from industry) with the highest P_{ij} value in repetition I and station 4 (pollutant source from livestock) with the highest P_{ij} value in repetition II. This proves that the increase in river pollution is caused by activities in the upstream to downstream areas of the river. The value obtained shows that there is pressure or influence that causes river pollution, but the value obtained is still at a low level or does not directly have a significant impact on pollution. The values obtained also illustrate that the Dissolved Oxygen (DO), TSS, and pH variables are still at the threshold of river water quality standards. The variables that have a major influence on the decline in the quality status of Seketak River waters are BOD and COD. Based on the pollution load (BP) analysis, it shows that the variables of Nitrite, BOD, COD, lead, and iron at several stations exceeded the Maximum Pollution Load (BPM). This can be seen in Figure 4 where in repetition I the variables of nitrite, BOD, COD, and iron exceeded the threshold, and in repetition II lead also showed that there was an increase. The highest pollution load is at stations 2 and 3, this is due to the location adjacent to residential areas and student boarding areas.

River discharge also has an influence on water quality. This is in line with the research of Suriadikusumah et al. (2021), which states that a fast flow rate can cause the ability of self-purification (natural purification) to decrease, increasing water pollution. Slow flow rates allow for more effective contact between substrates and microorganisms, while high flow rates reduce the interaction time between substrates and bacteria. As a

result, there are still substrates that have not been fully washed away. The decline in water quality status is also suspected to be due to the increase in people living in the Seketak River area. An increase in the number of people is relevant to an increase in the volume of waste. However, based on data obtained from the Semarang City Communication, Information, Statistics, and Signage Agency, there is a decrease in the amount of waste volume that can be handled each year and a decrease in manageable waste in Semarang City from 2021 of 74.22% and decreasing to 72.1% in 2024 (Figure 5). So there is approximately 18% of community waste that cannot be managed. This is suspected to be the trigger for the community to dispose of waste in the water body due to waste services in Semarang City, causing a decrease in water quality in Seketak River. Research by Pramesti et al. (2020), stated that only 60-70% of waste can be transported to landfills. The assumption is that there is 40% of waste that cannot be accommodated in the landfill.



Figure 5. Waste Management in Semarang City

Source: Communication, Informatics, Statistics and Coding Agency of Semarang City

The Pollution Index value, which shows the quality status as lightly polluted, requires a solution so that the waters of Seketak River do not experience increased pollution. This requires cooperation between the government, academics, and the community to be able to provide policy and community empowerment. Regarding non-technical aspects, a study of assimilation capacity can be conducted to determine the capacity of waters to be able to purify naturally (self-purification), by knowing the capacity that can be accepted by Seketak River, the government can formulate regional regulations on determining water quality status. The regulation is intended to prevent potential pollution of the aquatic environment caused by human and industrial activities. The technical aspect can be done by making a residential/household scale WWTP (Wastewater Treatment Plant). In addition, it can be done with a community-based approach, by utilizing Seketak River into a cultivation area so that the community has a sense of protecting the waters. With this research, it is expected that the government can make regulations and policies that can protect Seketak River. In

Commented [U9]: To small

Formatted: Centered

Commented [U10]: Plj

Commented [U11]: Plj

addition, there is also a need for technology that can monitor the quality of the Seketak watershed in real time, so as to obtain accurate and open data and information on the status of water quality. Based on the quality status analysis, a policy can be implemented to maintain and improve river water quality, including restricting waste in the aquatic environment.

CONCLUSION

The status of water pollution of Seketak River, which was reviewed using the Pollution Index (PI) method, showed the presence of pollution with a P_{ij} value of 2.36 - 2.91 (lightly polluted) in repetition I and repetition II of 2.80 - 3.25 (lightly polluted). The highest Pollution Index in repetition I was at station 1 (polluting source from industry) and station 4 (polluting source from livestock) in repetition II. Regarding pollution load. The pollution load of Seketak River shows that the variables of nitrite, BOD, COD, iron, and lead exceed the maximum pollution load (BPM) at several observation stations. Industrial activities at Station 1, domestic waste from residential areas and student boarding houses, and livestock activities at Station 4 are the main sources that contribute to the high pollution load. The water condition is exacerbated by the uneven management of domestic and industrial waste and the limited capacity of waste services in Semarang City.

Therefore, there is a need for strategies in the form of technical and non-technical aspects to reduce pressure on aquatic ecosystems and restore water quality.

ACKNOWLEDGMENT

Grateful acknowledgment is made to LPPM Diponegoro University for the grant of the Community Service Activity of the Science and Technology Scheme for Undip Bangalore Desire (IDBU) funded in addition to the state budget (in addition to the state budget) of Diponegoro University which has financed this community service and research with SPK Number: 974-06/UN7.D2/PM/IX/2024.

REFERENCES

Ahmada, N., & Sarifudin, I. (2023). Analisis Penggunaan Lahan Berdasarkan Aspek Geologi Lingkungan di Kecamatan Tembalang. *Perwira Journal of Science & Engineering*, 3(2): 6-13.

Aini, M., & Parmi, H. J. (2022). Analisis Tingkat Pencemaran Tambak Udang di Sekitar Perairan Laut Desa Padak Guar Kecamatan Sambelia Kabupaten Lombok Timur. *AQUACOASTMARINE: Journal of Aquatic and Fisheries Sciences*, 1(2), 67-75. <https://doi.org/10.32734/jafs.v1i2.9025>

Ajiansyah, E., & Surdin. 2016. Deskripsi kerusakan bantaran sempadan Sungai Abaito Sub DAS Roraya di Desa Ahuanggulasi Kecamatan Baito Kabupaten Konawe Selatan. *Jurnal Penelitian Pendidikan Geografi*, 1(1): 429-438.

Dallas, H. 2008. Water temperature and riverine ecosystems: An overview of knowledge and approaches for assessing biotic responses, with special reference to South Africa. *Water Sa*, 34(3): 393-404.

Data Terlaksananya Pengelolaan Sampah di Wilayah Kota Semarang. Dinas Komunikasi, Informatika, Statistik dan Persandian Kota Semarang

Desriyan, R., Wardhani, E., & Pharmawati, K., 2015. Identifikasi pencemaran logam berat timbal (Pb) pada perairan sungai Citarum Hulu segmen dayeuhkolot sampai nanjung. *Jurnal Reka Lingkungan*, 3(1): 41-52.

Gautam, A., Kushwaha, A., & Rani, R. (2021). Microbial remediation of hexavalent chromium: An eco-friendly strategy for the remediation of chromium-contaminated wastewater. In *The future of effluent treatment plants* (pp. 361-384). Elsevier.

Gazali, I., Widiatmono, B. R., & Wirosedarmo, R. 2013. Evaluasi dampak pembuangan limbah cair pabrik kertas terhadap kualitas air Sungai Klintar Kabupaten Nganjuk. *Jurnal Keteknik Pertanian Tropis dan Biosistem*, 1(2): 1-8. doi:10.1234/jkptb.v1i2.5678.

Hindaryani, I. P., Zainuri, M., Rochaddi, B., Wulandari, S. Y., Maslukah, L., Purwanto, & Rifai, A. 2020. Pola arus terhadap sebaran konsentrasi nitrat dan fosfat di perairan Pantai Mangunharjo, Semarang. *Indonesian Journal of Oceanography*, 2(4): 1-11.

Hudiyah, M., & Saptomo, S. K. 2019. Analysis of water quality of water distribution channels in new building of Faculty of Economics and Management Bogor Agricultural University (IPB). *JSIL Jurnal Teknik Sipil dan Lingkungan*, 4(1): 13-24.

Indriyani, A. R., Sudarti, & Yushardi. 2024. Analisis limbah pencemaran air sungai di kota dan desa. *OPTIKA: Jurnal Pendidikan Fisika*, 8(1): 28-34.

Keputusan Menteri Negara Lingkungan Hidup Nomor : 115 Tahun 2003 Tentang Pedoman Penentuan Status Mutu Air Menteri Negara Lingkungan Hidup

Mumpuni, A., Rahayu, P., & Rini, E.F. 2020. Partisipasi masyarakat dalam program pengelolaan sungai (Studi kasus: Sungai Pepe, Sungai Anyar, dan Sungai Premulung, Kota Surakarta). *REGION: Jurnal Pembangunan Wilayah dan Perencanaan Partisipatif*, 15(1): 67-80. doi:10.20961/region.v15i1.24976.

Nurlianti, M., Eviliyanto, & Veriansyah, I. 2022. Analisis pemanfaatan Sungai Sambas sebagai sarana obyek wisata di Kabupaten Sambas. *Geo Khatulistiwa: Jurnal Pendidikan Geografi dan Pariwisata*, 2(3): 1-9.

Commented [U12]: Plj

Commented [U13]: ??

Commented [U14]: Please recheck again list of references, there are some references not yet mentioned

- Pamuji, A., Muskananfolo, M. R., & A'in, C. 2015. The effects of sedimentation on macrozoobenthos abundance in Betahlawang Estuary of Demak. *Saintek Perikanan : Indonesian Journal of Fisheries Science and Technology*, 10(2), 129-135. <https://doi.org/10.14710/ijfst.10.2.129-135>
- Peraturan Pemerintah Republik Indonesia Nomor 22 Tahun 2021 Tentang Penyelenggaraan Perlindungan Dan Pengelolaan Lingkungan Hidup, Lampiran VI
- Putri, M. K., Septinar, H., & Daulay, R. W. (2019). Analisis pengaruh pengelolaan lingkungan terhadap kondisi masyarakat hilir Sungai Musi. *Jurnal Geografi*. 16(2): 80-89. <https://doi.org/10.15294/jg.v16i2.18955>
- Safitri, R. 2019. Physical Measurement of Water Chemistry on Upstream to Downstream The Percut River. *Jurnal Pembelajaran dan Biologi Nukleus*, 5(1): 50 – 58.
- Setyowati, D.L., Amin, M., Suharini, E., & Pigawati, B. 2012. Model agrokonservasi untuk perencanaan pengelolaan DAS Garang Hulu. *Tataloka*, 14(2): 131-141.
- Sihotang, F. R., Sifriyani, S., & Prangga, S. 2021. Aplikasi regresi nonparametrik spline birespons pada data kualitas air di das mahakam. *Media Bina Ilmiah*, 16(3), 6515-6526.
- Simbolon, A. R. 2016. Pencemaran bahan organik dan eutrofikasi di perairan Cituis, pesisir Tangerang. *Jurnal Pro-Life*, 3(2): 109-118.
- Suriadikusumah, A., Mulyani, O., Sudirja, R., Sofyan, E. T., Maulana, M. H. R., & Mulyono, A. 2021. Analysis of the water quality at Cipeusing river, Indonesia using the pollution index method. *Acta Ecologica Sinica*, 41(3): 177-182.
- Wahyudi, A. Setiyono, & O. W. Jayanthi. 2014. Studi kualitas dan potensi pemanfaatan airtanah dangkal di pesisir Surabaya Timur. *Eksplorium*, 35(1): 43-56.
- Yasa, M., Dindin, U., & Nurbaeti, N. 2024. Struktur komunitas fitoplankton pada budidaya ikan koi (*Cyprinus rubrofuscus*) dalam sistem vertiqua menggunakan biofikal filter atas. *Manfish: Jurnal Ilmiah Perikanan dan Peternakan*, 2(2): 191-212. DOI: 10.62951/manfish.v2i2.70.