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MAPPING OF BATANG MERAO RIVER WATER QUALITY USING A GEOGRAPHIC INFORMATION SYSTEM (GIS) IN KERINCI REGENCY

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Abstract

The Batang Merao River is one of the main water resources utilized by the people of Kerinci Regency to meet various needs, such as bathing, washing, irrigation, and other household activities. The increasing community activities along the riverbanks have the potential to cause a decline in water quality due to the entry of domestic waste into the river body. This study aims to map the water quality of the Batang Merao River using a Geographic Information System (GIS) so that the spatial distribution pattern of water quality conditions can be identified. The study used a quantitative descriptive method with sampling in the upstream and downstream parts of the Batang Merao River. Water quality data were obtained through laboratory testing of water quality parameters, then processed using a Geographic Information System through the process of inputting coordinates, spatial interpolation, and preparing thematic water quality maps. The mapping results show that water quality conditions have changed from upstream to downstream. The upstream area still shows relatively better water quality compared to the downstream area which is influenced by the increasing household activities along the riverbanks. Mapping using GIS is able to describe the spatial distribution of water quality more clearly so that it can be used as a basis for decision making for the management and control of pollution in the Batang Merao River.

Kata kunci:
Sistem Informasi Geografis; Kualitas Air; Sungai Batang Merao, Pencemaran air

ABSTRAK

Sungai Batang Merao merupakan salah satu sumber daya air utama yang dimanfaatkan masyarakat Kabupaten Kerinci untuk memenuhi berbagai kebutuhan, seperti mandi, mencuci, irigasi, dan aktivitas rumah tangga lainnya. Meningkatnya aktivitas masyarakat di sepanjang bantaran sungai berpotensi menyebabkan penurunan kualitas air akibat masuknya limbah domestik ke badan sungai. Penelitian ini bertujuan memetakan kualitas air Sungai Batang Merao menggunakan Sistem Informasi Geografis (SIG) sehingga dapat diketahui pola persebaran kondisi kualitas air secara spasial. Penelitian menggunakan metode deskriptif kuantitatif dengan pengambilan sampel pada bagian hulu dan hilir Sungai Batang Merao. Data kualitas air diperoleh melalui pengujian laboratorium terhadap parameter kualitas air, kemudian diolah menggunakan Sistem Informasi Geografis melalui proses input koordinat, interpolasi spasial, dan penyusunan peta tematik kualitas air. Hasil pemetaan menunjukkan bahwa kondisi kualitas air mengalami perubahan dari bagian hulu menuju hilir. Wilayah hulu masih menunjukkan kualitas air yang relatif lebih baik dibandingkan bagian hilir yang dipengaruhi oleh meningkatnya aktivitas rumah tangga di sepanjang bantaran sungai. Pemetaan menggunakan SIG mampu menggambarkan distribusi spasial kualitas air secara lebih jelas

sehingga dapat menjadi dasar dalam pengambilan keputusan untuk pengelolaan dan pengendalian pencemaran Sungai Batang Merao

1. INTRODUCTION

Water is a natural resource that plays a vital role in supporting human life, other living things, and the sustainability of ecosystems. Rivers, as a source of surface water, are used to meet various needs, such as clean water, irrigation, fisheries, industrial activities, and household activities (Uyun, 2020). The availability of good-quality water is a crucial factor in supporting sustainable development. However, increasing population growth and regional development have put pressure on water resources, particularly rivers, resulting in a continuous decline in water quality due to the influx of various pollutants (Ahda & Ernyasih, 2025).

River water pollution is an increasingly complex environmental problem in various regions of Indonesia. According to Law Number 32 of 2009 concerning Environmental Protection and Management, water pollution occurs when the entry of living creatures, substances, energy, or other components into a body of water results in the water quality no longer meeting established standards. Sources of this pollution come from various human activities, such as domestic waste, agriculture, livestock, and industry. Among these sources, domestic waste is the largest contributor to river water pollution, especially in areas with high population densities (Alfatihah et al., 2022).

Domestic waste from household activities, such as bathing, washing, cooking, and sanitation, contains various organic and inorganic materials that can degrade water quality. Disposing of waste directly into rivers increases the pollutant content, disrupting the balance of aquatic ecosystems (A. F. Anggraini, 2025). This can lead to decreased dissolved oxygen levels, increased organic pollutant loads, the growth of pathogenic microorganisms, and diminish the river's function as a water source for the community.

Kerinci Regency is home to several rivers that play a vital role in supporting the community's livelihoods, one of which is the Batang Merao River. This river serves as a water source for household needs, agricultural irrigation, and various economic activities. In addition to its ecological function as part of the river basin, the Batang Merao also plays a role in maintaining environmental balance in Kerinci Regency. Therefore, the river's existence must be maintained to ensure it continues to meet the community's needs sustainably (Almaidah, 2023).

As human activity increases along the banks of the Batang Merao River, pressure on water quality is also increasing. The expansion of residential areas, increased water use for daily needs, and the direct discharge of household waste into the river have the potential to cause water quality degradation. This condition is generally more pronounced in the downstream areas, which receive accumulated flow from upstream

areas along with various pollutants carried by the water flow(W. P. Anggraini et al., 2024).

Water quality monitoring is generally conducted through laboratory testing of several physical, chemical, and biological parameters. While these methods can provide information on water quality conditions at specific points, presenting results in tabular or graphical form still has limitations in depicting spatial pollution distribution patterns. Therefore, an approach is needed that integrates water quality data with spatial information to visualize the distribution of water quality conditions more clearly and easily.

Geographic Information Systems (GIS) are computer-based technologies capable of collecting, storing, managing, analyzing, and presenting geographically referenced data. In the environmental field, GIS has been widely used for water quality mapping, watershed analysis, pollution source identification, and environmental management policy development. Through its spatial analysis capabilities, GIS can produce thematic maps that show variations in water quality conditions based on observation locations, facilitating interpretation of environmental conditions (Anwar, 2025).

The use of Geographic Information Systems (GIS) in water quality mapping offers several advantages over conventional data presentation. Through spatial interpolation techniques, water quality values at observation points can be predicted into a continuous surface that depicts water quality conditions throughout the study area. This information allows for the identification of zones experiencing declining water quality, understanding pollution distribution patterns, and supporting the determination of priority locations for more effective and efficient river pollution control efforts (Budi & Ahlunnaza, 2023).

Several previous studies have shown that the application of Geographic Information Systems can improve the effectiveness of water quality analysis through informative spatial visualization (Dasrizal, Rahmi, et al., 2019). The mapping results not only show locations of pollution but also demonstrate the relationship between water quality conditions and land use, settlement density, and community activities around the river. This spatial information is crucial as a basis for developing sustainable water quality management strategies, particularly in areas experiencing pressure from domestic activities (Dasrizal, Barlian, et al., 2019).

Based on the above description, this study aims to map the water quality of the Batang Merao River using a Geographic Information System (GIS) to obtain an overview of the spatial distribution of water quality conditions from upstream to downstream (Dasrizal et al., 2026). The results are expected to provide more comprehensive information on the water quality conditions of the Batang Merao River and serve as a consideration for local governments and stakeholders in planning sustainable management, monitoring, and control of river pollution.

2. METHOD

This research was conducted on the Batang Merao River in Kerinci Regency, Jambi Province. The Batang Merao River is a major river used by the community for various purposes, such as household needs, agricultural irrigation, and economic activities. The

research focused on two river segments: the upstream section in Ujung Ladang Village and the downstream section in Lubuk Suli Village. The two locations were selected purposively because they have different land use characteristics and levels of community activity, thus representing variations in water quality conditions along the riverc (Dewa et al., 2025).

This study employed a quantitative descriptive method with a spatial approach. This approach was used to describe the water quality conditions of the Batang Merao River based on laboratory testing results, which were then visualized spatially using a Geographic Information System (GIS). Spatial analysis was conducted to determine the distribution patterns of water quality from upstream to downstream and to identify areas experiencing water quality decline (Edokpayi et al., 2020).

The data used consisted of primary and secondary data. Primary data were obtained through field observations, determining coordinates using a Global Positioning System (GPS), collecting river water samples at the research site, and documenting environmental conditions around the river. Secondary data included administrative maps of Kerinci Regency, river network maps, and various supporting documents obtained from relevant agencies and previous research.

Water sampling was conducted at two points representing the upstream and downstream parts of the Batang Merao River. The samples were then analyzed in the laboratory to determine water quality conditions based on six parameters: Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Suspended Solids (TSS), acidity (pH), Dissolved Oxygen (DO), and *Fecal Coliform* . The laboratory test results were then compared with water quality standards stipulated in Government Regulation of the Republic of Indonesia Number 22 of 2021 concerning the Implementation of Environmental Protection and Management as a basis for evaluating river water quality conditions (Firdaus & Zen, 2025).

Spatial analysis was conducted using Geographic Information Systems (GIS) software. The analysis stages included processing the coordinates of sampling locations, digitizing base maps, developing a spatial database, interpolating, and creating thematic water quality maps.

Laboratory and spatial analysis data were then analyzed descriptively by comparing water quality conditions between the upstream and downstream parts of the Batang Merao River. Interpretation was conducted by linking laboratory test results, land use characteristics, and community activities around the river basin. This approach provided a picture of the spatial distribution of water quality as a basis for supporting sustainable management and pollution control of the Batang Merao River. (Harefa, 2025).

This research used a quantitative descriptive method. The research location is the Batang Merao River in Kerinci Regency, Jambi Province, which is divided into two observation areas: upstream and downstream. The locations were selected purposively, taking into account the level of community activity around the river.

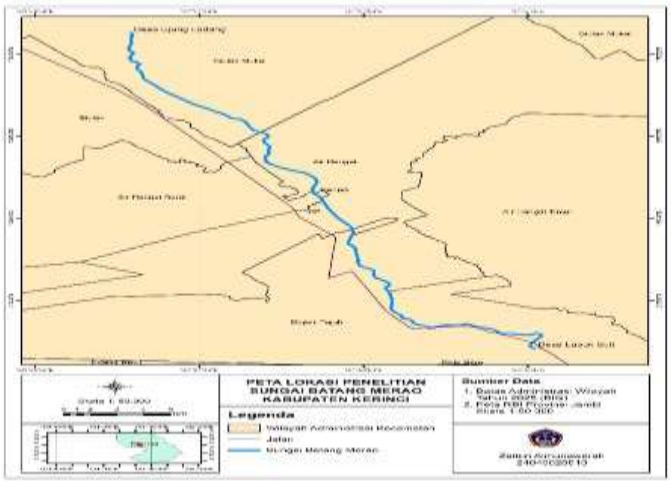

Figure 1. Research Location Map

Data collection was conducted through field observations, water sampling, laboratory analysis, and documentation. Water quality parameters were analyzed according to Indonesian National Standards (SNI). All spatial data was then processed using a Geographic Information System (GIS). The analysis process included inputting sampling point coordinates, digitizing base maps, spatial interpolation, and creating thematic water quality maps (Hasibuan, 2019).

The analysis was carried out descriptively by comparing water quality conditions in the upstream and downstream sections and interpreting water quality distribution patterns based on spatial mapping results.

Table 1. River Water Quality Parameters

No.	Parameter	Unit	Analysis Method	Reference Standard
1	pH	-	pH meter	SNI 06-6989.11-2004
2	TSS	mg/L	Gravimetry	SNI 06-6989.3-2004
3	BOD	mg/L	5 days incubation	SNI 6989.72:2009
4	COD	mg/L	Titrimetry (Reflux)	SNI 6989.73:2009
5	DO	mg/L	Winkler titration	SNI 06-6989.14-2004
6	Fecal Coliform	MPN /100 mL	Tube method double	SNI 6774:2008

3. RESULTS AND DISCUSSION

This study aims to analyze the water quality conditions of the Batang Merao River spatially using a Geographic Information System (GIS). The analysis was conducted based on the results of laboratory tests on six water quality parameters, namely Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Suspended Solid (TSS), acidity (pH), Dissolved Oxygen (DO), and *Fecal Coliform* . All of these parameters were chosen because they are able to represent the physical, chemical, and biological conditions of the waters, thus providing a comprehensive picture of the water quality of the Batang Merao River (Juita, Dasrizal, Ibrahim, Ulni, et al., 2025).

Sampling was conducted at two locations representing the characteristics of the upstream and downstream areas of the Batang Merao River. The upstream section is located in Ujung Ladang Village, which has relatively low community activity pressure, while the downstream section is located in Lubuk Suli Village, which is dominated by residential areas and domestic activities. The differences in the characteristics of the two locations serve as the basis for identifying changes in water quality along the river and analyzing the impact of community activities on water conditions.

Laboratory analysis results show that the water quality of the Batang Merao River varies between the upstream and downstream sections. BOD values increased from 75.4 mg/L in the upstream section to 133.6 mg/L in the downstream section. COD values also increased from 125.0 mg/L to 301.3 mg/L. Conversely, TSS parameters decreased from 8.2 mg/L to 4.0 mg/L, while pH values remained relatively stable at around 8.0 in the upstream section and 7.9 in the downstream section. DO content decreased slightly from 7.3 mg/L to 6.9 mg/L, while *Fecal Coliform* levels increased significantly from 6.8 MPN/100 mL to 68 MPN/100 mL (Juita, Dasrizal, Ibrahim, Yuniarti, et al., 2025).

The increase in BOD, COD, and *fecal coliform values* downstream indicates that the pollutant load tends to increase with increasing human activity along the river basin. Conversely, the stability of the pH value and the high DO content indicate that the general chemical conditions of the water bed are still able to support aquatic life, despite the increased input of organic pollutants downstream (Juita et al., 2018).

The results of data processing using a Geographic Information System produced a water quality distribution map that shows differences in water quality conditions spatially. The thematic map shows that water quality in the upstream areas is relatively better than in the downstream areas. This change is reflected in the distribution pattern that follows the direction of the river flow, with water quality tending to decline in areas with denser residential activity (Komariah & Matsumoto, 2016).

Spatial analysis also shows that water quality distribution is not uniform. Upstream, water conditions are still influenced by a relatively natural environment with less human activity. Conversely, downstream, there is an accumulation of pollutant loads originating from various community activities, such as domestic waste disposal, washing, bathing, and residential drainage flows that flow directly into the river.

Based on spatial interpolation results, zones with relatively good water quality are still found in the upper reaches of the river. This area is characterized by lower

concentrations of pollutant parameters than downstream areas. This is influenced not only by the low intensity of human activity, but also by the river's natural ability to dilute and purify water before receiving additional pollutant loads from areas further downstream (Napitupulu & Putra, 2024).

Conversely, zones showing declining water quality are concentrated in the downstream part of the Batang Merao River. This area exhibits increased concentrations of organic and biological pollutant parameters, indicating increasing environmental pressure. This condition reflects the accumulation of waste carried from upstream areas as well as additional pollutants from human activities along the riverbanks (Ningsih et al., 2020).

Water quality distribution patterns generated through GIS analysis demonstrate a close relationship between environmental conditions and land use activities. Areas dominated by residential areas tend to exhibit lower water quality than areas with less human activity. These results indicate that changes in land use around rivers contribute to changes in water quality, particularly in parameters related to organic pollution.

Overall, the research results indicate that the Geographic Information System (GIS) is capable of presenting information on the distribution of water quality in the Batang Merao River more comprehensively than tabular laboratory data. The integration of water quality data and spatial analysis results in visualizations that facilitate the identification of areas experiencing declining water quality. This information can be used as a basis for planning water quality monitoring, determining priority locations for pollution control, and developing strategies for sustainable management of the Batang Merao River (Ninta & Sitepu, 2024).

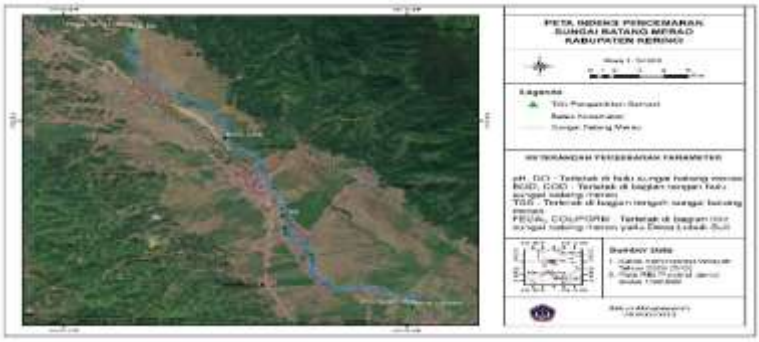

Figure 2. Pollution Index Map

Discussion

The results of the study indicate that the water quality of the Batang Merao River has changed spatially from upstream to downstream. (Wardhani, 2022). These changes are indicated by increasing concentrations of Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), and *Fecal Coliform* in the downstream area, while Dissolved Oxygen (DO) values have decreased, although they remain within the range that supports aquatic life. Meanwhile, the pH value is relatively stable and Total Suspended Solids (TSS) remain at low concentrations (Wandira et al., 2001). This pattern indicates that the decline in water quality in the Batang Merao River is more influenced by the increase in organic and biological pollutant loads than by changes in the physical

characteristics of the water. These findings indicate that human activities along the river basin are the main factor influencing water quality, especially in downstream areas with higher land use and settlement densities (Prayogo, 2015).

Increased BOD and COD values indicate a greater need for oxygen to decompose pollutants entering the water body. High BOD values indicate the abundance of organic matter that is easily degraded by microorganisms, while high COD values indicate the presence of organic and inorganic compounds that require chemical oxidation (Wijayanto, 2025). This condition is closely related to domestic activities, such as the disposal of used washing water, kitchen waste, detergent use, and household organic waste that flows into rivers without prior treatment. Increased *Fecal Coliform levels* downstream also indicate biological contamination originating from suboptimal sanitation systems. If this condition persists, the river's natural ability to self-purify *will* decrease, potentially accelerating water quality degradation (Prastiwi & Rosariawari, 2023).

Analysis using a Geographic Information System (GIS) added value to this research by integrating laboratory analysis results with spatial information, resulting in a more comprehensive visualization of water quality distribution (Utami et al., 2023). Through spatial interpolation, patterns of water quality change from upstream to downstream can be displayed in the form of easy-to-understand thematic maps. This spatial information not only indicates locations experiencing water quality decline but also illustrates the relationship between water quality conditions and land use characteristics and community activities around the river. Thus, GIS is an effective tool in supporting environmental monitoring activities by helping identify areas requiring priority management and pollution control (Salfia & Prarikeslan, 2025).

The results of this study are consistent with previous studies that indicate that residential areas are a major source of river pollution due to the influx of domestic waste into water bodies. Previous research also indicates that increased community activity along riverbanks is generally accompanied by increased BOD, COD, and bacteria indicators of pollution, while dissolved oxygen levels tend to decrease due to increased oxygen demand for organic matter decomposition (Rismawati & Sya'aban, 2023). These similar patterns indicate that the pollution characteristics of the Batang Merao River are similar to those of other rivers in Indonesia that experience pressure from residential development. Therefore, the results of this study strengthen empirical evidence that domestic waste management is a crucial factor in maintaining river water quality (Rahardjo et al., 2025).

The findings of this study have important implications for environmental management in Kerinci Regency. Spatial information generated through the Geographic Information System can be used as a basis for developing regular water quality monitoring programs, determining priority locations for pollution management, and evaluating the effectiveness of watershed management policies. Furthermore, the results of this study indicate the need to improve residential sanitation systems, manage domestic wastewater, and educate the public about the importance of maintaining river water quality (Ramadhan et al., 2023). Collaboration between the local government, the

community, and other stakeholders is a strategic step to maintain the ecological function of the Batang Merao River while supporting the sustainable use of water resources in the future.

4. CONCLUSION AND SUGGESTION

Based on the results of spatial analysis using Geographic Information Systems (GIS), the water quality of the Batang Merao River shows variations in conditions from upstream to downstream. Laboratory test results show that Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), and *Fecal Coliform parameters* increased in the downstream section, while Dissolved Oxygen (DO) values decreased slightly. Meanwhile, pH parameters were relatively stable and Total Suspended Solids (TSS) remained in relatively good condition. This pattern indicates that the decline in water quality of the Batang Merao River was more influenced by the increasing load of organic and biological pollutants than by changes in the physical characteristics of the water.

The application of a Geographic Information System (GIS) provides a clearer spatial picture of the distribution of water quality in the Batang Merao River than tabular presentation of laboratory data. Through spatial visualization, locations experiencing declining water quality can be identified, thus supporting the determination of priority areas for pollution control efforts. Thus, the integration of water quality data and a Geographic Information System (GIS) can be an effective basis for supporting sustainable water quality management in the Batang Merao River in Kerinci Regency.

Suggestion

Based on the research results, integrated water quality management of the Batang Merao River requires collaboration between the local government, the community, and other stakeholders. The Kerinci Regency Government is expected to improve regular water quality monitoring by utilizing Geographic Information Systems (GIS) to analyze and evaluate changes in water quality. Furthermore, efforts are needed to improve sanitation facilities, improve domestic waste management, and monitor community activities along the river basin to minimize the pollutant load entering the river.

Communities living along the Batang Merao River are also expected to play an active role in maintaining environmental quality by not dumping household waste directly into the river, implementing proper waste management, and supporting various government-organized environmental conservation programs. Public awareness and participation are crucial in maintaining the Batang Merao River's continued function as a vital water resource.

For future researchers, it is recommended to expand the scope of the study by increasing the number of sampling points, conducting observations in different seasons, and integrating other water quality parameters to obtain more comprehensive information regarding the dynamics of water quality in the Batang Merao River. Developing spatial analysis methods with a more diverse Geographic Information System approach is also expected to produce more detailed information as a basis for planning sustainable water resource management

REFERENCES

Ahda, & Ernyasih. (2025). *Hubungan Antara Pengelolaan Sampah Rumah Tangga Dan Kualitas Kesehatan Lingkungan Permukiman Universitas Muhammadiyah Jakarta , Indonesia*. *3*(2), 1107–1112.

Alfatihah, A., Latuconsina, H., & Prasetyo, H. D. (2022). *Analisis Kualitas Air Berdasarkan Parameter Fisika Dan Kimia Di Perairan Sungai Patrean Kabupaten Sumenep Water Quality Analysis Based On Physical And Chemical Parameters In Patrean River Waters , Sumenep Regency*. *1*(2), 76–84. Https://Doi.Org/10.32734/Jafs.V1i2.9174

Almaidah. (2023). *Analisis Dampak Pencemaran Sungai Terhadap Aktivitas Masyarakat Di Daerah Muara Sungai Jember Selatan*. *01*(09).

Anggraini, A. F. (2025). *Analisis Kualitas Air Dan Sumber Pencemaran Sungai Di Kota Surabaya*. *1*(4), 1456–1464.

Anggraini, W. P., Kusumastuti, D. I., & Wahono, E. P. (2024). Sistem Informasi Kualitas Air Sungai Di Wilayah Sungai Seputih Sekampung. *Briliant: Jurnal Riset Dan Konseptual*, *9*(4), 964–978. Https://Doi.Org/10.28926/Briliant.V9i4.2090

Anwar, Y. W. (2025). *Pengaruh Pencemaran Air Sungai Terhadap Kesehatan Lingkungan Dan Masyarakat*. *6*, 5061–5073.

Budi, S., & Ahlunnaza, A. (2023). *Analisis Sebaran Kualitas Air Sungai Bedok Dengan Aplikasi Arc Gis*. *3*(2), 79–84.

Dasrizal, Barlian, E., Farida, Rezki, A., Ulnie, A. Z. P., & Syafruddin, Y. S. (2019). Analysis Of Land Use Change Using Landsat Image From 2006 - 2016 In Solok Regency. *Iop Conference Series: Earth And Environmental Science*, *314*(1). Https://Doi.Org/10.1088/1755-1315/314/1/012068

Dasrizal, Juita, E., Wilis, R., Febriandi, & Febrina, T. (2026). Spatial Assessment Of Erosion And Landslide Hazards As Indicators Of Land Degradation In Solok Regency, West Sumatra. *Journal Of Degraded And Mining Lands Management*, *13*(1), 9443–9453. Https://Doi.Org/10.15243/Jdmlm.2026.131.9443

Dasrizal, Rahmi, R., Rezki, A., Farida, F., Ulni, A. Z. P., & Syafruddin, Y. S. (2019). Outlook For Carbon Stock Of Tropical Forest In The Context Of Climate Change. *Iop Conference Series: Earth And Environmental Science*, *299*(1). Https://Doi.Org/10.1088/1755-1315/299/1/012049

Dewa, R. P., Aryantie, M. H., Amru, K., & Anjani, R. (2025). Analisis Kualitas Sumber Air Baku Untuk Pemenuhan Kebutuhan Air Minum Di Ibu Kota Nusantara Quality Analysis Of Raw Water Sources To Provide Drinking Water Needs In Capital Nusantara. *Jurnal Teknologi Lingkungan*, *26*(1), 82–89.

Edokpayi, J. N., Odiyo, J. O., & Durowoju, O. S. (2020). *Impact Of Wastewater On Surface Water Quality In Sub-Saharan Africa Developing Countries: A Case Study Of South Africa Bt - Household Hazardous Waste Management In Developing Countries*.

Firdaus, N., & Zen, A. (2025). *Dampak Mikroplastik Terhadap Kesehatan Masyarakat Dan Lingkungan*. *6*, 146–153.

Harefa, S. V. (2025). *Analisis Penyebaran Air Tercemar Akibat*. *02*, 213–218.

Hasibuan, R. (2019). *Analisis Dampak Limbah/Sampah Rumah Tangga Terhadap Pencemaran Lingkungan Hidup*.

Juita, E., Dasrizal, D., Ibrahim, M. H., Ulni, A. Z. P., & Nefilinda, N. (2025). Spatio-Cultural Wisdom In Disaster Mitigation: Dual-Hazard Adaptation In The Minangkabau Highlands Of Indonesia. *Jurnal Ilmu Sosial Mamangan*, *14*(2), 37–52. Https://Doi.Org/10.22202/Mamangan.V14i2.9981

Juita, E., Dasrizal, Ibrahim, M. H., Yuniarti, E., Ulni, A. Z. P., & Soni. (2025). What Can Spatial Assessment Reveal About Flash Flood Risk And Ecosystem Carrying Capacity In Tropical Highland Environments? *Jurnal Penelitian Pendidikan Ipa*, *11*(11), 674–683. Https://Doi.Org/10.29303/Jppipa.V11i11.11889

Juita, E., Zulva, R., & Edial, H. (2018). Profile Of Development Of Critical Thinking Student Skills Assessment Instrument In The Course Geography Of Disaster. *Sumatra Journal Of Disaster, Geography And Geography Education*, *2*(1), 147. Https://Doi.Org/10.24036/Sjdgge.V2i1.142

Komariah, I., & Matsumoto, T. (2016). Investigation On The Expert Communities Awareness Of The Urban River Water Quality, Case Study Of Sugutamu River, Indonesia. *Journal Sampurasun: Interdisciplinary Studies For Cultural Heritage*, *2*(01), 115. Https://Doi.Org/10.23969/Sampurasun.V2i01.119

Napitupulu, R. T., & Putra, M. H. S. (2024). Pengaruh Bod, Cod Dan Do Terhadap Lingkungan Dalam Penentuan Kualitas Air Bersih Di Sungai Pesanggrahan. *Civeng: Jurnal Teknik Sipil Dan Lingkungan*, *5*(2), 79. Https://Doi.Org/10.30595/Civeng.V5i2.17878

Ningsih, S. R., Putra, E. G. E., & Goembira, F. (2020). Analisis Ketersediaan , Kebutuhan Dan Kualitas Air Pada Das Batang Merao. *Jurnal Ilmu Lingkungan*, *18*(3), 545–555. Https://Doi.Org/10.14710/Jil.18.3.545-555

Ninta, R., & Sitepu, B. (2024). *Analisis Dampak Limbah Domestik Rumah Tangga Terhadap Pencemaran Lingkungan Di Tanjungbalai Sumatera Utara*. *2*(2), 112–118.

Prastiwi, A. C., & Rosariawari, F. (2023). *Identifikasi Dan Penentuan Strategi Pengelolaan Limbah Domestik Pada Kawasan Pesisir Dusun Kisik , Kabupaten Pasuruan*. *2*(5), 947–957. Https://Doi.Org/10.55123/Insologi.V2i5.2670

Prayogo, T. B. (2015). *Analisis Kualitas Air Dan Strategi Pengendalian Pencemaran Air Sungai Metro Di Kota Kepanjen Kabupaten Malang*. *6*(2), 105–114.

Rahardjo, P. P., Widyastuti, D., Zairina, A., Mondiana, Y. Q., Wijaya, A. C., & Farida, S. (2025). *Integrasi Sistem Informasi Geografis Dalam Pemetaan Kualitas Air Untuk Mendukung Program Sanitasi Masyarakat Integration Of Geographic Information Systems In Water Quality Mapping To Support Community Sanitation Programs*. *4*, 58–66.

Ramadhan, D., Indah, S., & Helard, D. (2023). *Strategi Pengelolaan Air Limbah Domestik Di Kawasan Permukiman Hulu Sungai Kelurahan Hutaimbaru Kota Padangsidimpuan*. *22*(3), 274–281.

Rismawati, A., & Sya'aban, M. B. (2023). *Portrait Of Community's Ecological Awareness: Study Of Community Knowledge About Household Water Waste To Environmental Pollution*. *5*, 98–110.

Salfia, A. S. K., & Prarikeslan, W. (2025). Analisis Kualitas Air Dan Estimasi Potensi Beban Pencemaran Pada Sungai Batang Arau, Kota Padang. *Jurnal Inovasi Penelitian*, *1*, 1–15.

Utami, A. P., Pane, A., & Hasibuan, A. (2023). *Analisis Dampak Limbah / Sampah Rumah Tangga*. *6*(2), 1107–1112.

Uyun, S. (2020). Geographic Information System For A Community-Based Water Quality Mapping Of Rivers In Indonesia. *Kinetik: Game Technology, Information System, Computer Network, Computing, Electronics, And Control*, *5*(3), 219–226. Https://Doi.Org/10.22219/Kinetik.V5i3.1042

Wandira, N. A., Deliana, A., & Junedi, H. (2001). *Kualitas Sub Das Siulak Dan Batang Merao Daerah Mukai Tinggi Dan Sekitarnya, Kecamatan Siulak Mukai, Kabupaten Kerinci, Provinsi Jambi*. 507–515.

Wardhani, E. K. A. (2022). *Pemilihan Sistem Pengelolaan Air Limbah Domestik Di*. *10*(1), 67–78.

Wijayanto, R. (2025). *Pemantauan Kualitas Air Dan Status Mutu Air Sungai Bengkulu*. *13*(1), 401–409.